REVISED

ENVIRONMENTAL IMPACT STATEMENT

Volume II

KUILIMA RESORT EXPANSION

Koolauloa District
Oahu, Hawaii

Portions of Tax Map Key: 1st Division
5-6-03, 5-7-01, 5-7-03 and 5-7-06

7 October 1985

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Prepared by
Group 70, Planners

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AGRICULTURAL FEASIBILITY STUDY

AGRICULTURAL FEASIBILITY AND NEED
FOR LANDS ZONED AG-1 IN THE
KUILIMA RESORT EXPANSION PROJECT

PREPARED FOR
GROUP 70

BY
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Agricultural Economist

December, 1984

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INTRODUCTION

This report investigates the agricultural feasiblity of the 394.0 acres of Kuilima Resort Expansion Project lands which are currently zoned Ag-1 by the City and County of Honolulu, and the need for retaining these lands for agriculture. The acreage evaluated excludes two separately owned parcels of 4 and 1.8 acres which are located on the project boundary. The various parcels zoned Ag-1 are delineated in Figure 1.

Determination of agricultural feasibility is based on appropriate criteria which are defined in the following section of the report. The need for agricultural lands in the project area that meet the feasibility criteria is based on the relationship between availability of good agricultural lands on Oahu and past, current and projected acreages in cultivated crop production. Projections of land needed for agriculture on Oahu consider possible shifts in crop production to neighbor islands.

CROP FEASIBILITY CRITERIA

Agricultural feasibility of lands in the Kuilima development project zoned as Ag-1 by the City and County of Honolulu is based on the following criteria.

1. Ecological Adaptation, including soil type, topography, rainfall, availability of supplemental irrigation water, temperature, wind, light intensity, and insect and disease problems.
2. Sales Potential for the quantities of products which could feasibly be grown in the project area.
3. Economic Viability of crops which meet criteria "1" and "2".
4. Comparative Costs of Production in relation to competing areas.
5. Intensity of Production with respect to net income per acre.

ALISH CLASSIFICATIONS

ALISH Classifications (Agricultural Lands of Importance to the State of Hawaii) by the Hawaii State Department of Agriculture for the 394.0 acres zoned Ag-1 by the City and County of Honolulu are shown in Figure 2. Under ALISH, 44± acres in the south-mauka corner of the parcel are classified as prime agricultural land, 175± acres in the central portion are classified as other important agricultural land, 56± acres are classified as existing urban development and 119± acres are unclassified.

SOILS AND TOPOGRAPHY

Soil capability determinations in this report are based on classifications by the USDA Soil Conservation Service (9) and the University of Hawaii Land Study Bureau (7).

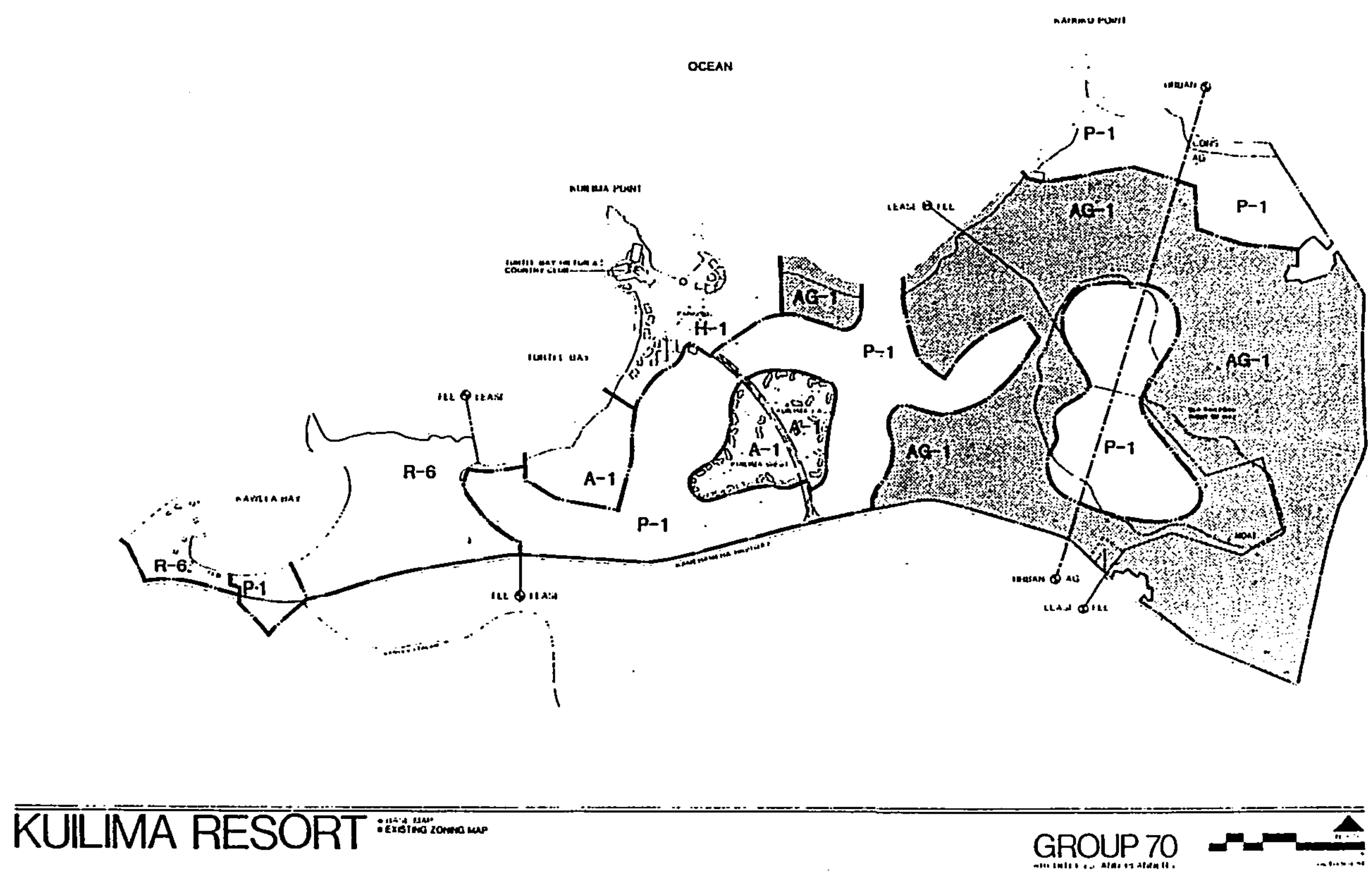

Figure 1.
Map of the Kuilima Resort Expansion Project
Delineating Lands Zoned as Ag-1

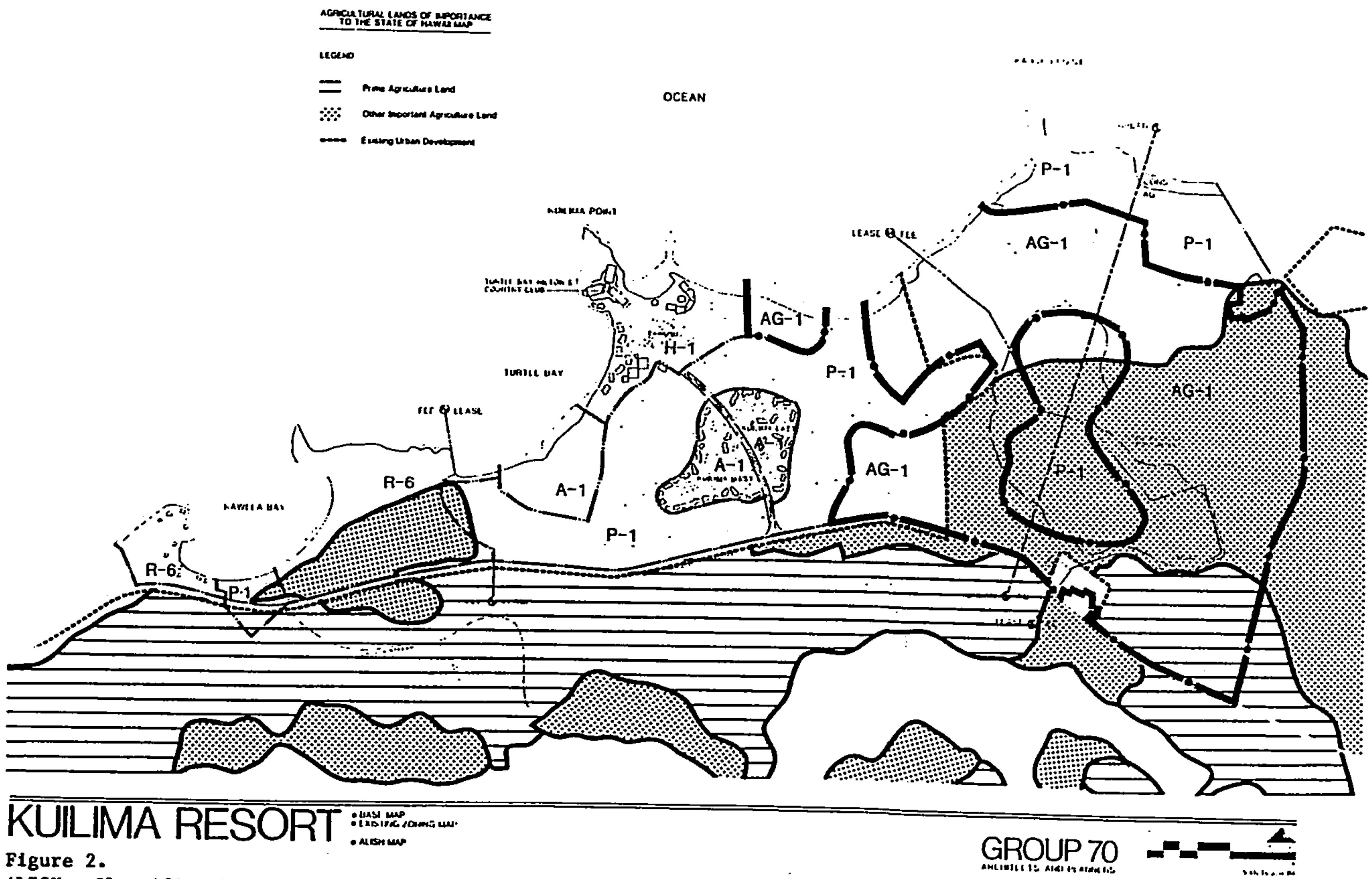

Figure 2.
ALISH Classifications of Kuilima Resort Expansion Project Lands Zoned Ag-1

SOIL CONSERVATION SERVICE CLASSIFICATIONS (SCS)

SCS soil classifications provide descriptions of soil profiles, topography, water holding capacity, pH, depth of root penetration, erosion hazard and crop capability ratings. On-site observations were made of areas zoned for agriculture as a check against SCS classifications. The SCS report provides crop capability classifications ranging from I to XIII, with I being the best. SCS classifi- cations in the project area (394.0 acres zoned by the City and County of Honolulu as Ag-1) identified in Figure 3 are as follows:

Pearl Harbor Clay (pH) Series

Pearl Harbor Clay (pH) series predominates in the area classified as Ag-1, encompassing 160± acres in the central and south-central area of the parcel. This series is nearly level and very poorly drained. The topsoil consists of very dark gray mottled clay about 12 inches in depth, with an angular or sub-angular blocky structure. The substratum is mock or peat. The topsoil has a pH of neutral and the subsoil is moderately alkaline. Permeability is very slow, runoff is very slow to ponded and the erosion hazard is slight. The available water capacity is a fairly low 1.4 inches per foot in both topsoil and subsoil. Roots penetrate to a depth of only 2 to 4 feet. The soil has a high shrink-swell potential and workability is very difficult. Brackish water exists near the ocean border at a depth of 20 to 33 inches. Pearl Harbor clay is given an SCS capability classification of IVw, reflecting severe limitations to crop production because of excess water. This type of soil is restrictive for all crops, but can best be utilized for bananas, taro and pasture.

Jaucas Sand, 0 to 15 Percent Slopes (JaC)

This subseries of the Jaucas series encompasses 117± acres in the makai area of the subject parcel. The soil consists of excessively drained calcareous soils developed from wind and water deposited sand derived from coral and sea shells in coastal areas. A representative profile consists of simple grain pale brown to very pale brown sandy soil of 60 or more inches in depth. The surface may be dark brown in some areas because of accumulation of humus and alluvium. The soil has a pH of neutral to moderately alkaline throughout. Permeability is rapid, but runoff is slow to very slow. Water erosion is slight, but wind erosion is severe when vegetation has been removed. The available water holding capacity is extremely low at 0.5 to 1.0 inch per foot of soil. Roots may penetrate to a depth of 5 feet or more. Workability for crop production is slightly difficult because of the looseness of the soil and lack of stability for equipment use. The soil is given a capability classification of IVs if irrigated because of limitations in texture and water holding capacity and VIe if nonirrigated because of the wind erosion hazard.

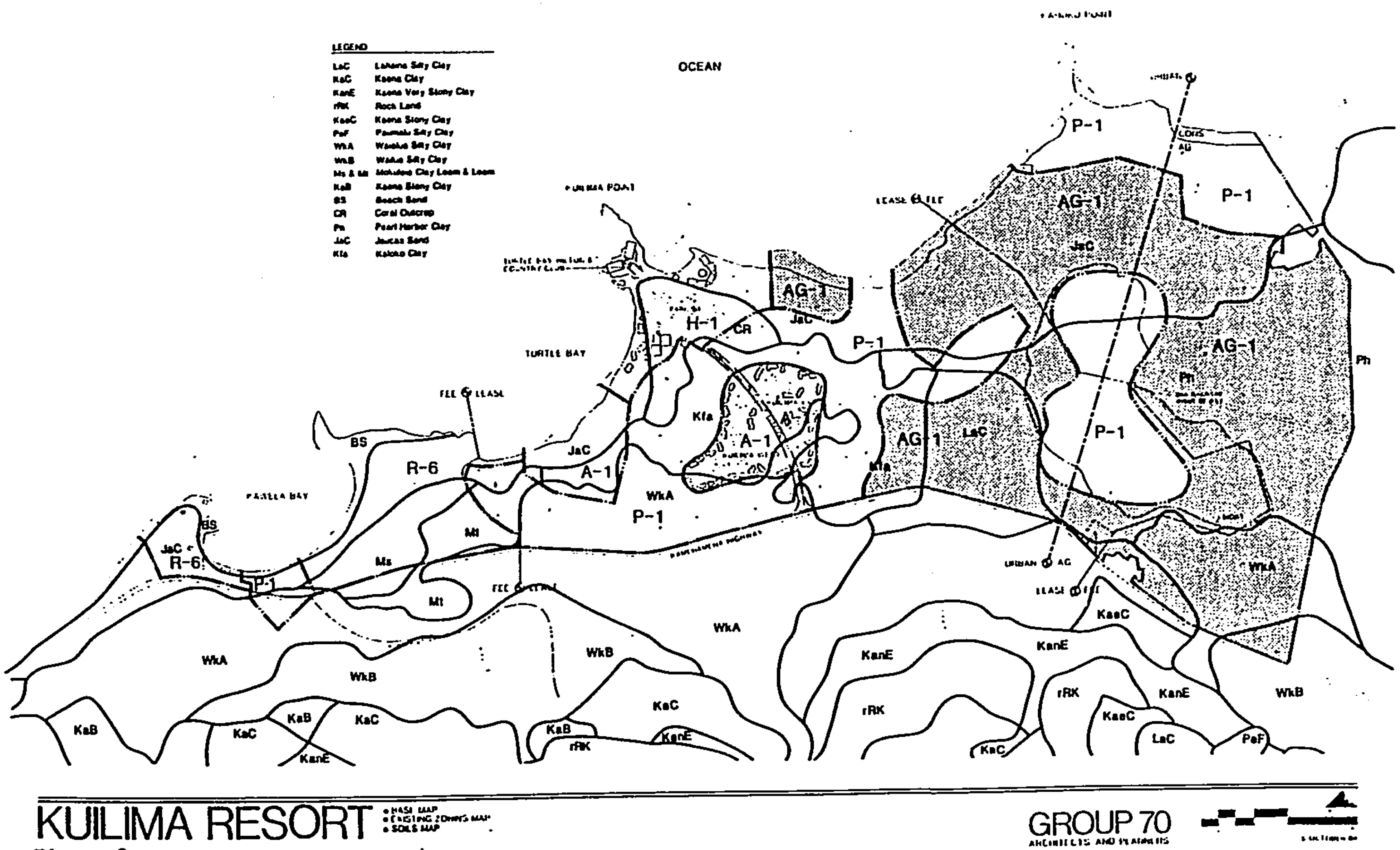

Figure 3.
Land Capacity Classifications of Soils in the Kuilima Resort Expansion Project by the USDA Soil Conservation Service, 1972

Waialua Silty Clay, 0 to 3 Percent Slopes (WkA)

This subseries of the Waialua series, which occupies about 45 acres in the extreme south-mauka portion of the area zoned Ag-1, consists of moderately well drained soils on alluvial fans. A representative topsoil consists of dark reddish-brown silty clay about 12 inches thick. The subsoil, which is about 26 inches thick, consists of dark reddish-brown or reddish-brown silty clay with a subangular blocky structure. The substratum is dark reddish-brown, mottled silty clay. The pH is neutral for the topsoil and slightly acid in the subsoil. Permeability is moderate, runoff is slow, and the erosion hazard is no more than slight. The water holding capacity is good, amounting to 1.8 inches per foot in the topsoil and 1.6 inches per foot in the subsoil. Roots may penetrate to a depth of 5 feet or more. The capability classification is I if irrigated or IIIc if nonirrigated because of inadequate rainfall in the area. The soil is very good if irrigated for sugarcane, truck crops, forage crops, orchards and grazing and good for pineapple.

Waialua Silty Clay, 3 to 8 Percent Slopes (WkB)

This subseries occupies about 3 acres in the extreme south-mauka corner of the Ag-1 parcel adjoining WkA. The subseries is the same as WkA, except for somewhat greater slopes. Because of the slopes, this soil is downgraded to IIc if irrigated because of a moderate erosion problem if not protected, and to IIIc if nonirrigated because of rainfall limitations. The soil is good if irrigated for the production of sugarcane, truck crops, forage crops, orchards, grazing and pineapple.

Lahaina Silty Clay, 7 to 15 Percent Slopes (LaC)

This subseries of the Lahaina series occupies 35+ acres in the north-mauka section of the parcel just north of the Punahoolapa Marsh. The soil is well drained and consists of material weathered from basic igneous rock. The topsoil consists of dark reddish-brown silty clay about 15 inches in depth. The subsoil is about 45 inches thick and consists of dusky-red and dark reddish-brown blocky silty clay and silty clay loam with a subangular structure. The pH of the topsoil is slightly to medium acid. Permeability is moderate, runoff is medium and the erosion hazard is moderate. There may be some steep mounts with cobblestones on the surface. The waterholding capacity is moderate, ranging from 1.3 inches per foot in the topsoil to 1.4 inches per foot in the subsoil. Roots may penetrate to a depth of 5 feet or more. The soil is given a capability classification of IIIe, irrigated or nonirrigated, with downgrading due to the erosion problem under irrigation. The soil is rated good for sugarcane, fair for pineapple and pasture and is not rated for truck crops, forage crops, or orchards.

Kaloko Clay (Kfa)

This subseries of the Kaloko series occupies 25+ acres in the north-mauka corner of the area zoned Ag-1, adjacent to the sewage treatment plant. The Koloko series consists of poorly drained, nearly level, soils on coastal plains. The soils derived from basic igneous rock deposited over marly lagoon deposits. Koloko clay contains small areas of mainly coral fragments or marly material; areas of clay, very poorly drained areas underlain by muck or peat; and small areas of very deep, moderately well drained soils. The topsoil consists of dark brown clay about 12 inches thick and the subsoil is dark reddish-brown and weak red clay about 12 inches thick. Below this is a third layer of mottled, white to light gray, platy clay about 13 inches thick. This is underlain by dark greenish-gray and dark gray massive silty clay. The pH of the entire profile is mildly alkaline to neutral. Permeability is moderately slow to slow, runoff is slow to very slow and the erosion hazard is no more than slight. The water holding capacity is good at about 1.6 inches per foot of soil. Roots may penetrate to a depth of about 40 inches or to the water table in undrained areas. Workability is somewhat difficult. This subseries is classified as IIIw if irrigated because of poor drainage and Vw if nonirrigated because of inadequate rainfall and poor drainage combined.

Kaena Clay, 2 to 6 Percent Slopes (KaB)

A small pocket of 9+ acres of this subseries of the Kaena series is located in the central mauka border of the area zoned Ag-1. The Kaena series consists of deep, poorly drained soils on alluvial fans and talus slopes. The soils are developed in alluvium and colluvium from basic igneous rock. The typical topsoil consists of dark gray clay about 10 inches thick. The subsoil is dark-gray and dark grayish-brown clay with a prismatic structure of 36 to 48 inches thick, underlain with highly weathered gravel. The soil is mottled, very sticky and very plastic. The pH of the entire soil profile is slightly acid to neutral. Permeability is slow, runoff is slow and the erosion hazard is slight. The water holding capacity is good at about 1.4 inches per foot in the toposil and 1.7 inches per foot in the subsoil. Roots may penetrate to a depth of 5 feet or more. Workability is difficult because of the sticky and plastic nature of the soil. The capability classification for this soil is IIIw if irrigated and IVw if nonirrigated because of the high water table resulting from poor drainage and possible seepage. The soil is indicated to be marginally adapted to surgarcane, pasture and woodland, but is not classified for other crops.

LAND STUDY BUREAU CLASSIFICATIONS (LSB)

The LSB classifies soils by land type in which crop productivity ratings are provided for an overall rating and for seven (7) selected crops, consisting of pineapples, vegetables, sugarcane, forage, grazing, orchards and woodland. The ratings are accompanied by soil descriptions. Overall ratings range from A to E, with A being the highest. Selected ratings range from a to e, with a being the highest. Ratings are generally comparable to those of the Soil Conservation Service, but differ somewhat because of fewer categories (A to E for LSB and I to XIII for SCS). Some differences also exist because of the use of somewhat different soil capability criteria.

LSB soil capability classifications for the 394.0 acres zoned by the City and County of Honolulu as Ag-1 are shown in Figure 4.

E115.

This land type predominates throughout the 394.0 acres zoned as Ag-1 and encompasses an estimated 130 acres. Most other land types consist of pockets of land interposed within or contiguous to E115. Land type E115 is given the lowest overall crop productivity rating of E and the lowest selected crop productivity rating of e for all crops. The land is classified as rocky, shallow and not suited to machine tillability. It is, however, well drained and is currently being used for grazing. The area classified as E115 by LSB constitutes much of the same area classified as Pearl Harbor clay with a IV in productivity rating by SCS. Whereas both productivity ratings are low, the LSB rating is lower than that of SCS.

E35.

A 25 acre strip of this land type is interspersed with E115 near the south border of the area zoned Ag-1. E35, although given an overall classification of E when nonirrigated is classified as B if irrigated. With irrigation, selected crop productivity ratings are: a for grazing; b for vegetables, sugarcane, forage and orchards, but e for pineapple. The land is nonstrong, moderately well drained and is given a moderate rating for machine tillability.

E78.

Approximately 30 acres of this land type are located on the south and north boundaries of Punahoolapa Marsh. The land is waterlogged and not suitable for irrigation. This land type is given an overall rating of E and selected crops productivity ratings of e for all crops, with or without irrigation. It is considered infeasible for any type of crop production.

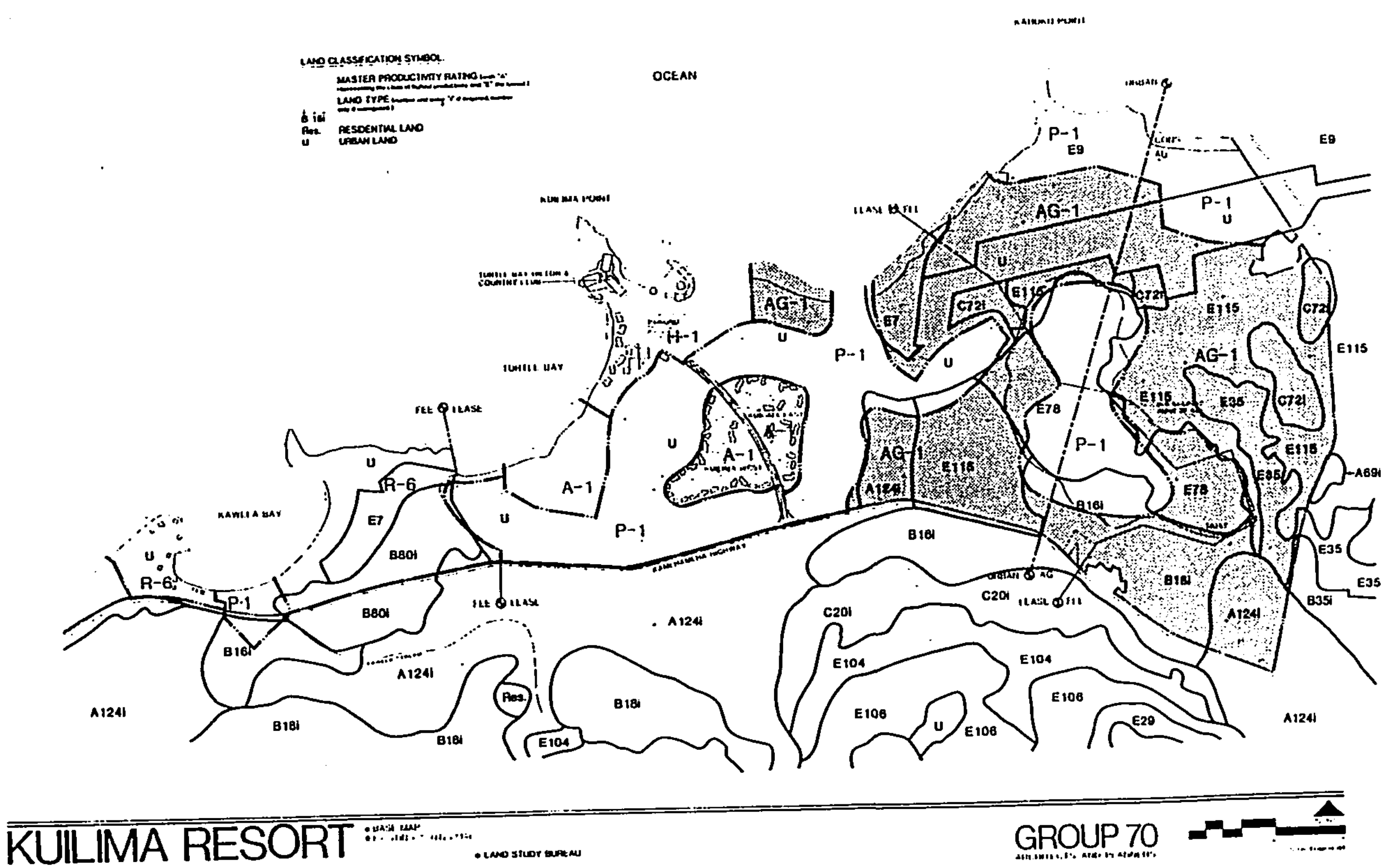

Figure 4.
Land Capability Classifications of Soils in the Kuilima Resort Expansion Project by the University of Hawaii Land Study Bureau, 1972

E9.

This soil type occupies about 32 acres along the makai border of the area zoned Ag-1. The soil consists of Jaucas Sand as classified by SCS and is given an overall rating of E and a selected crop productivity rating of e for all crops when unirrigated because of inadequate rainfall, course texture and excessive drainage. It is, however, rated good for machine tillability. If irrigated, the overall rating is increased to D and selected crop ratings are increased to d for all crops except pineapple, which retains an e rating.

E7.

This soil type, Jaucas Sand, occupies about 12.0 acres in the north-makai section of the area zoned Ag-1. When unirrigated, it is given an overall rating of E and selected crop productivity ratings of e for all crops, except forage and grazing, which are given d ratings. If irrigated, the overall rating is increased to C and selected crop productivity ratings are increased to c except for pineapples and vegetables, which are given e and d ratings, respectively. The soil is excessively drained, but has good machine tillability.

E72 (C72i).

Four pockets of this soil type constituting approximately 33 acres in total are scattered throughout the area zoned Ag-1. This land, if unirrigated, is given an overall crop productivity ratings of e for all crops. The land is well drained, stony, but moderately fine in texture and has moderate machine tillability. If irrigated, the overall productivity rating is increased to C and selected crop productivity ratings are increased to b for sugarcane, grazing and orchards, to c for vegetables and forage, but remain at e for pineapple.

E16 (B16i).

Approximately 55 acres of this soil type are located in the south-mauka section of the area zoned Ag-1. If unirrigated, this land type is given an overall productivity rating g E and selected crop productivity ratings of g e for all crops except forage and grazing, which are rated d. If irrigated, the overall productivity rating is increased to B and selected crop productivity ratings are increased to a for sugarcane and grazing; b for vegetables, forage and orchards; but remain at e for pineapples. The soils are of fine texture, nonstrong and moderately well drained. Machine tillability is rated as moderate.

D124 (A124i).

This land type occupies two pockets of land in the area zoned Ag-1. One pocket in the extreme south-mauka corner consists of about 22 acres. The other, in the extreme north-mauka corner occupies about 15 acres. The soil in these areas is defined as fine, nonstony and moderately well drained. Machine tillability is rated as good. The overall rating without irrigation is D and selected crop productivity ratings are c for pineapple, forage and grazing; d for vegetables and orchards; and e for sugarcane. With irrigation, the overall rating is increased to A and selected crop productivity ratings are increased to a for all crops except pineapple, for which the land is given a b rating. LSB rating of the north-mauka parcel is inconsistent with and much higher than that of SCS and by that determined by the criteria through on-site inspection. The discrepancy results from the fact that LSB indicated the land to be moderately drained, when in fact it is poorly drained.

U.

Approximately 40 acres of Ag-1 land is located in the makai section g. The property where an old airstrip existed plus an isolated parcel of 11.6 acres of Ag-1 land bordering the ocean and north of the contiguous areas of Ag-1 land classified as urban by the LSB.

SUMMARY - SOILS AND TOPOGRAPHY

Summaries of capability classifications for project lands zoned Ag-1 by the City and County of Honolulu are shown in Table 1 for SCS classifications and Table 2 for LSB classifications.

Based on SCS capability classifications, none of the 394.0 acres zoned Ag-1 is classified as optimal for crop production without irrigation. Eighty-three acres are considered sub-marginally adaptable and the remainder are considered infeasible for crop production. With adequate irrigation, 48± acres (classified as I and II) would become top quality land for most types of crops, disregarding wind conditions, 69± acres (Class III) would be sub-marginal and the remaining 277 acres (Class IV) would be infeasible for commercial crop production, even with irrigation.

TABLE 1. Acreage of Each Land Type, Kuilima Project Lands Zoned Ag-1, SCS Classifications

Soils Type	Acreage	Overall Capability With Irrigation	Overall Capability Without Irrigation
Ph Clay (ph)	160	IVw	IVw
Jaucas Sand (JaC)	117	IVs	VIe
Waialua Silty Clay (WkA)	45	I	IIIe
Waialua Silty Clay (WkB)	3	IIc	IIIc
Lahaina Silty Clay (LaC)	35	IIIc	IIIc
Kaloko Clay (Kfa)	25	IIIw	IIw
Kaena Clay (KaB)	9	IIIw	IVw
TOTAL	394		
Good Ag Land		48.0	0.0

TABLE 2. Acreage of Each Land Type, Kuilima Project Lands Zoned A-1, LSB Classifications

Soil Type	Acreage	Overall Capability With Irrigation	Overall Capability Without Irrigation	Selected Crop Productivity With Irrigation: Vegetables	Orchards	Forage
E115	130	E	E	e	e	e
E35	25	B	E	b	b	d
E78	30	E	E	e	e	e
E9	32	D	E	d	d	e
E7	12	C	E	d	c	c
E72	33	C	E	c	b	c
E16	55	B	E	b	b	b
D124	37	A	D	a	a	a
U	40	U	U	e	e	e
TOTAL	394					
Good Ag Land		117.0	0.0	117.0	117.0	92.0

Based on overall crop productivity ratings by LSB as shown in Table 2, none of the 394.0 acres is feasible for crop production without irrigation. With adequate irrigation, 37± acres (Class A) would constitute prime agricultural land for crop production, disregarding wind conditions, 80± acres (Class B) are good (which is higher than SCS ratings) and the remaining 277± acres would be infeasible for cultivated crop production, even with irrigation.

Crop productivity ratings by SCS and LSB are identical without irrigation, with the entire 394.0 acres being considered infeasible for cultivated crop production. With irrigation, both SCS and LSB classify 277± acres as infeasible for crop production. Identification of prime agricultural land is fairly comparable, amounting to 45 acres for SCS and 37 acres for LSB. The only discrepancy between SCS and LSB capability classifications is in differentiating between lands with moderate limitations to crop production (II or B) and those with severe limitations (III or c). SCS classifies only 3± acres as II and 70 acres as III, with irrigation. LSB classifies 80 acres as B and none as C, with irrigation. On-site inspection by the writer supports the more restrictive capability classifications of SCS over LSB, particularly for the land in the north-mauka corner of the area zoned Ag-1. Contrary to the LSB classification, this land (classified as B by LSB) was found to have extremely poor drainage, leading to ponding. Thus the acreage of moderately good to prime land as determined in this report is based primarily on SCS classifications.

With respect to specific location, the only moderately good to prime land, approximately 48 acres according to SCS classifications, is located in the south-mauka corner of the project. Another 60± acres, classified by SCS as III (with severe limitations), extending makai and north of the prime land, is considered submarginal for commercial agriculture under irrigation. All other land zoned Ag-1 in the project area is infeasible for any type of cultivated crop production.

LEASED VERSUS FEE SIMPLE LAND

An important consideration with respect to zoning for the Kuilima Resort Expansion project is that 251 acres of the 394 acres of land zoned Ag-1 is owned in fee by the developer and only 143 acres is leased. Of further consideration is the fact that the 48 acres of SCS Class I and II land is fee simple and most of the leased land is infeasible for crop production.

CLIMATE

State Weather Station No. 907.00 (Kahuku Pump No. 2) is located in the central mauka section of the area zoned Ag-1. This station is considered the most representative for the subject area and has an annual total and seasonal distribution of rainfall similar to other nearby recording stations.

Median annual rainfall for the Kahuku Pump 2 Station over a 60-year period amounted to 39.4 inches (Table 3). During 75 percent of the time, annual rainfall did not exceed 49.7 inches and was less than 32.4 inches only 25 percent of the time. The annual maximum was 80.9 inches and the annual minimum was 15.5 inches.

Rainfall adequacy at the site cannot be determined by the annual median, since seasonal distribution is extremely uneven. Vegetable crops, which are currently grown in the project area, require effective use of water of 4,000 gallons per acre per day or 4.4 acre inches per month. Only January and March provide median monthly rainfall of this amount. Median monthly rainfall during the hot warm season ranges from only 1.3 inches in June to 2.9 inches in April. This pattern is further aggravated by variation in seasonal distribution of rainfall from year-to-year. Minimum monthly rainfall during the period of record ranged from 0.1 inches in May and July to 0.7 inches in February. Basing annual supplemental irrigation requirements on the difference between annual median rainfall of 39.4 inches and annual effective water requirements for vegetables of 63.4 inches (52.8 inches plus a 20 percent compensating factor for uneven seasonal distribution), a typical year would require 24.0 acre inches or 660,000 gallons of supplemental irrigation water per acre. This would be higher for most other crops. Bananas, for example, would require 25 percent more than truck crops or 825,000 gallons per acre per year. The only type of agricultural enterprise which could exist in the area without irrigation is cattle grazing, which would constitute the lowest agricultural use value of the land.

The nearest temperature recordings of long duration were obtained from State Station 912.00 at Kahuku (Table 4). Temperatures are estimated to be about one degree higher than temperatures recorded in the project area over time periods of inadequate length. Temperatures in the project area are near optimal for the production of most tropical crops, some semi-tropical crops and warm season truck crops.

TABLE 3 RAINFALL RECORDINGS AT STATE KEY STATIONS WITHIN OR NEARBY THE KUILIMA RESORT EXPANSION PROJECT

MONTHLY AND ANNUAL RAINFALL SUMMARY , OAHU

SKN: 902.00 NAME: FIELD 20 OBSV: KAHUKU PLANT ELEV(FT): 150
DATA PERIOD: 1948-1968 NYRS: 21 READ: DAILY LAT: 21 39 30 LONG: 157 58 48

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	18.2	11.6	16.9	20.6	15.5	3.9	6.2	5.9	4.4	18.9	20.3	12.9	87.9
75%	10.1	7.8	9.2	5.1	3.6	2.3	3.3	3.9	3.0	5.8	9.2	7.7	59.3
MED	4.8	4.9	5.5	3.5	2.0	1.6	1.8	2.0	2.0	2.9	5.2	6.7	54.5
AVG	6.9	5.6	6.1	4.7	3.2	1.7	2.4	2.4	2.2	4.3	6.5	5.5	52.1
25%	3.2	3.8	2.1	1.6	1.5	0.9	1.4	2.7	1.3	1.9	2.5	3.1	40.0
MIN	1.4	0.7	1.1	0.5	0.0	0.4	1.1	0.4	0.4	1.0	1.3	1.3	29.2

SKN: 903.00 NAME: LAIE OBSV: KAHUKU PLANT ELEV(FT): 5
DATA PERIOD: 1910-1970 NYRS: 61 READ: DAILY LAT: 21 38 58 LONG: 157 58 12

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	21.5	17.8	19.6	27.4	17.4	6.8	6.1	6.5	11.5	18.2	20.4	32.6	100.8
75%	8.5	6.6	8.3	5.6	3.8	2.2	3.5	3.4	3.1	5.6	6.5	7.2	58.6
MED	4.7	3.9	4.7	3.0	2.5	1.5	2.1	2.3	2.2	2.9	3.9	4.3	47.2
AVG	5.9	4.0	5.6	4.5	3.1	1.9	2.8	2.7	2.7	4.4	4.9	5.8	48.5
25%	2.2	1.7	2.1	1.9	1.5	1.2	1.5	1.6	1.6	2.0	2.0	2.8	37.6
MIN	0.1	0.0	0.9	0.4	0.4	0.5	0.8	0.2	0.6	0.2	0.4	1.0	21.4

SKN: 903.10 NAME: BYU-LAIE OBSV: BYU-HAWAII ELEV(FT): 5
DATA PERIOD: 1967-1982 NYRS: 13 READ: DAILY LAT: 21 38 54 LONG: 157 55 55

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	17.3	15.9	40.5	8.9	8.7	9.0	7.8	7.2	10.3	8.8	10.1	20.1	115.3
75%	10.6	7.1	6.0	6.7	5.6	3.1	4.3	4.5	4.0	5.2	7.7	10.0	58.8
MED	7.0	3.3	4.2	4.1	3.0	2.6	3.3	2.7	2.6	4.0	3.1	4.4	54.9
AVG	4.0	5.1	6.5	4.6	3.7	2.8	3.6	3.3	3.6	4.4	8.3	6.8	58.9
25%	3.6	2.1	2.1	2.3	1.4	1.7	1.8	2.0	1.9	2.8	2.6	2.6	46.5
MIN	1.1	0.5	1.1	1.2	1.0	0.7	0.8	1.5	1.8	2.0	0.7	0.5	34.3

SKN: 904.00 NAME: HAUULA OBSV: KAHUKU PLANT ELEV(FT): 35
DATA PERIOD: 1907-1984 NYRS: 42 READ: DAILY LAT: 21 36 24 LONG: 157 54 30

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	24.0	17.8	22.7	31.7	15.8	6.9	9.4	10.4	8.6	15.4	14.6	25.0	98.1
75%	8.0	7.4	12.1	7.7	5.3	3.1	4.0	4.4	4.0	7.1	8.5	8.1	67.4
MED	4.4	5.1	7.2	3.9	3.1	2.2	2.9	3.2	2.9	4.2	4.7	5.2	58.4
AVG	6.4	6.1	8.1	5.9	3.9	2.5	3.2	3.6	3.3	5.3	6.1	6.3	60.4
25%	2.0	3.0	3.2	2.0	1.9	1.4	2.1	2.1	1.9	2.4	3.1	3.4	51.5
MIN	0.1	1.0	0.9	0.9	0.4	0.0	0.5	1.7	0.7	1.0	0.5	1.9	36.4

SKN: 905.00 NAME: PAPAAKUKU OBSV: KAHUKU PLANT ELEV(FT): 35
DATA PERIOD: 1946-1971 NYRS: 25 READ: DAILY LAT: 21 38 22 LONG: 157 53 50

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	28.3	17.6	23.8	33.0	23.0	8.7	9.0	7.4	7.8	15.4	23.8	17.2	117.6
75%	13.9	9.9	12.1	8.0	5.2	3.3	4.8	4.7	5.0	7.4	12.8	10.3	92.1
MED	6.6	6.3	6.9	5.3	3.5	2.1	3.6	3.5	3.4	4.8	7.7	6.4	80.6
AVG	9.6	7.0	8.7	6.7	4.6	2.5	3.9	3.4	3.6	5.6	9.0	7.8	77.0
25%	4.7	3.9	3.3	2.5	3.0	1.4	2.5	2.4	2.1	1.1	3.1	5.4	80.1
MIN	1.7	1.9	1.4	1.2	0.3	1.1	1.0	1.4	1.1	1.0	0.9	2.7	63.8

SKN: 906.00 NAME: FIELD 5 OBSV: KAHUKU PLANT ELEV(FT): 230
DATA PERIOD: 1920-1960 NYRS: 30 READ: MONTHLY LAT: 21 41 12 LONG: 158 0 6

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	17.9	10.2	13.4	16.5	8.3	4.4	5.6	7.9	5.5	14.9	10.2	30.2	81.0
75%	8.4	6.0	7.6	4.2	3.1	2.3	3.3	4.1	2.7	5.5	6.1	7.1	57.4
MED	4.1	4.1	4.7	2.7	2.0	1.6	2.3	2.5	1.5	2.8	3.7	4.0	43.4
AVG	5.4	4.7	5.3	3.3	2.0	1.8	2.4	3.1	2.1	4.0	4.1	5.8	44.9
25%	2.5	2.5	1.9	1.3	1.0	1.1	1.3	1.5	1.2	1.5	1.9	2.4	36.4
MIN	0.5	0.7	0.0	0.5	0.2	0.4	0.0	0.5	0.7	0.3	0.4	0.5	22.3

SKN: 906.10 NAME: CAMP 22 OBSV: KAHUKU PLANT ELEV(FT): 280
DATA PERIOD: 1926-1960 NYRS: 24 READ: MONTHLY LAT: 21 41 10 LONG: 157 59 12

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	19.0	15.5	16.3	12.2	8.2	3.3	5.0	6.2	4.1	10.8	14.4	26.3	70.0
75%	8.8	6.2	8.4	4.5	3.5	1.9	2.3	3.9	2.1	3.4	6.3	6.1	40.6
MED	3.8	3.9	3.7	2.3	1.7	1.3	1.4	2.1	1.8	2.1	4.1	3.3	38.2
AVG	5.4	4.2	4.7	2.9	2.4	1.4	1.8	2.6	1.7	3.0	4.1	4.8	39.4
25%	1.8	1.7	1.9	1.0	1.1	0.8	1.0	1.4	1.0	0.9	1.7	1.9	30.9
MIN	0.0	0.4	0.1	0.3	0.1	0.4	0.6	0.5	0.3	0.2	0.4	0.6	15.8

SKN: 907.00 NAME: KAHUKU PUMP 2 OBSV: KAHUKU PLANT ELEV(FT): 5
DATA PERIOD: 1910-1970 NYRS: 61 READ: DAILY LAT: 21 41 54 LONG: 157 59 6

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	17.5	15.0	15.8	20.5	11.7	5.9	5.6	10.2	8.2	19.7	18.0	34.5	80.4
75%	9.1	6.0	7.0	4.6	2.6	2.0	2.9	3.0	2.8	4.5	5.5	7.4	49.7
MED	4.4	3.1	4.4	2.9	1.9	1.3	1.7	2.1	1.9	2.5	3.4	4.1	39.4
AVG	5.6	3.8	4.8	3.7	2.2	1.6	2.1	2.5	2.1	3.8	4.4	5.1	41.5
25%	2.5	1.7	1.8	1.4	1.0	0.9	1.3	1.3	1.1	1.4	1.8	2.9	32.4
MIN	0.2	0.7	0.0	0.4	0.1	0.3	0.1	0.5	0.2	0.6	0.2	0.6	15.5

SKN: 908.00 NAME: PUMP 4-KAHUKU PL OBSV: KAHUKU PLANT ELEV(FT): 40
DATA PERIOD: 1948-1970 NYRS: 23 READ: DAILY LAT: 21 41 42 LONG: 158 0 12

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	15.7	9.3	16.5	22.8	12.4	3.0	6.6	4.5	3.5	8.4	17.9	12.6	69.9
75%	10.0	4.9	7.3	4.2	3.1	1.9	2.9	3.3	2.3	3.7	5.2	8.1	42.9
MED	4.0	3.5	3.1	2.6	1.9	1.8	1.4	1.8	1.5	2.9	3.7	4.2	40.1
AVG	5.7	3.9	4.8	3.7	2.3	1.4	2.2	2.2	1.7	3.1	4.8	4.6	40.2
25%	2.6	2.7	1.4	1.3	0.8	0.8	1.1	1.1	1.0	1.2	1.7	3.2	30.3
MIN	1.3	1.0	0.0	0.4	0.1	0.3	0.6	0.6	0.4	0.4	0.8	0.7	18.4

SKN: 910.00 NAME: PUMP 10 (KAHUKU) OBSV: KAHUKU PLANT ELEV(FT): 200
DATA PERIOD: 1946-1970 NYRS: 25 READ: DAILY LAT: 21 41 18 LONG: 157 59 0

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	16.8	9.8	19.9	44.9	5.0	4.7	4.7	4.7	3.4	10.8	21.1	13.4	88.8
75%	10.4	6.5	8.4	5.1	3.0	2.4	3.5	2.9	2.2	4.5	8.8	8.9	53.4
MED	5.6	4.5	4.5	3.2	2.0	1.8	2.1	2.1	2.4	2.6	4.5	5.6	48.5
AVG	7.0	5.0	5.4	4.5	2.1	1.8	2.6	2.8	2.1	3.6	5.8	5.6	49.9
25%	3.4	2.9	2.1	1.6	1.0	1.1	1.4	1.5	1.4	1.7	2.3	2.7	40.4
MIN	1.7	1.4	1.0	0.6	0.2	0.6	0.5	0.6	0.9	0.8	1.0	1.5	20.9

SKN: 911.00 NAME: PUMP 5 OBSV: KAHUKU PLANT ELEV(FT): 40
DATA PERIOD: 1946-1983 NYRS: 28 READ: DAILY LAT: 21 41 12 LONG: 157 58 12

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	17.7	10.1	17.1	19.2	14.6	6.5	6.3	5.5	3.9	10.2	17.8	11.9	90.5
75%	9.7	5.9	8.2	4.6	3.1	2.3	2.7	3.6	2.7	4.6	8.8	8.3	52.8
MED	4.9	4.0	4.0	2.5	2.2	1.7	1.7	1.8	2.1	2.5	4.4	5.1	47.1
AVG	8.9	4.4	5.5	3.5	2.7	1.8	2.4	2.5	2.1	3.0	5.0	5.2	45.8
25%	3.3	2.4	1.9	1.8	1.2	1.0	1.4	1.5	1.4	1.8	1.9	2.8	39.2
MIN	1.5	0.9	0.9	0.8	0.2	0.5	0.7	0.6	0.8	0.5	0.9	1.6	25.4

SKN: 912.00 NAME: KAHUKU (MILL) OBSV: ELEV(FT): 25
DATA PERIOD: 1891-1983 NYRS: 89 READ: DAILY LAT: 21 40 48 LONG: 157 57 10

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	18.8	30.8	18.1	22.0	14.6	8.1	5.1	8.9	8.3	14.1	17.7	29.9	87.8
75%	8.3	5.7	8.3	3.8	3.0	2.0	2.5	2.9	2.5	4.3	4.8	6.2	40.9
MED	3.7	3.4	3.4	2.9	1.7	1.3	1.8	1.8	1.7	2.4	2.9	3.8	37.5
AVG	6.9	4.5	4.8	3.4	2.4	1.8	2.0	2.2	2.1	3.8	3.8	4.8	40.0
25%	1.9	1.7	1.7	1.4	1.1	0.8	1.1	1.1	1.3	1.8	1.4	2.1	31.7
MIN	0.0	0.3	0.0	0.4	0.1	0.0	0.5	0.3	0.6	0.3	0.2	0.4	14.4

TABLE 4. Average Daily Maximum and Minimum Temperatures Recorded at State Key Station 912.00 (Kahuku) During A 68 Year Period

Month	Mean Daily Maximum (F)	Mean Daily Minimum (F)
January	78.1	64.0
February	78.4	64.1
March	78.1	65.2
April	78.9	67.0
May	80.7	68.6
June	82.5	70.5
July	83.5	71.7
August	84.2	72.3
September	84.5	71.4
October	83.7	70.0
November	81.2	68.4
December	79.3	66.4
ANNUAL	81.1	68.3

SOURCE: Division of Water and Land Development, Department of Land and Natural Resources, State of Hawaii

Light intensity for crop production is favorable during the warm months, but is somewhat restricted because of cloud cover during the winter months. Larson reports that fall planting of truck crops for spring harvest is risky because of marginal sunlight during the winter, which limits crop growth (4).

Tree fruits and nuts and vine or bush type vegetables are subject to severe wind damage in the project area, both from prevailing trade winds and from Kona storms. Plants grown near the ocean are also subject to salt damage. Winds in the area would not be expected to severely restrict the production of root type vegetables and melons, although some reduction in yield would result.

CROP SELECTION BASED ON ECOLOGY

Truck crops are currently grown under irrigation in the south-mauka corner of the project area. Low growing crops, such as watermelons, are well adapted, except for disease and insect problems. Limited amounts of warm climate vegetables are also grown, but staked vine crops are subject to wind damage as well as disease and insect problems. Many vegetables grown in Hawaii require a more temperate climate than in the project area, such as Kula on Maui, and Waimea on Hawaii. Among the crops in this category are cabbage, onions, celery and certain types of lettuce. Other major vegetables, such as Irish potatoes are not generally grown in Hawaii.

Flower and foliage production is better adapted to areas less subject to wind and salt problems than the project area.

Papayas are only marginally adaptable to the area because of wind damage and phytophthora root rot, which is aggravated by heavy winter rains and inadequate drainage. Citrus, avocados, and macadamias are better adapted to areas with less severe wind problems and better drainage, but could be grown, with limitations, in the south-mauka corner of the project, which has good soil, faily good drainage and is subject to less damage from prevailing winds than areas closer to the ocean.

Bananas are well adapted to the south-mauka corner of the project, except for potential serious losses from both prevailing and Kona wind storms.

Cattle grazing is marginally adaptable to project areas with better drainage and freedom from ponding. Without irrigation, however, the intensity of grazing is limited because of minimal warm season rainfall and would be economically infeasible with irrigation because of water cost. Grazing offers the least productive use value of the land and would provide a prohibitively low net return per acre. Most cattle grazing in the state is restricted to marginal lands of minimal market value at higher elevations. There would seem to be no justification for Ag-1 zoning of land on Oahu for use as cattle grazing.

Better drained lands in the project area could feasibly be used as sites for hog or dairy production, except for incompatibility with existing nearby resort and residential areas. These enterprises might also pose environmental problems to wildlife through the pollution of ponds and offshore areas.

SALES POTENTIALS

Since only 48 acres of land with SCS capability classes of I and II are considered feasible for commercial agricultural production, the market analysis applies only to this segment of the project. The determinations of sales potentials in this analysis are valid only for those crops which are agriculturally feasible for the project area with respect to ecological adaptation, economic viability, comparative costs of production and intensity of production.

Only truck crops have been determined to meet the feasiblity criteria other than the sales potential. This does not imply that other crops are not grown or cannot be grown in the area.

The acreage required to displace imports of truck crops that can be grown in Hawaii is sufficiently large that the market potential itself is not a limiting factor for the project. The sales potential or the ability to compete with other production areas may, however, be a potential problem.

Watermelons are indicated to be the most important truck crop in the project area, although subject to production problems. Insect damage has caused low per acre yields, although recent better production practices have tended to alleviate this problem. The harvest season has generally been restricted to the period of May through October, because of the adverse effects of heavy rains and reduced light intensity during winter months. The several months duration in harvest reflects staggered plantings rather than multiple cropping and watermelon production on Oahu is generally limited to one crop per year.

Only 39 percent of the Hawaii Market supply of 9,770,000 pounds of watermelons in 1983 was produced in Hawaii. Hawaii's share has been expanding and displacement of 5,910,000 pounds of imports in 1983 would require 296 acres of additional production at a projected yield of 20,000 pounds per acre. The annual harvested acreage of watermelons on Oahu has averaged about 70 acres during the past five years, but Oahu's share of state production has declined from 56 percent of 125 acres in 1979 to 23 percent of 310 acres in 1983. The major expansion in production has taken place on Molokai and Kauai, where production per acre is higher and costs are lower than on Oahu. These conditions would indicate a probable impending decline in watermelon production on Oahu. Although Kahuku is the center of watermelon production on Oahu, harvested acreage in the project area is estimated at not more than 20 acres during any one year.

Since expansion in watermelon production is unlikely, sales potentials for other ecologically adapted crops for the remaining 28 acres of prime agricultural land must be considered. Guava, although ecologically adapted to the project area if irrigated, should be eliminated from consideration because of the recent large

excess of supply over demand, resulting in depressed prices and abandonment of orchards. Displacement of banana imports offers a substantial market. Imports averaging about 8,000,000 pounds annually during the past five years would require 230 acres of additional Hawaii acreage at 35,000 pounds per acre. Whereas displacement of banana imports is indicated to be feasible for Hawaii producers expansion in production is expected to take place on large, well managed farms in Puna and to a lesser extent on Kauai at the expense of production on Oahu.

Although papayas have been produced in the project area, ecological adaptation is marginal and an assessment of the sales potential is not warranted.

The market could be expected to assimilate the output of vegetables ecologically adaptable to the remaining 28 acres. Hawaii marketings, imports and acreage required to displace imports for all vegetables considered at least marginally adaptable to SCS Class I and II lands in the project area are shown in Table 5. It is readily apparent that the market is a major limiting factor to expanded vegetable production in the project area. The only promising crops insofar as the market is concerned are green peppers for which displacement of 1983 imports would require about 90 acres and cucumbers for which displacement of imports would require about 78 acres. Displacement of sweet potato imports would require 32 acres, but other areas on Oahu and on the outside islands are considered superior to the project area for sweetpotato production with respect to both ecology and cost of production. A substantial market exists for certain other vegetables, such as tomatoes, but tomato production is better adapted to greenhouse production, rather than as a minor crop in small farm field production which characterizes farming in the project area.

Table 5. Acreage Required to Displace Imports of Vegetables Adaptable to SCS Class I and II Lands in the Project Area

Crop	Hawaii Production 1983 (1,000 pounds)	Imports 1983 (1,000 pounds)	Expected Yield Per Acre (pounds) *	Acreage Required To Displace Imports
Beans, snap	1,360	111	20,000	6
Cucumbers	5,200	1,550	25,000	62
Eggplant	1,480	139	30,000	5
Peppers, green	1,190	1,789	20,000	90
Sweetpotato	1,860	633	20,000	32

* Expected yield under good management and optimal climatic conditions. Yields would be expected to be lower in the project area because of wind, disease and insect problems.

LAND REQUIREMENTS IN RELATION TO AVAILABILITY OF AGRICULTURAL LAND ON OAHU

The acreage in cultivated crops on Oahu has steadily declined during the past ten years from 51,900 acres in 1974 to 49,100 acres in 1979 and 41,400 acres in 1983 (5). The very marked decline of 7,700 acres of crop production between 1974 and 1979 exceeds that which has been converted to uses other than agriculture, resulting in a stockpile of unused agricultural land of good quality. Most of the decline has been in sugar and pineapple production. Some of this land offers a potential for expansion in diversified crop production with respect to ecology, but high land prices, market limitations and difficulties in obtaining agricultural subdivision permits from the City and County of Honolulu have prevented its use for agriculture.

The LSB classified 53,039 acres of land on Oahu outside urban areas as good agricultural land in 1972 of which 20,583 acres were given crop productivity ratings of A and 32,456 acres were rated as B. In addition, 17,837 acres were classified as C, which is submarginal for cultivated crop production. This compares to a total of only 41,400 acres in cultivated crop production on Oahu in 1983 of which an undetermined number of acres in production had productivity ratings lower than B. These data thus indicate that the total acreage of good agricultural land (A and B) exceeds the total acreage in cultivated crop production on all classes of land by 11,639 acres. With Class C land included, the availability of cultivatable land based on the 1972 data exceeds the 1983 acreage in cultivated crop production by 29,476 acres. However, an undetermined amount of the 11,639 acres of excess good agricultural land has been converted to other uses and is no longer available for agricultural use.

The SCS classified 67,342 acres as good agricultural land in 1972, with 23,551 acres rated as I and 43,791 acres rated as II, with irrigation. Since an undetermined amount of this is in urban areas, the relationship of this acreage to acreage in cultivated crops cannot be determined without a detailed analysis of land use by land capability type, which is beyond the scope of this study. However, since SCS and LSB land productivity ratings are fairly comparable, a similar excess of perhaps 11,000 acres of good agricultural land over all land in cultivated crop production on Oahu is indicated.

The City and County of Honolulu reported 139,952 acres of land on Oahu zoned as Ag-1 in 1982. These lands are, with some exception, restricted to agricultural use and are separate from lands zoned as urban or conservation. The land area zoned as Ag-1 is far in excess of the 41,400 acres in cultivated crop production in 1983, the 53,039 acres classified as A and B by LSB, and the 67,342 acres classified as I and II by SCS.

The large acreage zoned as Ag-1 is not only far in excess of the acreages in good agricultural land as determined by LSB and SCS, but increasingly exceeds the land needed for crop production in face of a continuing decline in acreage devoted to crop production on Oahu. Another important consideration is that unused good agricultural land is available at lower cost on the outside islands. Because of lower land cost and lower or no irrigation water cost, production centers for crops such as bananas, watermelons, and guavas are moving to outside islands, thus increasing the amount of unused prime agricultural land and decreasing the agricultural need for it on Oahu.

NEED FOR AGRICULTURAL LAND IN THE PROJECT AREA

The excess of good agricultural land over land requirements for cultivated crop production on Oahu would indicate that the small acreage of good land in the project area might most feasibly be zoned for a higher use value unless other conditions strongly favor its use for agriculture. Of the 394± acres zoned Ag-1 in the Kuilima project, SCS classifies only 48 acres in capability group I and three acres in capability group II. The remaining 346± acres are classified in capability group III or lower and are not recommended for crop production. Group III, is defined by SCS as having severe limitations that reduce the choice of plants, require special conservation practices or both. Limitations for crop production are defined as very severe for Group IV, and Groups V to VIII are considered unsuitable for cultivated crop production. LSB classifies 37 acres in the project area in capability Group A and 80 acres in capability Group B. However, an on-site inspection by the writer indicates that most of the 80 acres classified as B have severe limitations for crop production, such as poor drainage, and should be classified into capability Group C, which is comparable to the Group III classification by SCS for these parcels. Thus the SCS capability classification of only 48 acres as good agricultural land will prevail in this analysis.

Since 346± acres of the 394± acres are considered inferior or submarginal for crop production, it is questionable that the small parcel of 48 acres of good agricultural land should be separated from the rest of the Kuilima project with respect to zoning. Other problems tending to weaken the justification for retaining the 48 acre segment in Ag-1 are severe wind conditions, which may reduce crop yields and product quality in relation to competing areas, use of lands of high market value and higher use value for the production of crops that can be grown more economically in competing areas, and limited acreages of adaptable crops which may result in marketing disadvantages. Further potential problems are use of scarce irrigation water which may have higher use value, farming activities within the Kuilima project area which may be incompatible with resort complexes because of chemical sprays, dust and noise.

VALUE OF AGRICULTURAL PRODUCTION FROM LEASED LANDS IN THE PROJECT AREA

At 1983 prices and yields as reported for Oahu by the Hawaii Crop and Livestock Reporting Service, the estimated value of agricultural production from leased lands in the project area zoned for Ag-1 is as follows:

The estimated 20 acres in truck crops, with an estimated equal area in watermelons and vegetables, would provide annual per acre returns of $5,200 gross, $3,640 to labor' management and risk with no out of pocket costs for family labor, and a net of $2,600 to risk after charging for all costs, including labor.

An estimated 100 acres utilized for grazing without irrigation might be expected to provide a gross return through cattle weight gains of $110.00 per acre annually. This is based on a feeder cattle weight gain of 220 lbs. per acre annually at a price of $.50 per pound live weight. At these rates, annual net return per acre to a family operation might be expected to amount to $80.00 in net return to risk approximately $60.00.

The aggregate annual gross value of agriculture on the subject leased lands is thus estimated at $115,000.00, including $104,000.00 for the estimated 20 acres in crops and $11,000 for the 100 acres utilized for livestock grazing. Aggregate net returns to family farms with no out of pocket costs for labor are estimated at $60,000.00, including $52,000.00 for crops and $8,000.00 for livestock grazing.

EFFECTS OF REZONING ON AGRICULTURAL EMPLOYMENT

Miscellaneous truck crop production in the project area on the prevailing basis of one crop annually would require approximately 0.25 man units per acre for labor and 0.05 man units per acre for management. Under full development, this would amount to 12.0 man units of labor and 2.4 man units of management for the 48 acres of land given productivity ratings of I and II by SCS.

Of the 138 acres of land currently leased by four farmers in the project area zoned Ag-1, it is estimated that not more than 20 acres is in crop production and the remainder is utilized for farm structures, homes, roadways and cattle grazing. Total job requirements, including both labor and management for the 20 acres subject to cultivated crop production is estimated at 6.0 man units. Requirements for the remainder of the leased land, most of which is used for cattle grazing, would not be expected to exceed 2.0 man units.

Based on the determination that only 48 of the 394.0 acres of land zoned Agriculture is ecologically adaptable to agriculture, rezoning of the 48 acres of good agricultural land out of agriculture to more optimal use would result in a potential displacement equivalent to 14.4 man units.

Rezoning of the entire 394.0 acres zoned agriculture would displace not more than 8 man units based on current leases of 138 acres and current production practices.

An investigation by the writer indicates that there are alternative lease opportunities for the four agricultural tenants who would be displaced in the Kuilima Resort Expansion project. Among these are opportunities for nearby leases on Campbell Estate land, and Castle and Cooke lands near Mililani. These leases are reasonable in price, but somewhat higher than the existing month-to-month Kuilima leases. The alternative leases are, however, long-term and include prime agricultural land for farmers interested in intensive crop production.

SUMMARY AND CONCLUSIONS

The analyses in this report indicates that 346± acres of the 394± acres zoned Ag-1 in the Kuilima Resort Expansion Project are ecologically infeasible or submarginal for cultivated crop production. The remaining 48 acres of land zoned Ag-1, located in the south-mauka corner of the project is given SCS crop capability classifications of I and II with respect to soil type and topography. However, in spite of the high ranking with respect to soil type and topography, this area has severe wind problems which limit the types of crops that can be grown and cause reductions in yield for adaptable crops. This condition reduces the competitive position of farming in relation to competing production areas. The small area of good land also limits the volume of marketing of various crops, which tends to increase harvesting and production costs per unit and reduces the competitive advantage in the market place. The area has very poor rainfall distribution, with most of the rainfall realized during the winter months when cloud cover is extensive and limited light intensity tends to retard crop growth.

Production of the types of crops best adapted to the south-mauka corner of the project is shifting to other areas, particularly to neighbor islands, because of lower cost of production, especially with respect to irrigation.

The land area devoted to crop production on Oahu has been declining for several years and underwent a very substantial reduction of 7,700 acres between 1979 and 1983. The total acreage of available good agricultural land on Oahu is estimated to exceed foreseeable crop production needs by over 11,000 acres. Thus there is no indicated overall agricultural need for the 48 acres of good land in the Kuilima Development. The study thus indicates that rezoning of the entire 394± acres of Ag-1 land in the Kuilima Resort Expansion Project would have no adverse effect on agriculture in the state, except for the displacement of six lessees whose lease agreements are currently on a month-to-month basis.

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APPENDIX B

WATER MASTER PLAN

WATER MASTER PLAN

FOR

KUILIMA RESORT

AT

Kahuku, Oahu, Hawaii

Prepared for

KUILIMA DEVELOPMENT COMPANY
Honolulu, Hawaii

Prepared by:

EDP Hawaii Inc.
1164 Bishop Street, Suite 1515
Honolulu, Hawaii

August, 1984

A. INTRODUCTION

The Kuilima Resort development is situated in Kahuku on the north coast of Oahu. This resort development, as currently planned, will include the development of additional hotel and condominium apartment units, a small commercial center, a second 18-hole golf course and several park sites as shown on the Master Plan.

Presently, the development at Kuilima consists of the 487-room Turtle Bay Hilton Hotel, the Kuilima East and the Kuilima West developments with a total of 368 apartment units, and an 18-hole golf course. The proposed future developments will require additions to the existing water system which shall be constructed in phases as required to meet the needs of the future developments.

Discussed in this Master Plan are the water demand requirements and the proposed water system improvements which will ultimately be needed to service the Kuilima Resort development. The use of the treated wastewater generated by the development will be discussed in the wastewater master plan for the development.

B. EXISTING WATER SYSTEM

The water system serving the existing developments was constructed by the Developers and subsequently dedicated to the Board of Water Supply. Initially a 16" water main was constructed along Kamehameha Highway from the Waialee Water System to the intersection of Kuilima Drive and Kamehemeha Highway and a 12" main was constructed along Kuilima Drive to provide service the existing developments. A 2.0 mg reservoir, with a spillway elevation of

228 feet, was later constructed to provide and meet BWS' storage capacity requirements. The reservoir is connected to the system by a 20-inch transmission main which extends from the reservoir to the 16" main, as shown on the Master Plan. Water for the existing 487 hotel units and 368 condominium units is supplied from the Board of Water Supply wells at Waialee.

C. ESTIMATED WATER DEMAND

The total water demand for the ultimate development shown on the Master Plan is estimated as follows:

		No. of Units	Unit Demand	Total Demand (mgd) Ave-Day	Total Demand (mgd) Max-Day
1. **Existing Developments**					
Turtle Bay Hilton Hotel		487	350	0.170	0.255
Kuilima East Apts.		169	400	0.068	0.102
Kuilima West Apts.		199	400	0.080	0.120
Totals				0.318	0.477
2. **Future Developments**					
Hotel Units		1435	350	0.502	0.753
Apt. Units		2073	400	0.829	1.244
Commercial	(Ac)	5	3000	0.015	0.022
G. C. Clubhouse	(Ac)	3	4000	0.012	0.018
Parks	(Ac)	63	4000	0.252	0.378
Stable	(Ac)	10	4000	0.040	0.060
STP	(Ac)	5	4000	0.020	0.030
Totals				1.670	2.505
3. **Grand Totals**				1.988	2.982

D. PROPOSED WATER SYSTEM IMPROVEMENTS

1. Water Source Facilities

a. Existing Water Source

The BWS currently provides the Kuilima Resort development with a max-day water supply of up to 0.5 mgd from their Waialee System. The BWS will continue to provide this supply of water contingent upon modifications to be made by the Developer to the Waialee System to make the Sunset-Paumalu System compatible with the Kuilima 228 System.

This 0.5 mgd source is sufficient to meet the max-day water demand for the existing Turtle Bay Hilton hotel and the 368 condo apartment units within the existing Kuilima East and Kuilima West Developments.

b. Future Water Source Facilities

Additional water well facilities will be developed to provide the additional 2.50 mgd max-day water demand as estimated in C.2 for the future developments at Kuilima.

Based on current BWS standard of 16 hrs/day pumping, the total well pumping capacity ultimately required will be 3.73 mgd or 2600 gpm.

Well pumping units will be developed and provided in phases as required to meet the water demand of the various phases of development proposed for Kuilima. Initially, the Opana (Kawela) Well field, as located on the Master Plan, will be developed and shall include one production well plus one standby well unit. The actual well pump capacity and the ultimate number of units developable at this source is not known at this time and shall be determined upon completion of pump tests to establish the water quality and sustainable yield of this water source.

The well facilities will be designed to pump water to the existing 2.0 mg reservoir shown on the Master Plan. All facilities shall be designed to BWS standards and is intended to be dedicated to the BWS upon completion.

2. Reservoir Storage

The existing 2.0 mg reservoir will be adequate until the total max-day demand of actual developments at Kuilima reaches 2.0 mgd.

A second reservoir with a capacity of 1.0 mg will be required to provide the max-day storage for the ultimate development as currently planned for Kuilima. This is based on the estimated max-day demand of 2.982 mgd for the ultimate development and the

current BWS' requirement of providing storage capacity equal to the max-day demand.

This second reservoir shall be constructed on the site reserved for it adjacent to the existing 2.0 mg reservoir, when required.

3. Water Distribution System

As stated previously, the existing water distribution system includes a 20" main from the 2.0 mg reservoir to Kamehameha Highway. This main is connected to a 16" main that runs along Kamehemeha Highway to Kuilima Drive. A 12" main then extends along Kuilima Drive and serves the existing Turtle Bay Hilton hotel and the Kuilima East and West developments.

Additional water mains as shown on the Master Plan will be constructed in phases to service the future developments.

Water system analyses for peak hour conditions through the proposed distribution system are summarized in Tables I and II.

TABLE I
WATER DEMAND FOR DISTRIBUTION SYSTEM

Draft Point	Dev. Parcel	No. of Units	Unit Demand	Water Demand (MGD) Ave-Day		Max-Day	Peak-Hr
	P-1	5 ac	4000	0.020			
A					0.020	0.030	0.060
	STP	5 ac	4000	0.020			
C					0.020	0.030	0.060
	K-East	169	400	0.068			
	K-West	199	400	0.080			
D					0.148	0.222	0.444
	TBH Hotel	487	350	0.170			
E					0.170	0.255	0.510
	A-1	540	400	0.216			
	A-7	180	400	0.072			
F					0.288	0.432	0.864
	C-1	5 ac	3000	0.015			
	H-1	500	350	0.175			
	H-2	500	350	0.175			
G					0.365	0.548	1.095
	Stable	10 ac	4000	0.040			
H					0.040	0.060	0.120
	P-2	46 ac	4000	0.184			
I					0.184	0.276	0.552
	A-4	180	400	0.072			
	A-6	300	400	0.120			
	A-5	240	400	0.096			
	P-3	10 ac	4000	0.040			
J					0.328	0.492	0.984
	A-3	315	400	0.126			
K					0.126	0.189	0.378
	A-2	318	400	0.127			
	H-3	330	350	0.116			
L					0.243	0.365	0.729
	CH-1	3 ac	4000	0.012			
M					0.012	0.018	0.036
	P-4	2 ac	4000	0.008			
	H-4	105	350	0.037			
N					0.045	0.068	0.135
TOTALS					1.989	2.985	5.967

TABLE II
DISTRIBUTION SYSTEM ANALYSIS

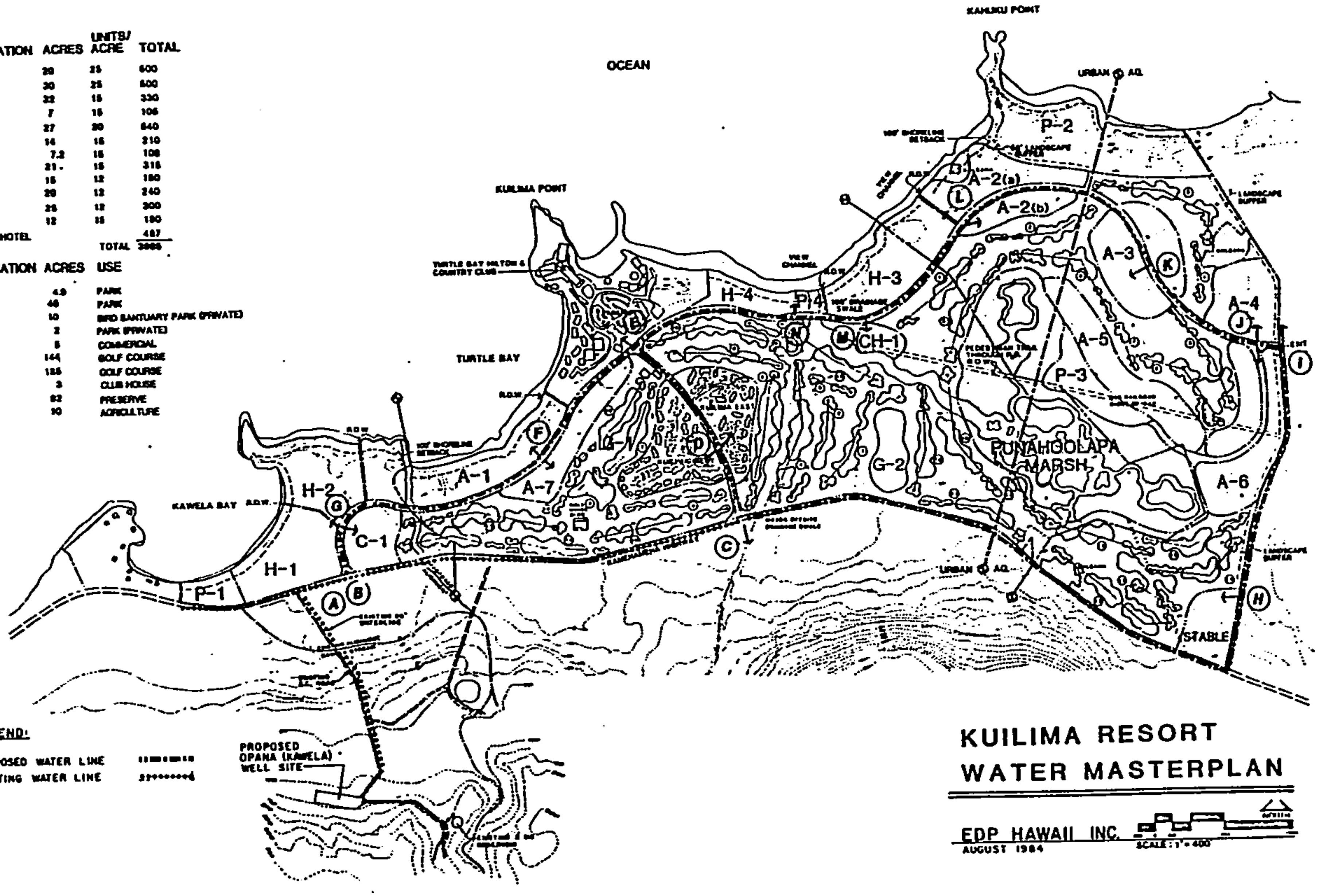
	PT	LINE	DIA	L	C	Q	HF/1000	HF	HG	GRD* ELEV	RESIDUAL PRESSURE (PSI)
	RES								228.0		
		R-A	20	3800	120	5.967	3.38	- 12.84			
	A								215.2	10	88
		AB	16	550	120	5.907	9.83	- 5.41			
	B								209.7	10	86
LOOP 1	B								209.7	10	86
		BC	16	4550	120	3.076	2.94	- 13.38			
	C								196.4	14	79
		CD	12	800	110	1.706	4.71	- 3.77			
	D								192.6	15	76
		DE	12	1500	110	1.262	2.70	- 4.04			
	E								188.6	25	70
		EF	12	1600	110	0.872	1.36	2.18			
	F								190.7	(20)	73
		FG	12	2550	110	1.736	4.86	12.40			
	G								203.1	(20)	79
		GB	12	550	110	2.831	12.02	6.61			
	B								209.7	10	86

	PT	LINE	DIA	L	C	Q	HF/1000	HF	HG	GRD* ELEV	RESIDUAL PRESSURE (PSI)
LOOP 2	C								196.4	14	79
		CH	12	6900	110	1.310	2.89	- 19.96			
	H								176.4	(20)	67
		HI	12	3000	110	1.190	2.42	- 7.27			
	I								169.2	(20)	64
		IJ	12	350	110	0.638	0.77	- 0.27			
	J								168.9	(20)	64
		JK	12	1600	110	0.346	0.25	0.39			
	K								169.3	(20)	64
		KL	12	2600	110	0.724	0.96	2.50			
	L								171.8	(20)	65
		LM	12	1500	110	1.453	3.50	5.25			
	M								177.0	(20)	68
		MN	12	800	110	1.489	3.66	2.93			
	N								180.0	(20)	69
		NO	12	2000	110	1.624	4.30	8.60			
	E								188.6	25	70
		ED	12	1500	110	1.262	2.70	4.04			
	D								192.6	15	76
		DC	12	800	110	1.706	4.71	3.77			
	C								196.4	14	79

* Final Elevation for the development parcels are not known at this time. However, elevations shown in parentheses indicate probable highest final site elevations.

DESIGNATION	ACRES	UNITS/ ACRE	TOTAL
H-1	20	25	500
H-2	20	25	500
H-3	22	15	330
H-4	7	15	105
A-1	27	20	540
A-2(a)	14	15	210
A-2(b)	7.2	15	108
A-3	21	15	315
A-4	15	12	180
A-5	20	12	240
A-6	25	12	300
A-7	12	15	180
EXISTING HOTEL			487
		TOTAL	3995

DESIGNATION	ACRES	USE
P-1	4.5	PARK
P-2	46	PARK
P-3	10	BIRD SANCTUARY PARK (PRIVATE)
P-4	2	PARK (PRIVATE)
C-1	5	COMMERCIAL
G-1	144	GOLF COURSE
G-2	135	GOLF COURSE
CH-1	3	CLUB HOUSE
MARSH	82	PRESERVE
STABLE	10	AGRICULTURE



LEGEND:

PROPOSED WATER LINE

EXISTING WATER LINE

KUILIMA RESORT
WATER MASTERPLAN

EDP HAWAII INC.
AUGUST 1984
SCALE: 1" = 400'

APPENDIX C

ANALYSIS OF IMPACTS
OF TERRESTRIAL STORM RUNOFF
ON THE NEARSHORE MARINE ENVIRONMENT

OI CONSULTANTS, INC.

IMPACTS OF TERRESTRIAL STORM RUNOFF ON
THE NEARSHORE MARINE ENVIRONMENT
OFF KUILIMA AND KAHUKU, OAHU, HAWAII

FINAL REPORT

MAKAPUU POINT
WAIMANALO, HAWAII 96795
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IMPACTS OF TERRESTRIAL STORM RUNOFF ON
THE NEARSHORE MARINE ENVIRONMENT
OFF KUILIMA AND KAHUKU, OAHU, HAWAII

FINAL REPORT

Prepared for:

Kuilima Development Co.
1001 Bishop Street, Suite 1980
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Prepared by:

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Waimanalo, Hawaii 96795

Dr. David A. Ziemann
Project Manager

JULY, 1985

EXECUTIVE SUMMARY

The Kuilima Resort Development, located on the north shore of Oahu, presently consists of the Turtle Bay Hotel and Country Club and the Kuilima East and West Condominiums. Plans for development include the construction of additional resort complexes, expanded golf course, commercial areas, and parks. The completed resort complex will cover approximately 800 acres.

Drainage system modifications are planned to handle runoff from resort development and to realign Kawela Stream. The result of these plans will be to decrease the storm runoff entering Kawela Bay and to increase the runoff into Turtle Bay. Punahoolapa Marsh will continue to be a storm runoff ponding basin, and will discharge excess flow into Kuilima Bay.

Water quality conditions within Kawela Bay will probably improve after the diversion of Kawela Stream. Flow into the Bay will decrease to approximately 30% of present flow under storm conditions. The decreased input of sediment into the Bay will result in improved water clarity and increased coral growth.

Turtle Bay will receive increased runoff and sediment load after diversion of Kawela Stream. The point of discharge, however, is in an area which experiences strong rip currents which will carry much of this sediment offshore before it can settle. Water quality conditions within the Bay are not likely to change except at the point of discharge, and this should be only temporary. The benthic communities in this area are not likely to be affected by the storm discharge. Corals and algae in the discharge area are relatively sparse.

Storm drainage entering Kuilima Bay (the embayment located between Kuilima and Kahuku Points) will increase by approximately 20% after development is complete. The character of the discharge is not likely to change, since the majority of the watershed area is agricultural or undeveloped land whose uses will not be affected by the development. Punahoolapa Marsh will continue to be a storm runoff ponding area. Flow from the marsh to the ocean will probably be lower in solids concentration than direct discharge would be because the marsh will act as a settling basin. Strong currents in Kuilima Bay will tend to move storm discharge out to sea rapidly.

The development of the Kuilima Resort does not appear likely to result in any significant decrease in nearshore water quality. Surveys of the existing benthic communities, especially in Kuilima Bay, show evidence of the effects of existing point and non-point source freshwater discharges. The benthic communities appear to be most affected, however, by the high wave energy to which the coastline is periodically subjected. Development is not foreseen to result in negative changes in benthic communities. Conditions in Kawela Bay are likely to improve; conditions in Turtle Bay and Kuilima Bay will likely remain unchanged.

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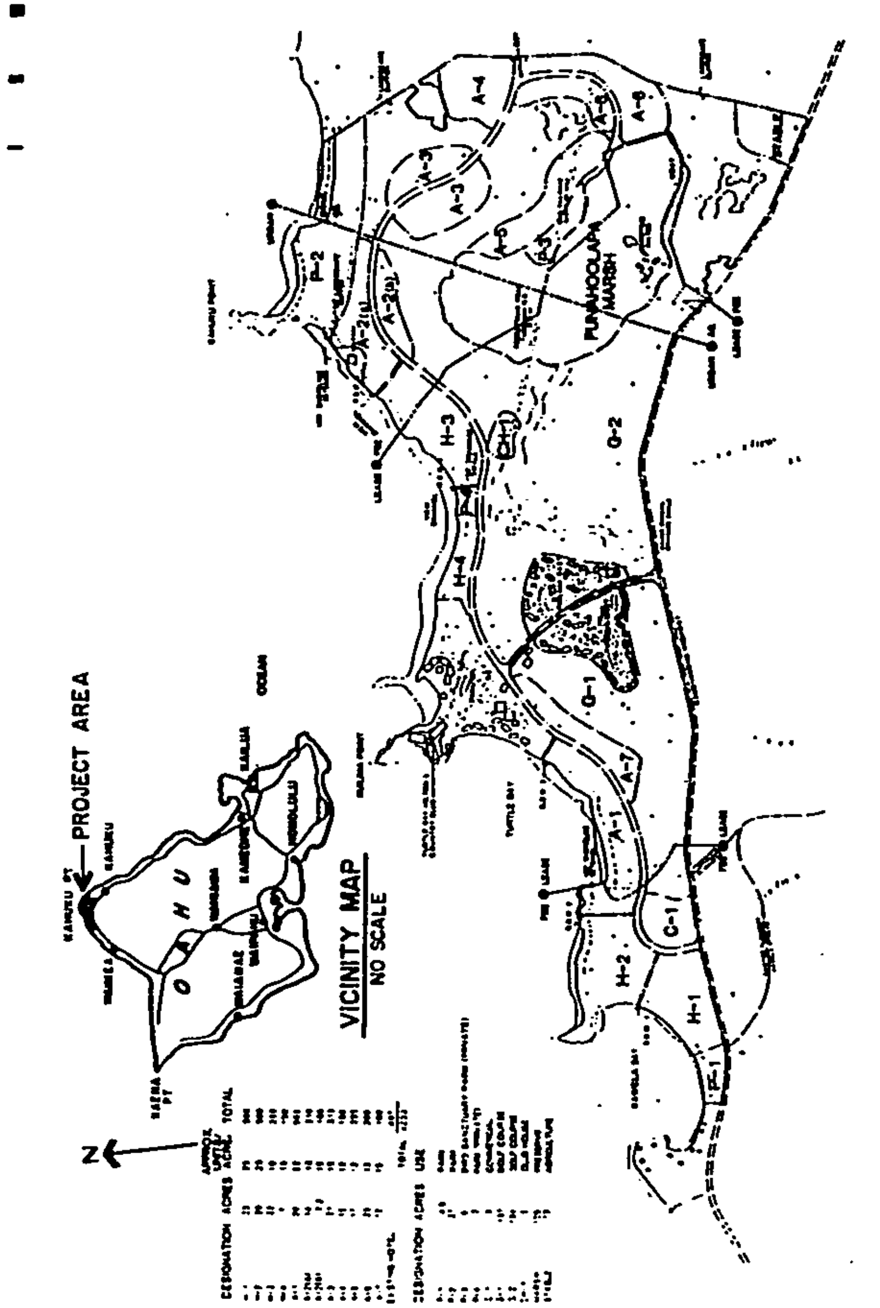
INTRODUCTION

The Kuilima Resort Development is located between Kawela Bay and Kahuku Point on the north shore of Oahu, Hawaii (Figure 1). The present development consists of the Turtle Bay Hilton Hotel and Country Club, and Kuilima West and East (condominium developments). Future development plans envision additional hotel and condominium development, an expanded golf course, a commercial area, and park areas. The fully-developed resort will cover approximately 800 acres.

Storm runoff from the existing Kuilima Resort Development (Turtle Bay Hilton and Country Club; Kuilima East and West) is presently discharged into the ocean at two points: West Kuilima Drain and East Main Drain. Extensive additional resort development is planned for the area, and runoff from this additional (now rural, agricultural or undeveloped) area will be discharged at the above two points and two additional points: Kawela Stream and West Main Drain. Some of the discharge now channeled through Kawela Stream will be diverted through the West Main Drain. Punahoolapa Marsh, a series of interconnected pools and channels, is fed by Hoolapa Stream and by springs. The marsh receives storm runoff from immediately surrounding areas and the Hoolapa watershed. Proposed drainage modifications include channeling the excess water from the Marsh into the East Main Drain; a weir or weirs will be constructed to prevent saltwater intrusion into the Marsh.

The four drainage points discharge into three physically separate marine embayments: Kawela Stream into Kawela Bay, West Main Drain and West Kuilima Drain into Turtle Bay, and East Main Drain into the apparently unnamed embayment located between Kuilima Point and Kahuku Point, hereafter referred to as "Kuilima Bay". These embayments are generally similar in the biological communities which inhabit them, but are dissimilar in water quality and the degree of mixing and circulation they experience.

The objectives of this study are: to describe the water quality conditions and benthic communities of Kuilima Bay; to describe the physical oceanographic conditions, water quality conditions and benthic communities of Kawela Bay, Turtle Bay, and Kuilima Bay; to describe the changes due to resort development and drainage system modifications in quantity and quality of storm runoff which enters these bays; and to assess the impact of the changes in storm runoff water quantity and quality on the water quality and benthic communities of the nearshore marine environment.



KUILIMA RESORT

FIGURE I

PROPOSED MASTER PLAN

GROUP 70

DESCRIPTION OF PHYSICAL OCEANOGRAPHIC CONDITIONS, WATER QUALITY CONDITIONS, AND BENTHIC COMMUNITIES OFF KUILIMA AND KAHUKU

Kawela Bay

Kawela Bay receives the discharge of Kawela Stream. The Bay has a relatively sluggish circulation (Marine Advisors, 1965), and inshore the bottom is noticeably silted after heavy rain storms (AECOS, 1979). Generally, waters of Kawela Bay are clean during the dry summer months and almost continuously dirty during the winter when wet weather causes increased runoff (Clark, 1977). The extensive siltation is attributed to severe erosion in Kawela Gulch. Following rainstorms, suspended sediment load remains high long after coastal waters have cleared (Marine Advisors, 1965; Belt, Collins and Associates, 1979).

A survey (Bienfang and Brock, 1981) studies the water quality conditions within Kawela Bay during summer (dry) and winter (wet) conditions. Samples were taken at six stations within the Bay (Figures 2 and 3) and were analyzed using the methods described in Appendix A1. The results of this water quality survey are presented in Table 1. Water quality conditions were relatively uniform within the Bay during the dry sampling period, but one station (Station 9) showed significantly higher levels for some parameters during the wet season sampling. Water temperature (wet mean = 23.3°C; dry mean = 24.6°C) and salinity (wet mean = 32.5 ppt; dry mean = 33.8 ppt) were lower during the wet period; dissolved oxygen concentrations were lower (wet mean = 6.08 ml/l; dry mean = 4.99 ml/l) during dry weather; values were typical of nearshore marine conditions. Turbidity levels during both seasons were similar (dry mean = 0.3 - 1.4 NTU; wet mean = 0.6 - 2.1 NTU) with the exception of a high (19.8 NTU) value at Station 9 during wet conditions. With the exception of a high wet condition value (85.8 mg/l) at Station 9, filterable solids levels were lower during the wet season (mean = 18.1 mg/l) than during the dry season (mean = 29.3 mg/l).

Concentrations of nitrate-nitrite were higher in winter (mean = 1.48 uM; uM = microMolar = microgram-atom per liter) than in summer (mean = 0.73 uM). Concentrations of ammonium showed the opposite pattern: levels were higher in summer (mean = 0.43 uM) than in winter (mean = 0.11 uM). Phosphate levels were the same (mean = 0.16 - 0.18) for both seasons.

High concentrations of chlorophyll (2.66 ug/l) and phaeopigments (4.41 ug/l) were observed at Station 9 under wet conditions; for the other stations, the overall means were roughly 1.5 - 2x higher during the winter (mean chlorophyll = 0.25 ug/l; mean phaeopigments = 0.45 ug/l) than during the summer (mean chlorophyll = 0.14 ug/l; mean phaeopigments = 0.35 ug/l).

Bacterial concentrations were higher in winter than in summer. Under dry conditions, total coliforms and fecal coliforms were not found in the bacteriological tests; fecal streptococcus were low (mean = 2 colonies per 100 ml). Total

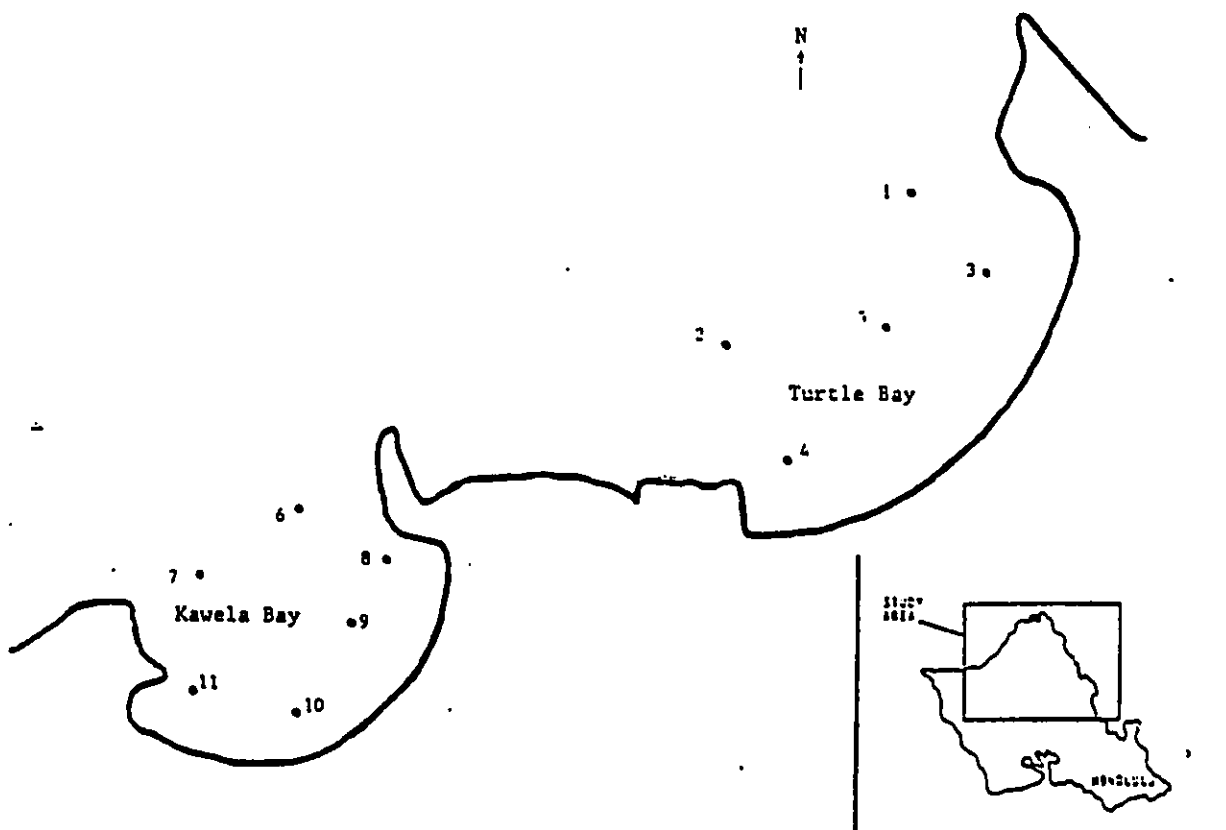


Figure 2. Station locations for the water quality sampling during dry conditions.

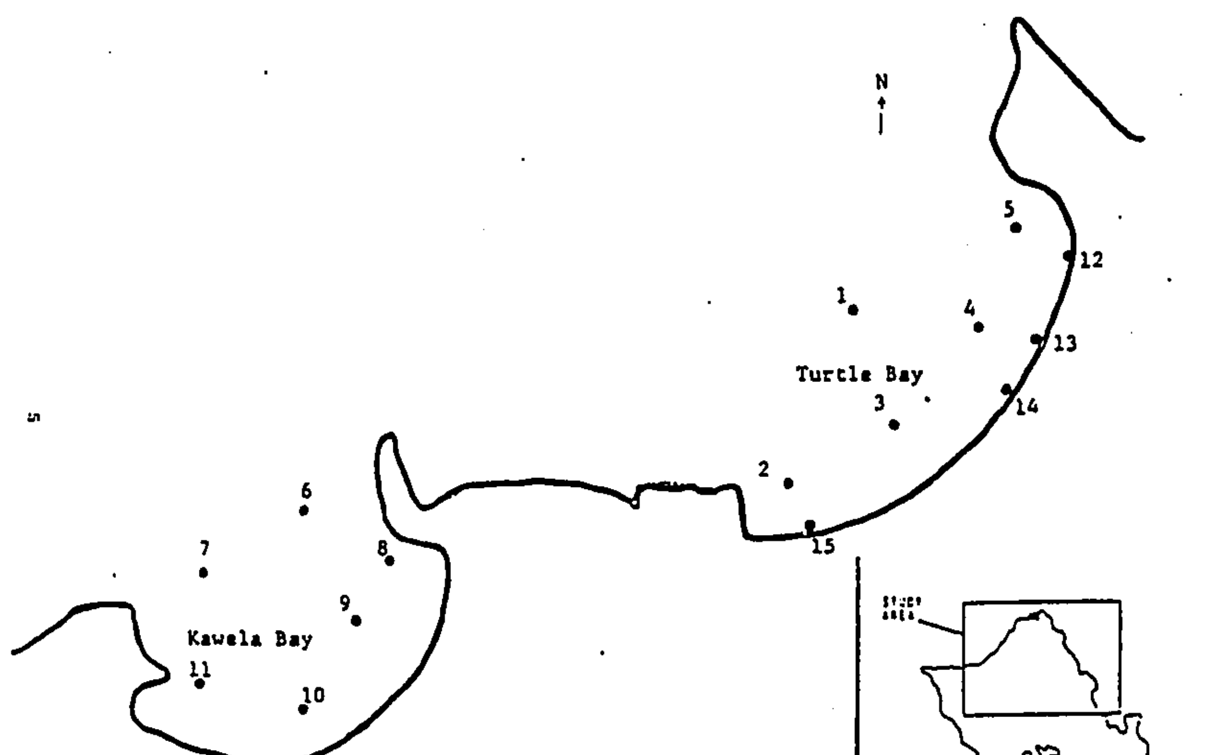


Figure 3. Station locations for the water quality sampling during wet conditions. Extra stations 12-15, located right at the shorelines, were sampled for bacteria and salinity only.

Station	Depth (m)	Temp (deg C)	Salinity (ppt)	Dis O2 (ml/l)	Turb (NTU)	F Sol (mg/l)	NO2+NO3 (uM)	NH4 (uM)	PO4 (uM)	Chl a (ug/l)	Phaeo (ug/l)	T Coli #/100 ml)	F Coli #/100 ml)	F Strep #/100 ml)
KAWELA BAY														
DRY														
6	1.0	23.5	34.2	4.76	0.5	29.2	0.30	1.03	0.19	0.14	0.31	0	0	0
7	1.0	23.0	34.3	5.10	0.5	28.9	1.27	1.13	0.41	0.11	0.27	0	0	1
8	1.0	23.0	34.5	4.81	0.3	28.7	0.19	0.02	0.03	0.08	0.29	0	0	0
9	1.0	24.0	33.8	5.17	0.8	30.4	0.54	0.02	0.07	0.12	0.54	0	0	0
10	1.0	24.0	32.8	4.84	1.4	29.7	1.16	0.16	0.21	0.21	0.38	0	0	3
11	1.0	24.0	33.0	5.25	0.5	28.8	0.91	0.20	0.06	0.16	0.29	0	0	4
MEAN		23.6	33.8	4.99	0.7	29.3	0.73	0.43	0.16	0.14	0.35	0	0	2
ST DEV		0.7	0.7	0.21	0.4	0.7	0.45	0.51	0.14	0.05	0.10	0	0	2
WET														
6	1.0	24.0	34.4	5.77	0.6	20.9	0.17	0.00	0.11	0.27	0.32	43	0	2
7	1.0	23.5	33.7	5.96	0.6	15.9	0.53	0.35	0.13	0.12	0.26	0	1	1
8	1.0	23.5	32.8	6.04	1.2	18.7	1.54	0.06	0.23	0.27	0.21	43	1	24
9	1.0	23.0	32.5	6.37	19.8	85.8	0.65	0.08	0.19	2.66	4.61	37	1	14
10	1.0	23.0	32.3	6.15	1.2	17.9	1.90	0.00	0.21	0.25	0.37	37	0	1
11	1.0	23.0	29.5	6.20	2.1	17.1	4.11	0.19	0.19	0.33	0.91	398	0	45
MEAN		23.3	32.5	6.08	4.3	29.6	1.48	0.11	0.18	0.65	1.32	74	1	15
ST DEV		0.4	1.7	0.21	7.6	27.7	1.44	0.14	0.05	0.99	1.63	110	1	18

Table 1. Results of water quality analysis from stations in Kawela Bay under dry and wet weather conditions.

coliforms (mean = 74 per 100 ml) and fecal streptococcus (mean = 15 per 100 ml) were higher under wet conditions; highest values were found near the shoreline at Station 11, and lowest values near the mouth of the Bay at Station 7. Fecal coliforms were found in low numbers (mean = 1 per 100 ml).

The above data show the changes in water quality experienced by Kawela Bay under different climatic conditions. During dry periods, the water quality of the Bay is determined by the degree of mixing with nearshore ocean water and groundwater seepage. This is reflected mainly in the higher levels of ammonium observed. During wet weather, the water quality of the Bay is determined by the volume and duration of stream and surface flow. These inputs result in locally high levels of suspended material (turbidity and filterable solids), higher levels of nitrate-nitrite, and higher levels of enteric bacteria. The increased wave action which usually occurs during the winter may also contribute to the increased turbidity and suspended solids load.

The locations of the six major benthic biotopes identified in Kawela Bay (Bienfang and Brock, 1981) are shown in Figure 4. The mean % coral coverage, and mean numbers of algal and fish species observed in each biotope are summarized below.

Biotope	Mean Coral Coverage %	Mean # of Species Algae	Fish
1. Sand/Scattered Coral Heads	2	19	5
2. Shallow Limestone Bench	4	9	5
3. Hard Bottom/*P. lobata* Heads	5	11	11
4. Surge Channels	19	3	27
5. Deeper Rubble/Sand	5	2	18
6. Large *P. lobata* Heads			39

The nearshore area (Biotope 1) consists of mostly sand and small scattered coral heads. The area is relatively well protected from waves, and macrothalloid algae dominate the substratum (19 species; mean coverage = 9%), while coral coverage is only 2%. Corals in the biotope are characteristically small (5 - 15 cm diameter). Few fish or macroinvertebrates are present in this area.

Two discontinuous areas of shallow limestone bench constitute Biotope 2. These bench areas are situated in shallow (0.5 - 1.25 m) water and receive a significant amount of wave energy. Scattered across the bench are shallow depressions filled with rubble. The eastern portion of this biotope had approximately 26% algal cover (9 species) and 8% coral cover. Five species of macroinvertebrates and six species of fish were observed. The western portion of the biotope is nearly devoid of attached forms; algal cover was less than 1%, and no corals were

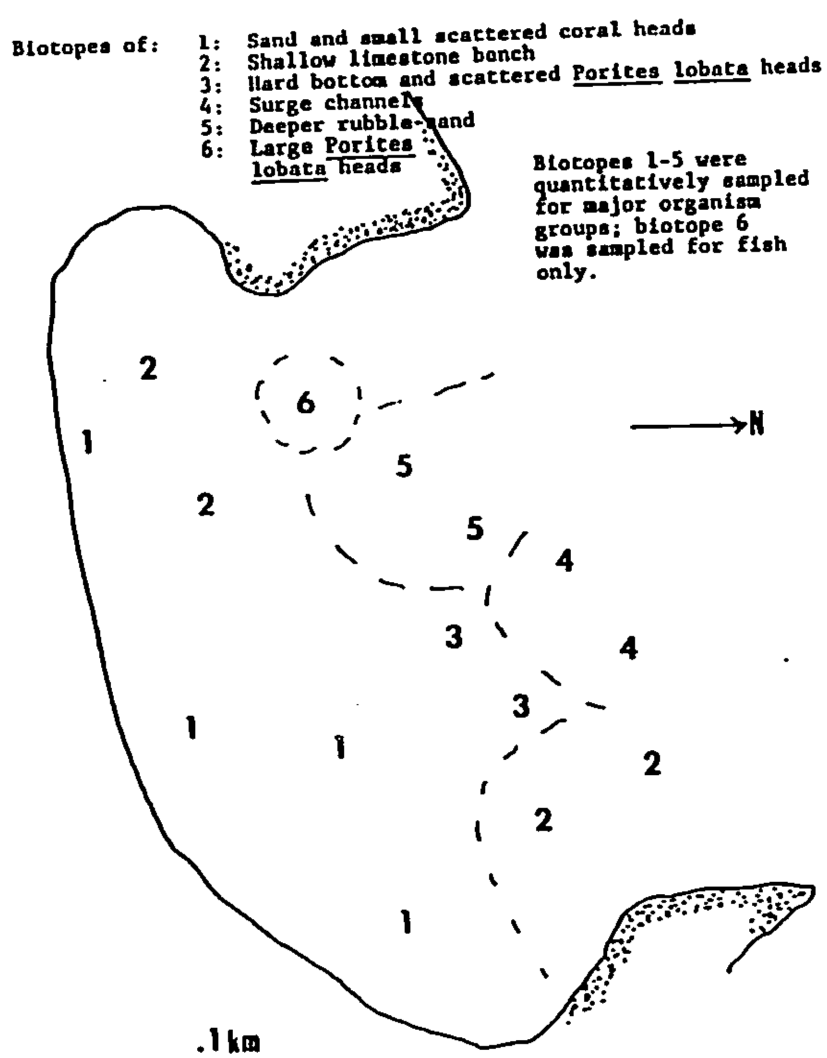


Figure 1. Approximate locations of the six biotopes of Kawela Bay. Stippled shoreline depicts the extent of emergent limestone.

observed in the transects, although one small colony was noted nearby. Only one macroinvertebrate and four fish species were observed.

Biotope 3 is an area of hard bottom and scattered heads of *Porites lobata*. The substrate is primarily limestone with small patches of rubble and sand. *Porites lobata* heads 1 - 2 m in diameter spaced 3 - 15 m apart are the dominant coral in this community. Algal coverage ranged from 6 - 9% (11 species); coverage by corals other than *P. lobata* ranged from 3 - 7%. Fish were more abundant in this biotope than those nearer shore; eleven species were observed in transects covering two areas, with an additional 6 - 11 species observed outside the transects.

Seaward of the previously described biotope is an area of surge channels (Biotope 4). These surge channels are oriented perpendicular to shore and are 2 - 5 m in width and 20 - 40 m in length. There are scattered knolls and large *Porites lobata* heads. Macrothalloid algae (3 species) cover less than 1% of the bottom in this biotope. Seven species of coral cover over 18% of the bottom. The surge channels and coral heads provide shelter for a number of invertebrates and fishes. Of the biotopes quantitatively surveyed, the biotope of surge channels harbored the most diverse assemblage of fishes. A total of thirty-seven fish species (27 in transects, 10 outside transects) were observed in the area.

A deeper area of emergent limestone, coral rubble and loose limestone blocks (Biotope 5) is situated adjacent to and surrounded by the area of surge channels. Corals cover 5% of the bottom. Twenty-four species of fish (18 in transects, 6 outside transect areas) were encountered in this area.

The last and smallest biotope (Biotope 6) recognized in Kawela Bay is the biotope of large *Porites lobata* heads. This biotope is small, being less than 80 m in diameter. The substrate is rubble-sand and large *P. lobata* heads with diameters of 1.5 - 3 m spaced about 5 m apart across the bottom. The large coral heads harbor entire benthic communities, consisting of cryptic invertebrates and coral-associated fishes. A total of thirty-nine species of fish were observed within this small area.

Turtle Bay

Longshore currents in the Bay are strong during winter and are sometimes strong even when the ocean is calm. A rip current runs through the channel along the western side of the Bay.

The survey by Bienfang and Brock (1981) also studied the water quality conditions within Turtle Bay during summer and winter conditions by taking samples at five (dry) or nine (wet) stations within the Bay (Figures 2 and 3) and analyzing these samples using the methods described in Appendix A1. The results of this water quality survey are presented in Table 2. Water quality conditions within Turtle Bay were relatively uniform at

TURTLE BAY

Station	Depth (m)	Temp (deg C)	Salinity (ppt)	Dis O2 (ml/l)	Turb (NTU)	F Sol (mg/l)	NO2-NO3 (uM)	NH4 (uM)	PO4 (uM)	Chl a (ug/l)	Phaeo (ug/l)	T Coli (#/100 ml)	F Coli (#/100 ml)	F Strep (#/100 ml)
DRY														
1	1.0	25.5	34.8	4.79	0.5	26.2	0.44	1.75	0.31	0.11	0.11	0	0	0
2	1.0	25.0	34.6	4.93	0.5	30.7	0.44	0.03	0.03	0.08	0.36	0	0	0
3	1.0	25.0	34.7	4.37	0.3	28.2	0.43	0.34	0.78	0.11	0.20	0	0	0
4	1.0	25.0	34.6	4.70	0.5	30.9	0.37	0.25	0.38	0.06	0.31	0	0	0
5	1.0	25.0	34.7	4.93	0.5	29.8	0.46	0.74	0.33	0.08	0.38	0	0	0
MEAN		25.1	34.7	4.74	0.5	29.1	0.47	0.62	0.37	0.09	0.23	0	0	0
ST DEV		0.2	0.1	0.23	0.1	2.0	0.06	0.68	0.27	0.02	0.08	0	0	0
WET														
1	1.0	24.0	34.7	5.77	0.4	20.2	0.48	0.00	0.13	0.19	0.42	8	1	1
2	1.0	24.0	34.6	6.70	0.3	27.0	0.42	0.06	0.12	0.22	0.43	10	0	2
3	1.0	24.0	34.6	6.78	0.4	19.8	0.50	0.74	0.10	0.25	0.35	5	1	1
4	1.0	24.0	34.7	6.34	0.5	25.5	0.22	0.00	0.09	0.31	0.55	4	0	1
5	1.0	24.0	34.7	4.73	0.4	26.3	0.38	0.00	0.67	0.25	0.63	12	1	4
MEAN		24.0	34.7	6.10	0.4	23.7	0.40	0.16	0.22	0.24	0.48	8	1	2
ST DEV		0.0	0.0	0.87	0.1	3.4	0.11	0.33	0.25	0.04	0.11	3	1	1

Table 2. Results of water quality analysis from stations in Turtle Bay under dry and wet weather conditions.

each sampling period, and the differences between dry and wet conditions were less marked in Turtle Bay than in Kawela Bay. Mean water temperature was slightly lower (24°C) in the winter than in the summer (25.1°C). Salinity values were identical (mean = 34.7 ppt) for both periods. Dissolved oxygen levels were higher in winter (mean = 6.10 ml/l) than during the summer (4.74 ml/l), possibly reflecting increased gas exchange due to higher surf conditions and better mixing.

Turbidity and filterable solids levels were similar for both sampling periods (mean turbidity = 0.4 – 0.5 NTU; mean filterable solids = 23.7 – 29.1 mg/l). Nitrate-nitrite concentrations were relatively uniform throughout the Bay and similar for both seasons (mean = 0.40 – 0.47 uM). Ammonium and phosphate concentrations were more variable than nitrate-nitrite. High ammonium concentrations were observed at Stations 1 and 5 during the summer and at Station 3 during the winter; the overall summer mean (0.62 uM) was higher than the winter mean (0.16 uM). Higher phosphate concentrations were observed at Station 3 during the summer and at Station 5 during the winter; the summer mean (0.37 uM) was higher than the winter mean (0.22 uM).

Chlorophyll and phaeopigment concentrations were relatively uniform during each season; winter values (chlorophyll mean = 0.24 ug/l; phaeopigment mean = 0.48 ug/l) were 2 – 3 times higher than summer values (chlorophyll mean = 0.09 ug/l; phaeopigment mean = 0.23 ug/l).

Enteric bacterial levels were higher during the winter than during the summer. No bacteria were observed in the summer sampling. The winter sampling found relatively low levels of total coliforms (mean = 8 per 100 ml), fecal coliforms (mean = 1 per 100 ml) and fecal streptococci (mean = 2 per 100 ml).

Seven benthic biotopes were recognized in a survey (Bienfang and Brock, 1981) of Turtle Bay (Figure 5). The mean % coral coverage and mean number of algal and fish species observed in quantitative transects of these biotopes are presented below.

Biotope	Mean Coral Coverage %	Mean # of Species Algae	Fish
1. Subtidal Bench	<1	1	18
2. Shallow Reef Flat	13	15	7
3. Sloping Bench	7	6	10
4. Rubble/Sand	1	1	10
5. High Cover and Potholes	12	0	26
6. Channels	10	3	18
7. Offshore Limestone Shallows	13	1	24

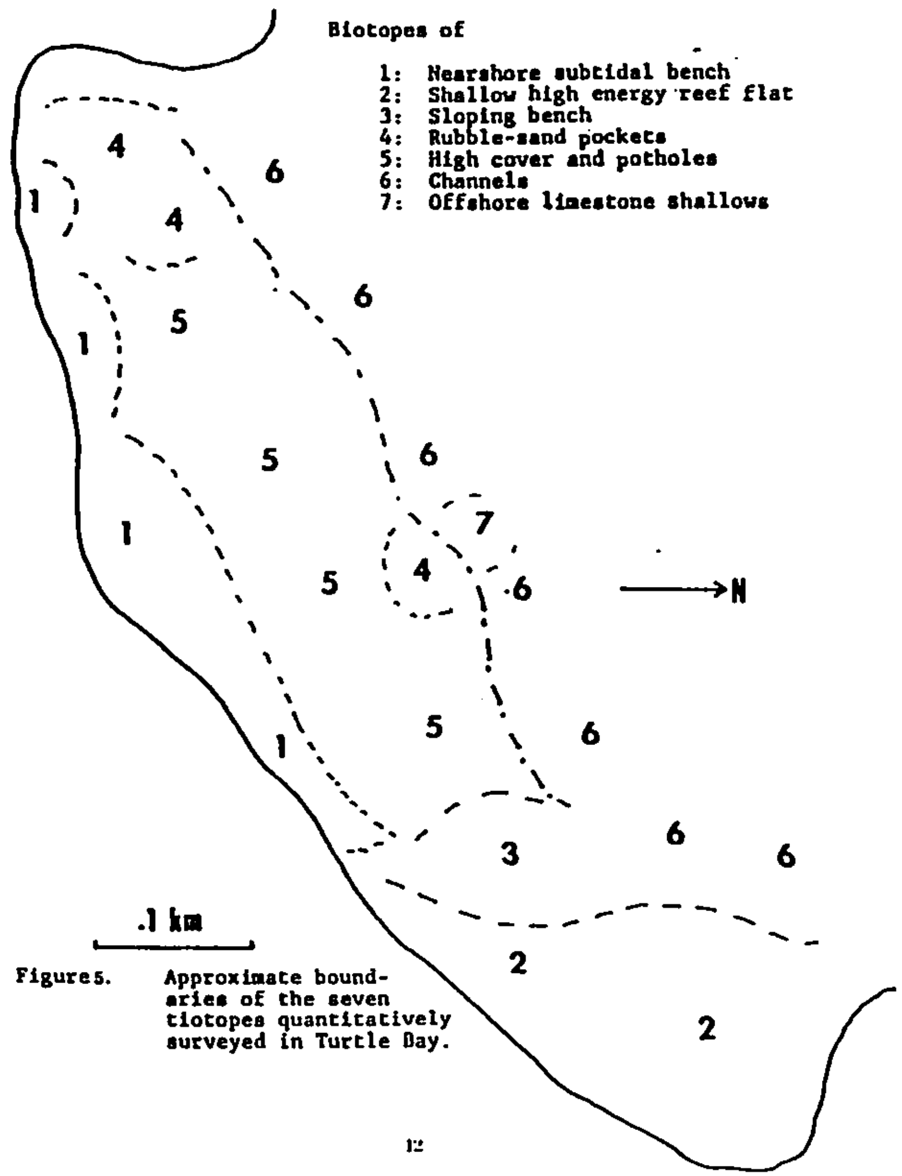


Figure 5. Approximate boundaries of the seven tiotopes quantitatively surveyed in Turtle Bay.

A subtidal bench (Biotope 1) extends along much of the shoreline of Turtle Bay. This bench is broken into large limestone blocks 10 - 80 m in length and 5 - 20 m in width. These blocks slope seaward and grade into sand and/or a biotope of high cover and potholes. Few corals are present in this high energy area; coral coverage was less than 1%. Macrothalloid algae are also uncommon; only one species was observed. Eighteen fish species were observed in a quantitative transect; many of theses were subadult commercially important species (kumu, Parupeneus porphyreus, munu, P. bifasciatus, moano, P. multifasciatus, and aholehole, Kuhlia sandvicensis). Lobsters (Panulirus marginatus and P. penicillatus) were also observed.

A zone of shallow, high energy reef flats (Biotope 2) is located in the northeastern corner of Turtle Bay. The substrate here is similar to the subtidal bench, but coral cover (13%) and algal cover (7%) are higher. Depressions in the substrate and the relatively high coral and coralline algae coverage create a three-dimensional biotope which is favorable for fishes and many invertebrates. Eleven species of macroinvertebrates, including octopus (Octopus cyanea), were observed in a quantitative transect. Only seven fish species were observed in the transect; however, many other fish species and lobster were seen in areas adjacent the transect.

West of the high energy reef flat is the sloping bench biotope (Biotope 3). The substrate of this area is primarily limestone which slopes at an angle of 20° or more and which grades into the adjacent zone of high cover and potholes (Biotope 4). Because the sloping bench has greater water depth and more wave scouring than shallower areas, coral diversity is locally greater but patchily distributed. Coral cover is only 7%; however, ten coral species have been recorded from this area. Algal cover averaged 3%. Few macroinvertebrates were present. Ten species of fish were observed in a transect of this zone; eight additional species were observed in the vicinity. Most were typical reef-dwelling species.

Sand/rubble pockets (Biotope 4) are distributed throughout Turtle Bay, but the majority are in the western corner. These pockets range in size from 20 - 100 m in length. Several large sandy pockets also occur in the central part of the Bay. Corals occurring in this biotope are generally small, having settled and grown on rubble; they frequently do not grow to maturity because of the instability of the substrate. The low abundance of corals (3% cover) and lack of emergent limestone provides little cover for macroinvertebrates. Fishes encountered in this zone are typical of sand flat areas: flatfish Bothus mancus, lizardfish, Saurida gracilis, and schooling weke, Mulloidichthys flavolineatus. Some reef fishes were seen to wander into the area from adjacent, higher coverage zones.

Located through most of the central portion of the Bay is the biotope of high cover and potholes (Biotope 5). Within the confines of the Bay, this biotope is probably the most significant since it encompasses the largest part of the Bay. This biotope is dominated by a limestone substrate with troughs 0.5 - 10 m in width, generally oriented perpendicular to the shore and running from 5 - 50 m in length. In the seaward direction these troughs increase in size and complexity, giving rise to the biotope of channels (Biotope 6). Large depressions 5 - 50 m in diameter occur irregularly over the bottom; areas of limestone blocks of boulders occurring singly or in piles that may cover up to 100 m^2 provide a large amount of shelter for both invertebrates and fish.

Coral coverage in Biotope 5 ranged from 18 - 33%, and was dominated by *Porites lobata*. Seven species were identified in three quantitative transects; another nine species were seen in the vicinity. Larger invertebrates encountered included starfishes (*Ophiocoma* spp., *Linkia* sp.), sea cucumber (*Holothuria atra*), molluscs (*Conus* spp., *Octopus cyanea*), crustaceans (lobsters and crabs) and polychaete worms. Forty-four species of fish were censused in the three quantitative transects; among the most numerous were the surgeonfishes, *Acanthurus olivaceus* and *A. nigrofuscus*. A large number of commercially important species were sighted in the vicinity of the transects; these included papio, *Caranx melampygus*, oio, *Albula vulpes*, menpachi, *Myripristis amaenus amaenus*, aveoweo, *Priacanthus cruentatus*, weke'ula, *Mulloidichthys vanicolensis*, aholehole, *Kuhlia sandvicensis*, and the introduced taape, *Lutjanus kasmira*.

Seaward of the biotope of the biotope of high cover and potholes is the biotope of channels (Biotope 6). Much of this biotope extends seaward beyond the scope of the survey. The biotope of channels receives considerable impact from surf that characteristically breaks across the mouth of Turtle Bay. Algal cover was low, ranging from 0 - 4%. Coral growth was mostly crustose or prostrate, probably in response to the high surf. Coral coverage was patchy and ranged up to 30% over small areas, but averaged between 7 and 10% over the whole area. *Porites lobata* dominated the coral assemblage. Eight other species were censused in two quantitative transects, and two other species were observed in the vicinity.

Large adult herbiverous fish were common in the biotope; schools of kala (*Naso unicornis*) and large parrotfishes (*Scarops rubroviolaceus*, *Scarus perspicillatus* and *Calotomus sandvicensis*) were frequently seen. A number of commercially important fish species were also encountered; these included aholehole, *Kuhlia sandvicensis*, menpachi, *Myripristis amaenus amaenus*, papio, *Caranx* sp., weke, *Mulloidichthys flavolineatus*, weke'ula, *M. vanicolensis*, kumu, *Parupeneus porphyreus*, and aweoweo, *Priacanthus cruentatus*. A wandering school of manini, *Acanthurus triostegus sandvicensis*, passed through the transect area. Slipper lobsters, *Paribacus antarcticus*, and spiny lobsters, *Panulirus penicillatus* and *P. marginatus*, were occasionally seen.

Approximately 250 - 300 m offshore in the midpart of Turtle Bay, arising in the biotope of channels, is a large, shallow

(1.5 - 2.5 m depth) limestone flat (Biotope 7). On the limestone substrate are scattered small potholes spread 3 - 5 m apart. A few small ridges and channels traverse the area. *Porites lobata* was by far the most abundant coral species; corals had assumed a crustose growth form and averaged 13% cover. Algal cover was almost non-existent. Twenty-four fish species, including a relatively large number of herbiverous surgeonfishes, were censused in a single transect in the area.

Kuilima Bay

The relocated mouth of Oio Stream and a smaller unnamed stream to the east discharge into Kuilima Bay. Nearshore waters may be discolored occasionally by terrigenous sediments, although high wave activity achieves dispersion of these sediments. The bottom is free from silt except off the mouth of Oio Stream (Belt, Collins and Associates, 1979). A strong rip current develops within Kuilima Cove through the channel running seaward adjacent to Kuilima Point. Large winter waves cause this rip current as well as other strong currents outside the cove. The area between Kuilima Cove and Kahuku Point is afforded little protection against tradewind generated waves. One or more rip currents are generated between Kuilima Cove and Kahuku Point even during calm ocean conditions. Kahuku Point is an area of convergence and divergence of ocean currents. Net water transport is generally toward the northwest, away from Oahu (Bathen, 1978).

Water quality conditions were sampled (see Appendix A1) at twelve stations within Kuilima Bay and in the area east of Kahuku Point (Figure 6). The results of the analyses of samples from twelve near-shore stations in the Kuilima area and the overall means and standard deviations for each analysis are presented in Table 3. Water quality conditions were relatively uniform both vertically and between stations. Temperature at all stations and depths was 27°C; mean salinity was 36.4 ppt. The mean pH was 8.38 and the mean dissolved oxygen concentration was 6.21 ml/l. These values are typical of nearshore marine waters around Hawaii; the low standard deviations (see Appendix) reflect the uniform character of the area.

Turbidity values had an overall mean of 0.4 NTU; stations nearest the shoreline (Stations 6, 10, 11, and 12) had higher turbidity levels (1.0 - 1.9 NTU) than did those stations further removed from shore (0.1 - 0.9 NTU). These higher nearshore levels reflect the presence of particles stirred up into the water by wave action. However, filterable solids concentrations did not show a clear difference between near shoreline and further offshore samples; the overall mean was 48.2 mg/l. This apparent contradiction may be due to the presence of detrital or benthic algal material in the nearshore samples (see below) which caused higher turbidity readings but did not contribute significantly to filterable solids weights.

Concentrations of nitrate-nitrite (M = 0.48 uM; SD = 0.24),

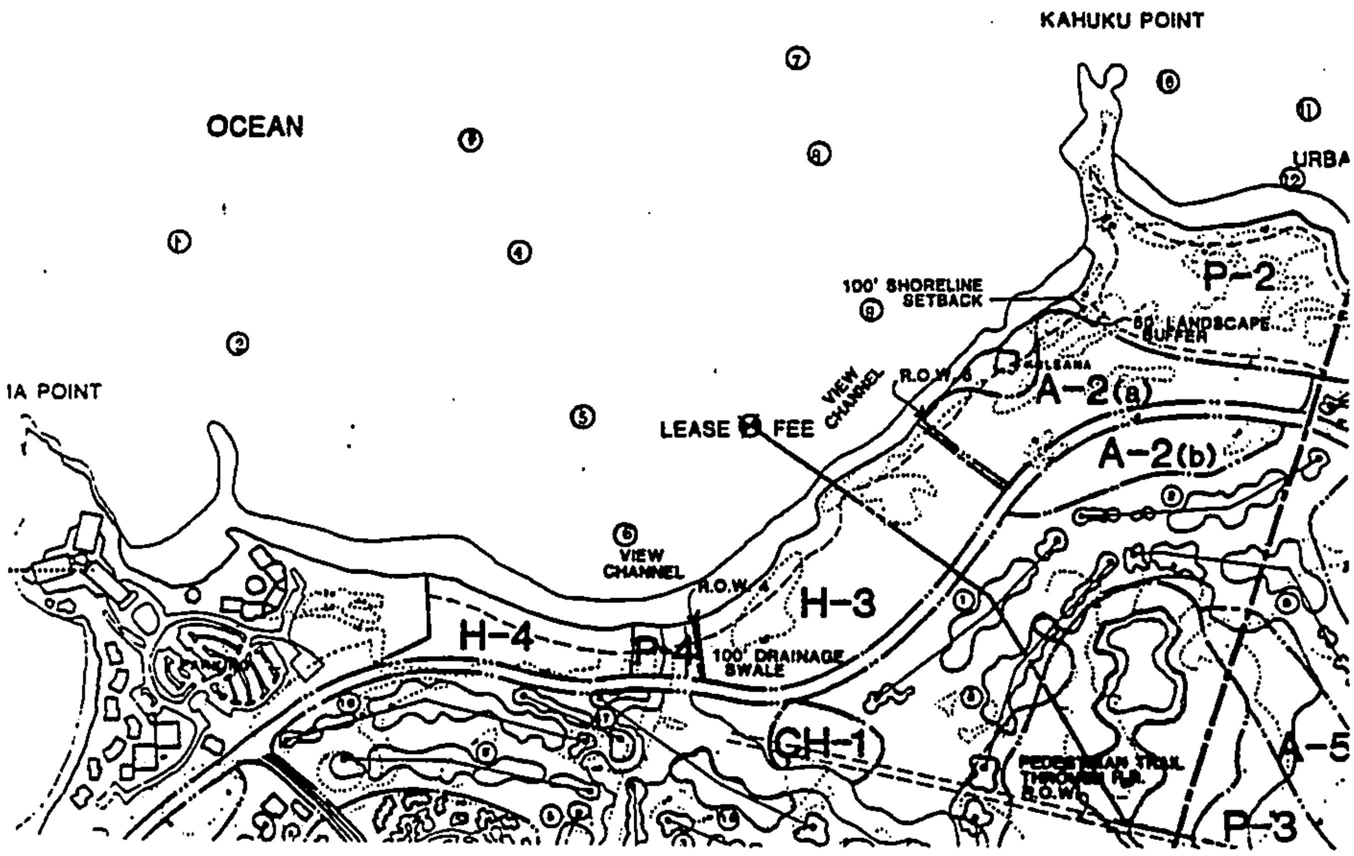


Figure 6. Location of water quality stations within Kuilima Bay and east of Kahuku Point under dry weather conditions.

KUILIMA BAY

Station	Depth (m)	Temp (deg C)	Salinity (ppt)	pH (units)	Dis O2 (ml/l)	Turb (NTU)	F Sol (mg/l)	NO2-NO3 (uM)	NH4 (uM)	PO4 (uM)	Chl a (ug/l)	Phaeo (ug/l)	T Coli #/100 ml	F Coli #/100 ml	F Strep #/100 ml
1	1.0	27.0	37.0	8.36	5.61	0.1	32.0	0.37	1.34	0.37	0.04	0.06	0	0	0
	4.5	27.0	37.0	8.37	5.63	0.2	32.0	0.59	2.17	0.35	0.05	0.06	0	0	0
	9.0	27.0	37.0	8.34	6.31	0.3	134.0	0.39	1.49	0.35	0.05	0.05	0	0	0
2	1.0	27.0	36.0	8.33	6.33	0.2	68.0	0.33	1.28	0.30	0.05	0.06	0	0	0
	5.0	27.0	37.0	8.35	5.97	0.1	50.0	0.20	0.89	0.30	0.07	0.09	0	0	0
3	1.0	27.0	36.0	8.37	5.18	0.1	44.0	1.04	1.50	0.28	0.05	0.05	0	0	0
	4.5	27.0	36.0	8.36	6.63	0.2	62.0	0.30	1.66	0.23	0.05	0.04	0	0	0
	9.0	27.0	36.0	8.37	6.42	0.2	28.0	0.46	5.53	0.22	0.05	0.06	0	0	0
4	1.0	27.0	36.0	8.37	6.65	0.6	44.0	1.01	3.38	0.18	0.07	0.08	0	0	6
	3.0	27.0	36.0	8.37	6.76	0.9	30.0	0.57	1.12	0.29	0.07	0.07	0	0	0
	6.0	27.0	37.0	8.37	6.42	0.1	44.0	101.10	31.06	1.87	0.05	0.05	0	0	0
5	1.0	27.0	36.0	8.37	3.63	0.6	52.0	0.36	1.20	0.15	0.08	0.08	0	0	3
	5.0	27.0	36.0	8.40	6.63	0.5	22.0	0.37	0.63	0.21	0.09	0.08	0	0	4
6	1.0	27.0	37.0	8.34	6.69	1.9	38.0	0.37	2.01	0.37	0.11	0.16	0	0	72
7	1.0	27.0	36.0	8.43	6.65	0.2	34.0	0.32	3.99	0.08	0.02	0.01	0	0	2
	4.0	27.0	36.0	8.42	6.21	0.3	40.0	0.85	4.53	0.20	0.03	0.02	0	0	1
	8.0	27.0	36.0	8.39	5.53	0.2	62.0	0.31	1.36	0.14	0.05	0.04	0	0	0
8	1.0	27.0	36.0	8.41	6.33	0.3	48.0	0.42	2.17	0.16	0.04	0.04	0	0	0
	3.0	27.0	37.0	8.40	5.97	0.1	28.0	0.37	2.25	0.42	0.06	0.07	0	0	0
	6.0	27.0	37.0	8.40	6.08	0.5	48.0	0.33	0.93	0.11	0.07	0.07	0	0	0
9	1.0	27.0	37.0	8.43	5.63	0.3	34.0	0.75	1.69	0.12	0.05	0.05	0	0	1
	4.0	27.0	36.0	8.42	5.97	0.1	44.0	0.42	1.26	0.07	0.05	0.06	0	0	7
10	1.0	27.0	36.0	8.37	6.36	1.0	33.0	0.23	1.15	0.23	0.07	0.06	0	0	2
11	1.0	27.0	36.0	8.37	6.36	1.1	56.0	0.29	2.33	0.29	0.09	0.10	0	0	1
12	1.0	27.0	36.8	8.40	6.36	1.1	67.0	0.15	2.19	0.15	0.10	0.12	0	0	44
MEAN		27.0	36.4	8.38	6.21	0.4	48.3	0.48	2.01	0.24	0.06	0.06	0	0	6
ST DEV		0.0	0.5	0.03	0.47	0.4	19.8	0.26	1.21	0.13	0.02	0.03	0	0	16

Table 3. Results of water quality analysis from stations in Kuilima Bay and east of Kahuku Point under dry weather conditions.

ammonium (M = 2.01 uM; SD = 1.21) and phosphate (M = 0.24 uM; SD = 0.12) were typical of nearshore ocean conditions. One sample (Station 4, 6 m depth) was apparently contaminated; the high nutrient levels observed, if real, could only have come from some groundwater source near the sampling site. Other water quality parameters (especially temperature and salinity) showed no evidence (i.e., lower temperature and salinity) of groundwater influence which would support such a hypothesis. The data for Station 4, 6 m depth were not included in the above calculations of nutrient means and standard deviations.

Chlorophyll levels ranged from 0.11 ug/l at Station 6, 1m depth to 0.03 ug/l at Station 7, 5 m depth; the mean chlorophyll concentration was 0.06 ug/l. Phaeopigment levels ranged from 0.16 ug/l at Station 6, 1 m depth to 0.01 ug/l at Station 7, 1 m depth; the mean phaeopigment level was 0.07 ug/l. The highest concentrations of chlorophyll and phaeopigments were found at the stations closest to shore (Stations 6, 11 and 12). These higher values are probably the result of the suspension of benthic algal material by wave action in the surf zone.

Enteric bacterial levels were generally low throughout the area surveyed. Total coliform and fecal coliform tests found no evidence of the presence of these bacteria, which are rapidly killed off in seawater. Fecal streptococcus levels were also generally low (less than 10 per 100 ml); at the stations nearest the shoreline (Stations 6 and 12), however, higher counts (72 and 44 colonies per 100 ml) were observed. These higher counts may indicate the presence of seepage of groundwater at or near the shoreline; however, the other water quality parameters, especially dissolved nutrients, did not exhibit higher concentrations which would be expected with groundwater influx.

Kuilima Cove (Figure 7) is a shallow inlet defined by the rocky headlands of Kalaeokamanu and Kuilima Point. Waters in the cove are protected by a shallow limestone formation across much of the mouth. Parts of this shelf emerge above the water surface. Sand channels pass to either side of this emergent formation. The channel flanking the western margin is the former watercourse of Oio Stream and is 5 - 8 feet deep and 60 - 80 feet wide. Inside the cove is a bottom of sand and rubble. Outside the cove, at depths between 20 and 30 feet, there occurs an irregular bottom of limestone. Surge channels and other depressions contribute to considerable relief off Kuilima Point.

Porites lobata is the dominant species of coral in Kuilima Cove. Few kinds of fish inhabit the cove; most common are the wrasse, Thalassoma duperreyi, the surgeonfish, Acanthurus triostegus, and the butterfly fish, Chaetodon fremblii. Outside of the cove, corals and algae each account for about 30% bottom cover. Porites lobata, Montipora flabellata, and Pocillopora meandrina are the most common of the coral species present. Many of the heads of the latter species appear to be dead or dying (AECOS, 1979).

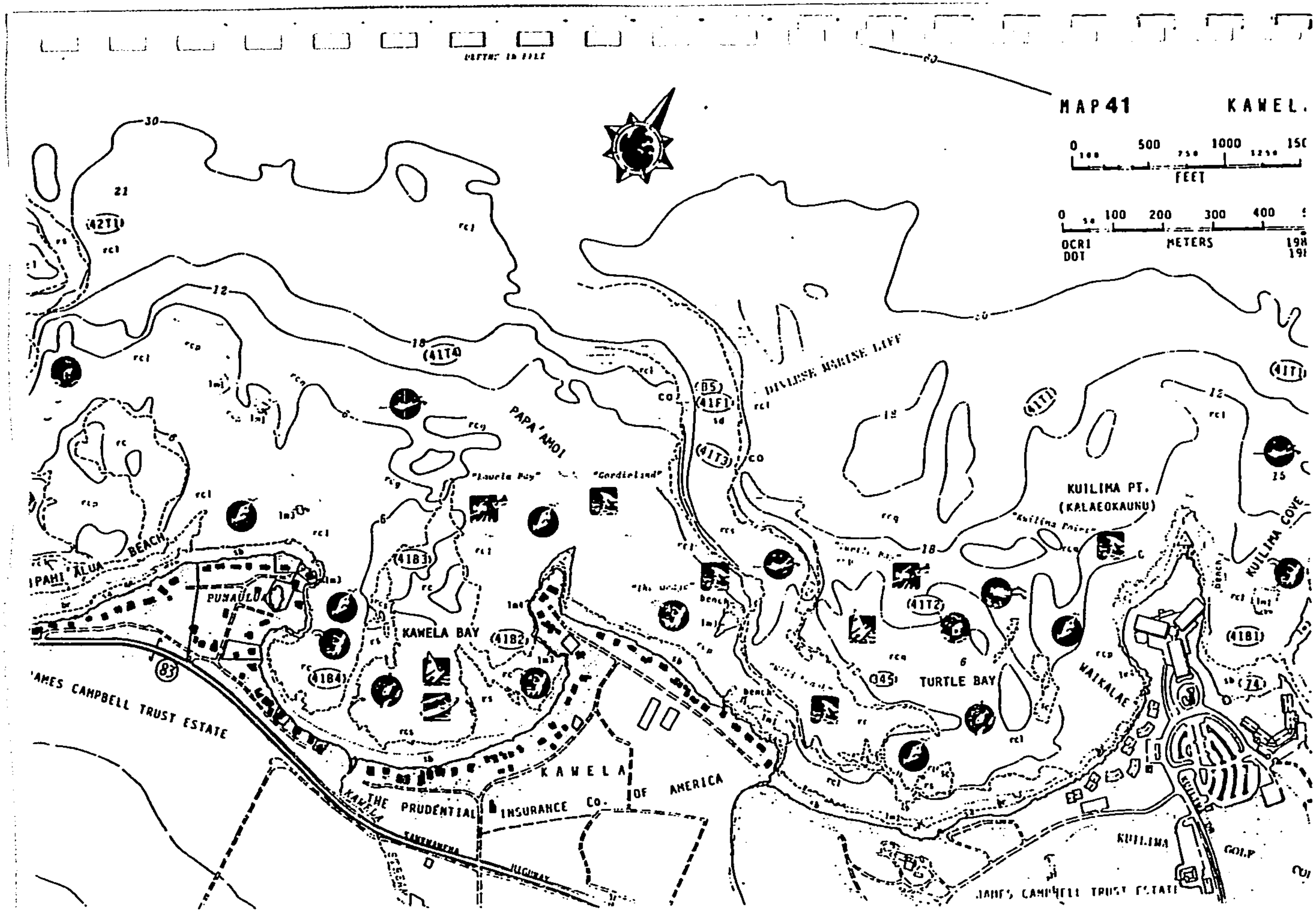


Figure 7. Location and bathymetry of Kawela Bay, Turtle Bay, and Kuilima Cove.

The curving, mile-long shoreline between Kuilima Cove and Kahuku Point is a nearly continuous strip of beachrock, in places up to 4 feet thick. Offshore is an irregular limestone bottom interrupted by sand pockets and channels. A wide channel is located off the mouth of Oio Stream. Numerous rocks offshore are awash at low tide.

The shallow marine biotopes in the vicinity of Kahuku Point are dominated by hard coralline or limestone substrate and have benthic communities representative of high energy areas. Four major biotopes were recognized (Brock, 1985) in the area between Kuilima and Kahuku Points (Figure 8). Much of the substratum is a continuous limestone bench that in areas may be relatively uniform and flat (Biotope 1--Smooth Limestone Bench Biotope), sculptured having channels cut into it oriented perpendicular to shore (Biotope 2--Biotope of Surge Channels) or faulted where slabs of limestone have collapsed forming pits (Biotope 4--Biotope of Complex Sinkholes and Reticulations). In the western part of the study area shoreward of Biotope 1 is a relatively anomalous low energy biotope (Biotope 3--Biotope of Large Porites Colonies) that, in a seaward direction, is protected by a small fringing reef. The mean % coral coverage and mean number of algal and fish species observed in quantitative transects of these biotopes are presented below.

Biotope	Mean Coral Coverage %	Mean # of Species Algae	Fish
1. Smooth Limestone Bench	4	4	9
2. Surge Channels	9	<2	17
3. Large Porites Colonies	12	5	8
4. Complex Sinkholes/Reticulations	10	5	9

Biotope 1, the Smooth Limestone Bench Biotope, is dominated by a limestone substratum affording little cover for invertebrates and fishes. This biotope occurs as a near-continuous band across the seaward sector of the study area, bissected only by the biotope of surge channels. What little substratum relief is present is provided by either occasional large loose boulders (only in the western corner of this biotope) that range from 0.75 to 2 m across and are spaced 50 to 70 m apart or more commonly by potholes or depressions in the limestone that may be from 0.5 to 5 m across and to approximately 1 m in depth. These features are usually spaced from 20 to 100 m apart.

The apparent scoured appearance of much of the substratum and the presence of prostrate growth forms of corals suggests that considerable wave energy impinges on this biotope. Species present are those characteristic of subtidal high energy Hawaiian habitats. These include the corals Pocillopora meandrina and

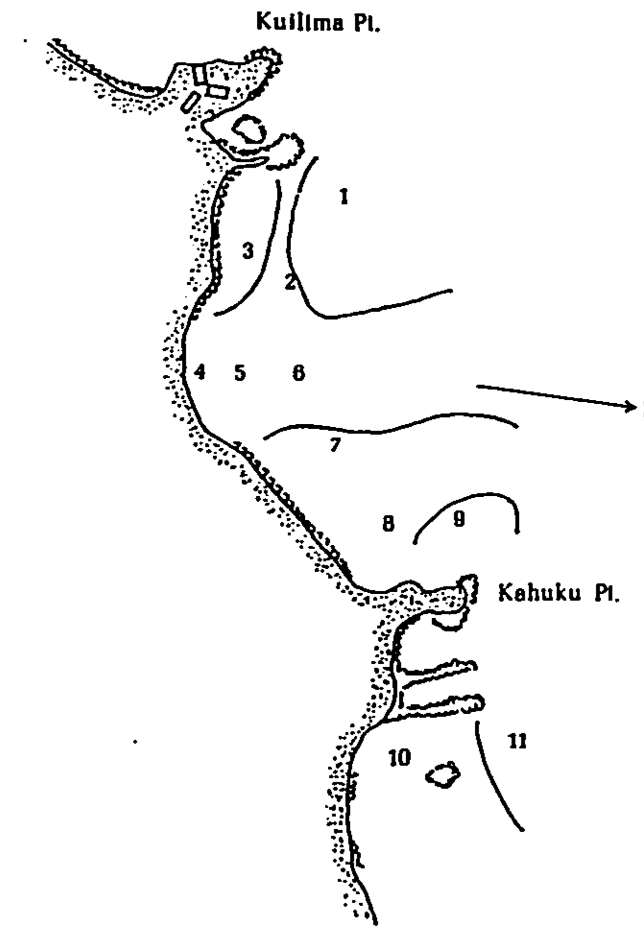


Figure 8. Map of Kahuku Point, Oahu and vicinity showing the approximate boundaries (solid lines) of the four Biotopes noted in the area and the locations (numbered) of the 11 quantitative stations sampling those biotopes. These biotopes are:
Biotope 1--Smooth Limestone Bench Biotope;
Biotope 2--Biotope of Surge Channels;
Biotope 3--Biotope of Large Porites Colonies;
Biotope 4--Biotope of Complex Sinkholes and Reticulations.
(Scale: 1 cm = 146 m)

Porites lobata, the small sea urchin Echinometra mathaei, sea cucumbers Actinopyge mauritiana, cone shells Conus lividus and C. ebraeus and in patches a relatively diverse algal community. Common algal species include Galaxaura rugosa, Dictyosphaeria cavernosa, Dictyota spp., Dictyopteris spp., Sargassum spp., Halimeda discoidea, and the heavily calcified Porolithon gardineri. Because of the little available shelter, fishes are not a particularly conspicuous component of the community. Fish species present include the surgeonfishes--ma'i'i'i (Acanthurus nigrofuscus), manini (A. triostegus), hinalea (Thalassoma duperryi, T. umbrostigma), and a variety of other species: o'ili-uwi'uwi (Pervagor spilosoma), damselfish (Abudefduf imparipennis), po'o-pa'a (Cirrhitus pinnulatus), humuhumu (Rhinecanthus rectangulus) and moano (Parupeneus multifasciatus).

Eighteen species of fish were censused at the stations within this biotope; only one species (Thalassoma duperryi) was encountered at all stations. Fish transects conducted in the Smooth Limestone Bench Biotope yield a mean of 9 families, 9 species, and 33 individuals per station. Average coral coverage varied from 0.3 to 5.1% (quadrat method). A total of 7 coral species were encountered in the quantitative stations done in this biotope; Porites lobata and Pocillopora meandrina are the most conspicuous coral species.

For the most part, the Biotope of Surge Channels (Biotope 2) has its greatest development in deeper waters where it occurs as a near continuous band seaward (and outside) of the present study area. This biotope is present in the shallow study area as a shoreward extension essentially dividing the study area into two (east and west) sectors.

The distinctive feature of the Biotope of Surge Channels is the presence of a limestone substratum through which are cut surge channels that are usually oriented perpendicular to shore. These surge channels vary in width from 0.5 to 20 m across and cut down into the substratum between 1 to 4 m. Individual channels vary in length from a few to over 50 m; they are spaced from 5 to 50 m apart. Channels are frequently undercut, thus providing considerable cover for large invertebrates and fish. The substratum in some of the larger channels has a veneer of loose rock or rubble.

Coral coverage in the biotope varies from less than one to over 21%. The most common species are Porites lobata (encrusting form) and Pocillopora meandrina. In total, 10 coral species were noted in the quantitative stations. Forty-one species of fish (mean = 17 species per station) were censused in the 20 x 4 m areas of the five stations. Present at every station were the ma'i'i'i (Acanthurus nigrofuscus), manini (Acanthurus triostegus), hinalea aki-lolo (Coris gaimardi), hinalea (Thalassoma duperryi), oili 'uwi'uwi (Pervagor spilosoma), and damselfish (Stegastes fasciolatus). Most abundant species were Thalassoma duperryi and Acanthurus nigrofuscus. the average number of fish censused per station was 107 individuals. Seven

macroinvertebrate species were seen in the 20 x 4 m quantitative survey areas of the five stations; larger exposed invertebrates were not particularly common and this may be related to the obvious exposure of the entire biotope to high energy conditions.

The Biotope of Large Porites Colonies (Biotope 3) begins about 215 m east of Kuilima Point and parallels the shoreline as a band for about 300 m extending approximately 120 m seaward. This biotope is situated shoreward of a shallow limestone reef that effectively serves as a barrier to high waves impinging in the area. The biotope is bordered by a shoreline on two sides and a shallow reef on the third (seaward) side. It is shallow (no deeper than about 2 m) and the substratum over most of the biotope is sand and rubble. Emergent limestone occurs along the beach and reef crest areas of the biotope.

A dominant component through the central part of this biotope is the presence of large Porites lobata colonies. Most of these colonies are situated closer to the seaward reef crest than to shore; in this area they are spaced from 2 to 50 m apart. The P. lobata colonies range in size from 1.5 to about 4 m in diameter. The average diameter is about 2 m. Also present in this shallow biotope are scattered Porites compressa colonies (up to about 50 cm in diameter). The presence of P. compressa suggests that the area is relatively protected from high surf. In this biotope, coral coverage ranges from about 2 to 15%.

Other than a number of holothurian species (sea cucumbers), most fish and invertebrates seen in this biotope are small. Common under the rubble are brittlestars (Ophiocoma spp.); small hermit crabs (Calcinus spp.) are present as are occasional cone shells (Conus lividus and C. pulicarius). Most fish seen in this biotope are juveniles of species seen further offshore. Important species are juvenile wrasses or hinalea (Thalassoma duperryi, Stethojulis balteata, and Thalassoma umbrostigma) as well as herbivorous fish such as the manini (Acanthurus triostegus) and the ma'i'i'i (A. nigrofuscus) and damselfish (Stegastes fasciolatus).

East of Kahuku Point

Currents are frequently strong along this shore, especially when large waves strike the coast (Clark, 1977).

The water quality conditions of the nearshore area east of Kahuku Point have been surveyed in detail only once (AECOS, 1982). This study examined the water quality conditions at five stations (Figure 9) arranged in both along-shore and off-shore transects. Samples were taken on both rising and falling tide during dry weather conditions. The results of the chemical analyses of these samples are presented in Table 4.

Water quality parameters were generally uniform with depth, and differences between rising and falling tide were small. Water temperature averaged 26.1°C on a falling tide and 26.4°C on

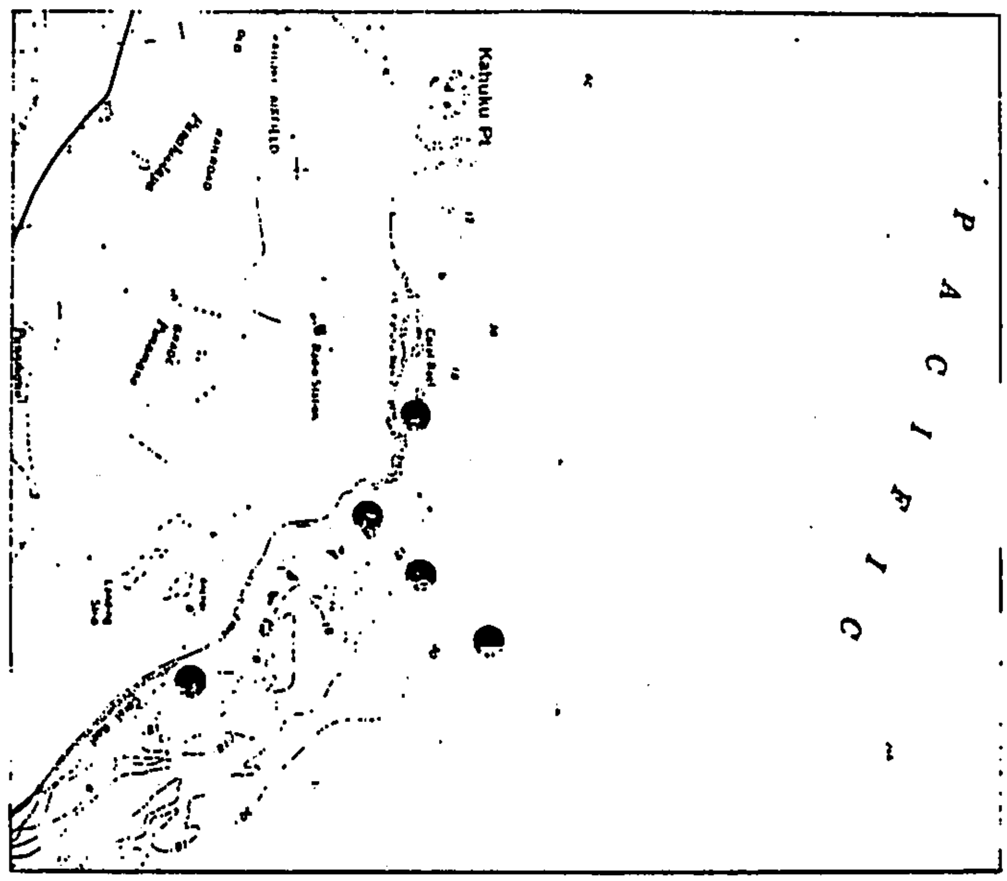


FIGURE 9. MARINE WATER QUALITY SAMPLING STATIONS, AUGUST 19, 1982.

KAHUKU

Station	Depth (m)	Temp (deg C)	Salinity (ppt)	pH (units)	Dis O2 (ml/l)	Turb (NTU)	T Sol (mg/l)	NO3-NO2 (uM)	NH4 (uM)	PO4 (uM)	Chl a (ug/l)
FALLING											
1	1	26.2	35.6	7.94	6.73	1.9	2.1	0.39	0.23	0.08	0.04
	5	26.0	35.9	8.09	6.58	1.4	1.4	0.23	0.32	0.06	0.03
	7	26.1	35.9	8.13	6.73	0.7	1.4	0.21	0.25	0.13	0.03
2	1	26.2	35.4	7.87	6.87	2.0	1.7	0.35	0.69	0.10	0.04
	2	26.2	35.4	8.07	6.31	1.9	2.6	0.31	0.40	0.10	0.06
3	1	26.1	35.5	8.00	6.80	1.6	1.4	0.32	0.40	0.08	0.03
	5	26.2	35.6	8.13	6.87	0.7	1.6	0.19	0.16	0.05	0.02
	7	26.1	35.6	8.10	6.85	1.0	1.6	0.21	0.30	0.06	0.04
4	1	26.1	35.5	8.06	4.99	0.6	0.9	0.09	0.17	0.03	0.03
	5	26.2	35.4	8.11	7.15	1.2	0.7	0.08	0.08	0.10	0.03
	10	26.2	35.6	7.28	6.03	1.6	0.7	0.10	0.22	0.04	0.01
5	1	26.2	35.5	8.02	5.78	0.9	1.9	0.22	0.22	0.06	0.03
	3	26.2	35.5	8.08	6.48	1.1	2.8	0.22	0.19	0.05	0.06
	5	26.1	35.6	8.07	6.68	0.6	3.0	0.22	0.20	0.06	0.03
MEAN		26.1	35.6	8.00	6.56	1.2	1.6	0.23	0.27	0.07	0.03
ST DEV		0.0	0.2	0.22	0.55	0.5	0.6	0.14	0.15	0.03	0.01
RISING											
1	1	26.6	35.7	8.09	7.67	0.9	2.2	0.79	0.24	0.07	0.04
	5	26.5	35.8	8.08	7.33	0.5	1.8	0.27	0.27	0.02	0.03
	8	26.4	35.6	8.13	7.47	0.5	1.2	0.33	0.45	0.05	0.03
2	1	26.5	35.6	7.85	7.27	0.7	1.6	0.47	0.42	0.10	0.03
	2	26.4	35.7	8.01	7.50	0.5	1.0	0.35	0.32	0.11	0.03
	3	26.4	35.6	8.10	7.35	2.0	4.5	0.38	0.35	0.10	0.07
3	1	26.4	35.5	8.06	7.23	0.3	1.3	0.22	0.16	0.02	0.03
	5	26.3	35.5	8.10	7.13	0.3	1.5	0.20	0.26	0.15	0.07
	10	26.6	35.5	8.06	7.63	0.4	1.6	0.23	0.21	0.10	0.03
4	1	26.3	35.5	8.06	6.83	0.3	1.6	0.16	0.12	0.07	0.03
	5	26.3	35.5	8.13	7.08	0.6	0.7	0.16	0.06	0.09	0.02
	10	26.3	35.6	8.05	7.20	0.1	1.2	0.16	0.12	0.06	0.02
5	1	26.9	35.6	8.01	8.62	0.9	2.9	0.27	0.27	0.05	0.04
	3	26.6	35.6	7.98	8.03	1.3	3.6	0.30	0.32	0.05	0.04
MEAN		26.4	35.5	8.03	7.44	0.6	1.9	0.30	0.25	0.07	0.03
ST DEV		0.0	0.1	0.07	0.44	0.5	1.1	0.17	0.11	0.04	0.01

Table 4. Results of water quality analysis from stations off Kahuku during rising and falling tides under dry weather conditions.

a rising tide. Salinity averaged 35.6 ppt (falling) and 35.5 ppt (rising). pH averaged 8.00 (falling) and 8.05 (rising). Dissolved oxygen levels were higher (mean = 7.44 ml/l) on a rising tide than on a falling tide (mean = 6.56 ml/l); these levels are at or near saturation concentrations. Turbidity levels were higher (mean = 1.2 NTU) on a falling tide than on a rising tide (mean = 0.6 NTU); filterable solids, however, were similar (falling tide mean = 1.6 mg/l, rising tide mean = 1.9 mg/l). Nutrient levels were generally similar at both tidal states; falling and rising tide means were 3.44 uM and 3.81 uM for nitrate-nitrite (omitting one near-shore surface value of 11.1 uM on the rising tide), 3.73 uM and 3.43 uM for ammonium, and 2.08 uM and 2.30 uM for phosphate. Mean chlorophyll levels were the same (0.03 ug/l) for both tidal states.

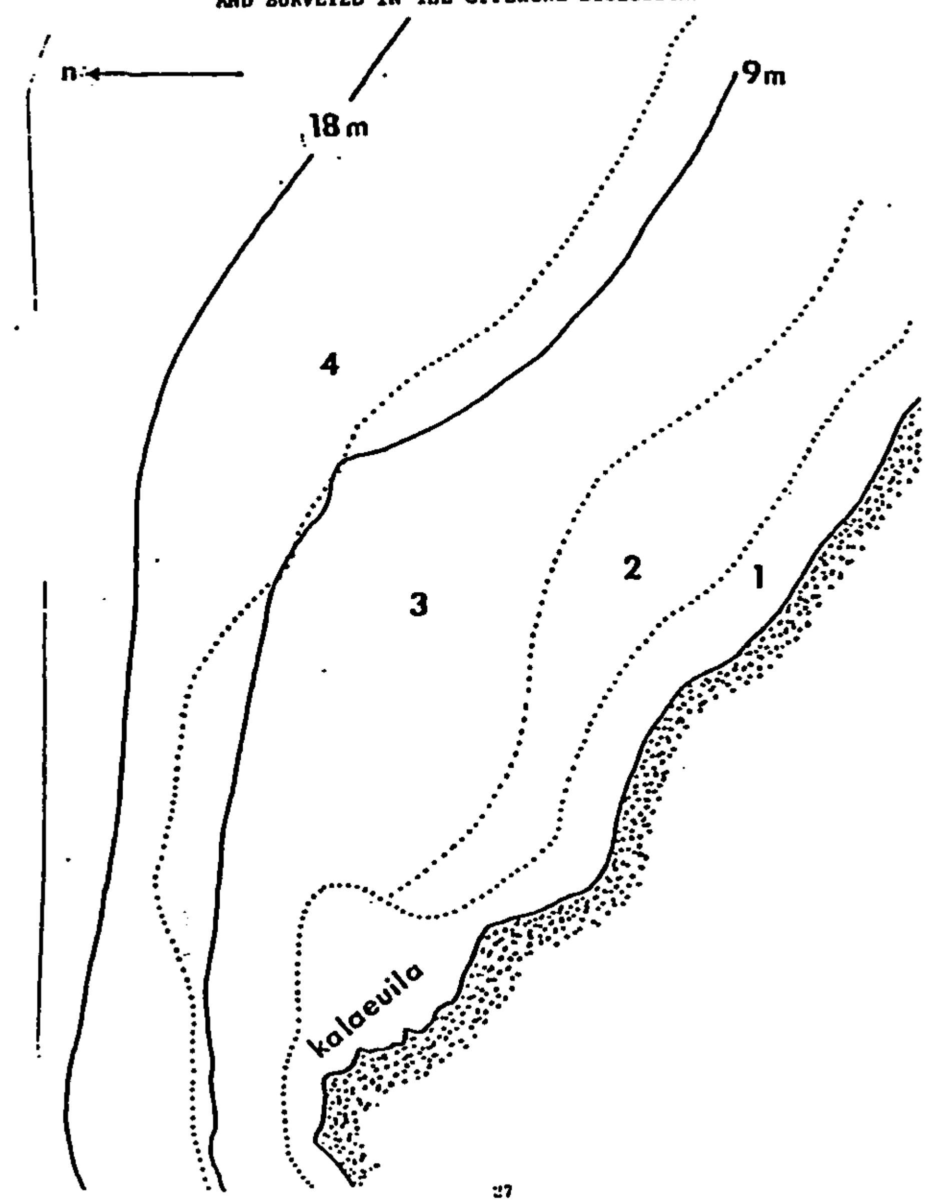
No significant differences in along-shore or off-shore transects were observed for temperature, salinity, or pH during either tidal state. Turbidity values were relatively uniform on the falling tide, but lower in the two offshore stations during rising tide. Filterable solids concentrations were lower at the offshore stations on both tides. Nitrate-nitrite concentrations were highest at the middle of the three near-shore stations and lowest at the furthest offshore station during the falling tide; the same pattern was seen on the rising tide, except that the surface sample taken at the westernmost station was much higher in nitrate-nitrite than at any other station/depth/time. Ammonium, phosphate and chlorophyll concentrations showed the same general pattern as nitrate-nitrite.

The shoreline east of Kahuku Point to Kalaeuila Point is a wide, steep sand beach known as Hanakailio. Like other beaches along the Kahuku coast, a strip of beachrock is present at the water's edge. A shallow bench projects seaward just east of Kahuku Point forming a somewhat undefined cove. An irregular limestone bottom furrowed by surge channels containing sand and boulders occurs offshore. Coral coverage off Hanakailio is probably similar to that of areas further east (Puanui). Algae cover 80% of the hard bottom off Puanui, with corals covering less than 1% of the bottom. The wrasse Thalassoma duperreyi is the most common of eleven species recorded for the Puanui area (AECOS, 1979).

The benthic communities east of Kahuku Point were surveyed recently (Brock, 1985). The bottom communities there are similar to areas further along the Kahuku coast, given the similarities in bottom topography and wave action. A survey (Brock, 1982) of the benthic communities off the landing strip at Kahuku, also provides a general picture of the benthic communities near Kahuku Point.

Four major biotopes (Figure 10) were recognized in Brock's (1982) survey; only two of these biotopes were encountered in Brock's 1985 survey. These biotopes ran roughly parallel to the shoreline and to the depth contours. The mean % coral coverage and mean number of algal and fish species observed in

FIGURE 10. APPROXIMATE BOUNDARIES OF THE FOUR BIOTOPES DEFINED AND SURVEYED IN THE OFFSHORE BIOLOGICAL SURVEYS.



quantitative transects of these biotopes are presented below.

Biotope	Mean Coral Coverage %	Mean # of Species Algae	Fish
1. Shallow Limestone Bench (*)	<1(4)	1(4)	18(9)
2. Surge Channels	4(9)	9(2)	20(17)
3. Potholes and Channels	<2	6	12
4. Limestone Flats	8	3	15

* No data; likely similar to Turtle Bay and Kuilima Bay ().

The biotope nearest the shore (Biotope 1) was not included in the 1982 survey work. This is a shallow (less than 2 m depth), high energy area which is well scoured by wave action. The benthic communities here are probably similar to those high energy biotopes in Turtle Bay, Kuilima Bay and off Puanui.

Biotope 2 lies in water 2 - 5 m deep and is dominated by a hard limestone pavement. Surge channels perpendicular to shore cut through this pavement and are the major physiographic feature of the biotope. These channels are 2 - 20 m apart, are from 0.5 - 3 m in width, and usually range from 0.5 - 1 m in depth. Heads of calcareous algae (Porolithon gardineri) virtually dominate the substrate, providing maximum coverage of 16% (mean = 4%). Few corals are present in this area; Porites lobata (crustose form) may provide patchy coverage locally of up to 30% (mean = 1%). Many of the fishes seen in this biotope were juveniles, including wrasses (Thalassoma spp.), acanthurids, surgeonfishes, and damselfishes. In the western corner of this biotope, near Kalaeuila, several fish species of commercial importance were seen, including kumu, Parupeneus porphyreus, malu, P. pleurostigma, moano, P. multifasciatus, weke, Mulloidichthys flavolineatus, aweoweo, Priacanthus cruentatus, aholehole, Kuhlia sandvicensis, and po'o-pa'a, Cirrhitus pinnulatus. Common macroinvertebrates seen included wana, Echinothrix diadema, lobster, Panulirus penicillatus, and small encrusting colonies of the sponge, Chondrosia chucalla.

Biotope 3 is located in water between 4.5 and 11.5 m in depth. A limestone pavement characterized by potholes is the dominant substrate. These potholes are less common in the eastern part of the biotope, and as a consequence less shelter is available for invertebrates and fish. Algal coverage was as high locally as 40%; in the western part, off Kalaeuila, the alga, Asparagopsis taxiformis, formed mats with local coverage up to 85% over areas of up to 30 m^2. Few corals were seen in this biotope; coverage was less than 1% in the eastern part, and between 1 and 2% in the western part of the biotope. In the central and western part of the biotope, surge channels originating in Biotope 2 form an extension seaward into Biotope 3. Here Porites lobata coral covers 1 to 5% of the substrate.

The greater vertical relief provided by the surge channels and coral heads provide shelter for many fish species, including uhus, wrasses, moray eels, and species of commercial importance. Larger invertebrates (lobster, wana, urchins, and sea cucumbers) were occasionally encountered.

Biotope 4 (the biotope of limestone flats) lies seaward of the biotope of potholes and surge channels. Water depth range from 10 m to the upper edge of a vertical (6 m) escarpment situated in approximately 14 m of water. This escarpment is a general feature of the Kahuku coast and provides a sharp boundary between the biotope of limestone flats and those lying in deeper water. Corals have a mean coverage of about 8% over the entire biotope; Porites lobata is the dominant species. Few fish species are met with in this biotope. Fishes seen include hawkfishes, Paracirrhites forsteri, P. arcatus and Cirrhitus pinnulatus, uhu, wrasses, triggerfishes, butterflyfishes, angelfishes, damselfishes, surgeonfishes, and moray eels. The boring sea urchin, Echinostrepus aciculatus, occurs in relatively high densities, and the octopus, Octopus cyanea, is sometimes seen. Green sea turtles, Chelonia mydas, were noted during the survey.

DESCRIPTION OF THE EXISTING DRAINAGE SYSTEM AND PROPOSED DRAINAGE SYSTEM MODIFICATIONS

Existing Drainage System

The drainage system for the Kuilima Resort Development (KRD) currently consists of four major drains: Kawela Stream, West Main Drain, West Kuilima Drain, and East Main Drain (Figure 11). The drainage areas which these drains serve within the KRD and mauka of Kamehameha Highway are shown in Figures 11 and 12, respectively, and tabulated in Table 5. Kawela Stream conveys the storm runoff from about 771 acres (Areas A, B and C) on the mauka side of Kamehameha Highway and 8 acres (Area 1) within the KRD into Kawela Bay. The West Main Drain conveys storm runoff from about 193 acres (Area D) of land mauka of Kamehameha Highway and about 63 acres (Areas 2, 3, 4, 5, 6, 7, and 10) of land within the KRD into Turtle Bay. The West Kuilima Drain conveys storm runoff primarily from 88 acres (Areas 8, 9, 11, 12, 13, 14, 15, and 16) within the KRD into Turtle Bay also. The East Main Drain receives storm runoff from 1664 acres (Areas E and F) mauka of Kamehameha Highway and 148 acres (Areas 17-24, 35, and part of 37) within the KRD and discharges this runoff into Kuilima Bay. Punahoolapa Marsh receives storm runoff from 430 acres (Areas G and H) mauka of Kamehameha Highway, and from 424 acres (Areas 25-34, 36, and part of 37) of the KRD. Runoff received by Punahoolapa Marsh does not discharge into the ocean, but seeps into the ground.

Proposed Drainage Modifications

The proposed modifications to the Kuilima Resort Development drainage system consist of realignment of Kawela Stream and connection of Punahoolapa Marsh with the East Main Drain. The realignment of Kawela Stream would direct storm runoff from the largest of the drainage areas mauka of Kamehameha Highway now served by Kawela Stream (Area C; 601 acres) into the existing West Main Drain, and thence into Turtle Bay; the drainage area served by the West Main Drain would increase from 256 acres to 857 acres. Storm runoff from two small drainage areas (Areas A and B) mauka of Kamehameha Highway and land makai of Kamehameha Highway (Area 1) would still be discharged into Kawela Bay. After diversion of Kawela Stream, the drainage area served by Kawela Stream would decrease from 779 acres to 178 acres.

Storm Runoff Volume Flow

The volume of water discharged by the four main drains within the KRD have been computed (EDP Hawaii, 1984) based on watershed area served by each drain, coefficient of runoff (what fraction of water falling on various types of land is discharged as surface flow) for each drainage parcel, and rainfall amount for 10-year, 50-year, and probable maximum precipitation (PMP; based on Plate 6, Curve A, City & County of Honolulu Drainage Standards). Under 10- and 50-year storm conditions, surface runoff would be discharged by the main KRD drains; under PMP

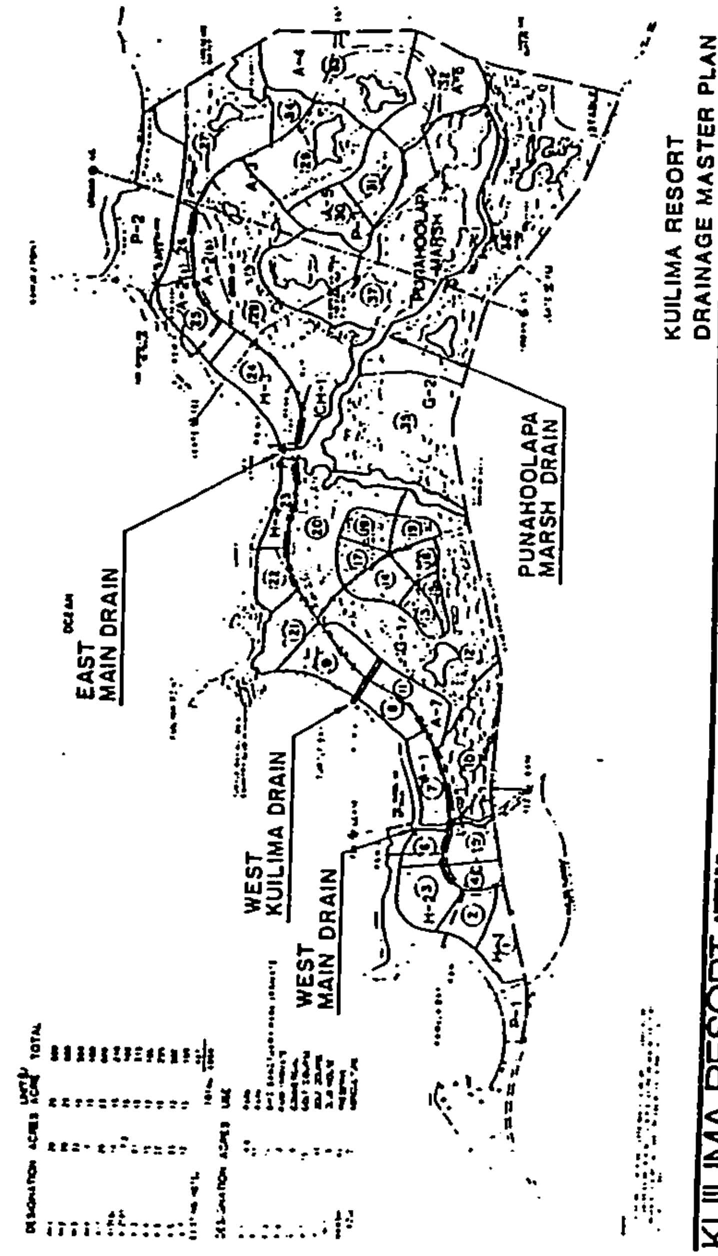


Figure 11. Location of major drainage discharge points and drainage areas within the Kuilima Resort Development.

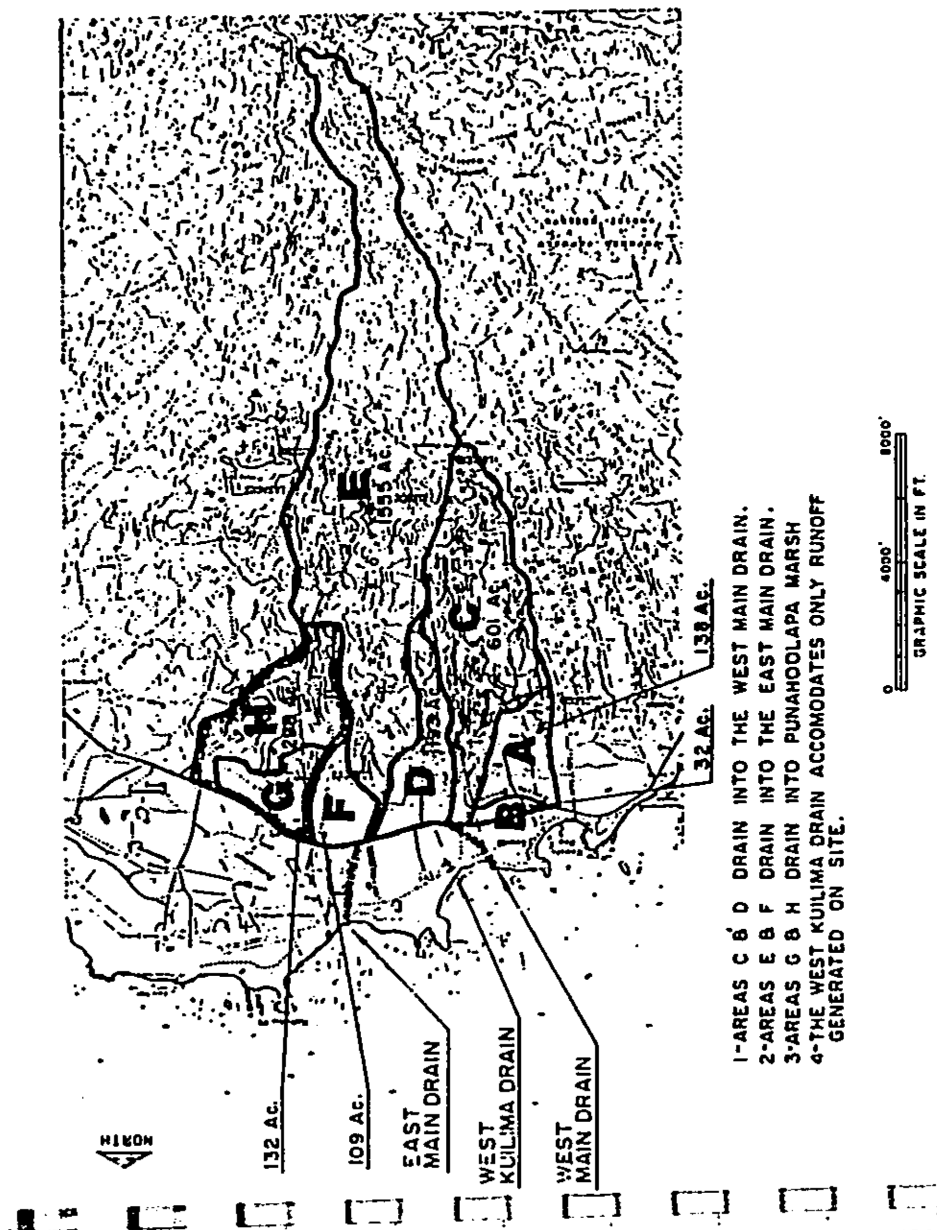


FIGURE 12

MAP SHOWING OFFSITE DRAINAGE AREAS

Table 5. Drainage areas and land uses serviced by the four drains within the Kuilima Resort Development.

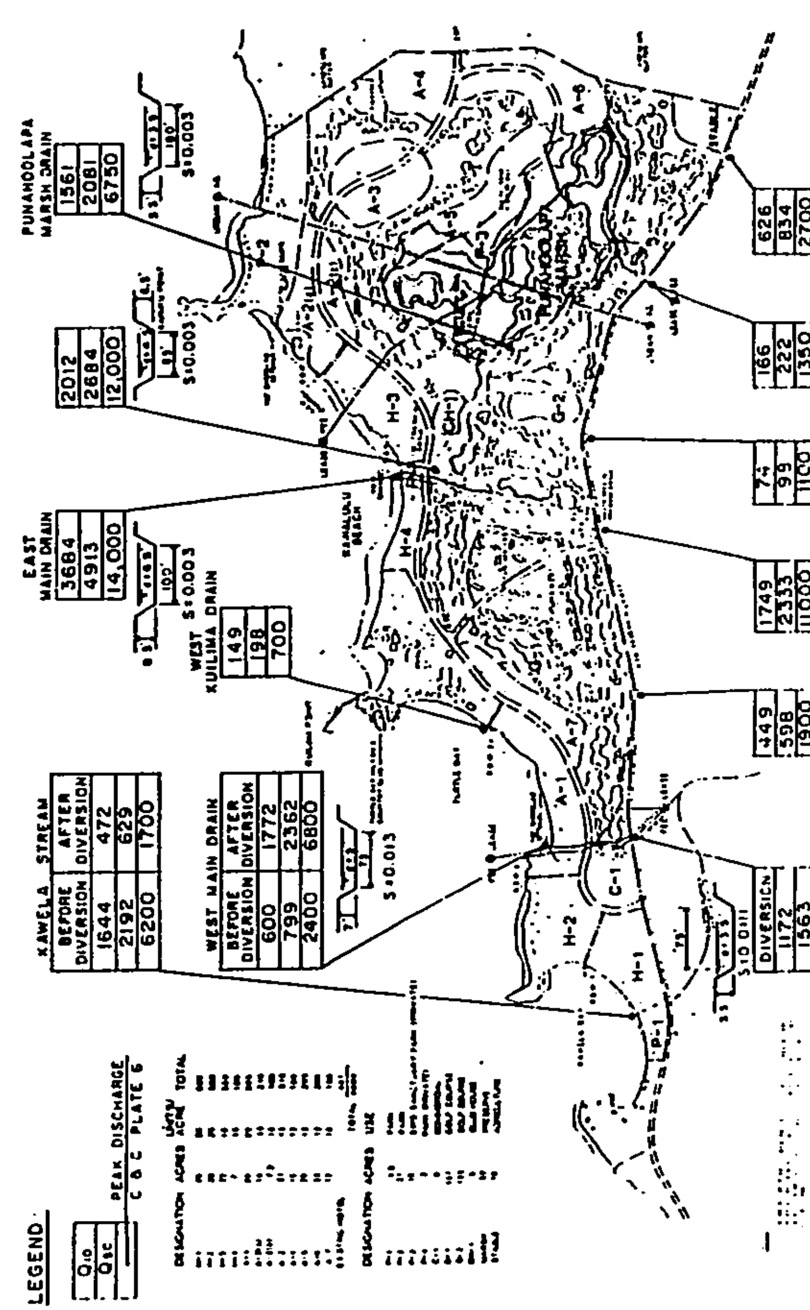
DRAIN	RUNOFF AREA	ACRES	TOTAL
KAWELA STREAM	A	138	
	B	32	
	C	601	
	1	8	779
WEST MAIN DRAIN	D	193	
	2	8	
	3	11	
	4	4	
	5	7	
	6	5	
	7	7	
	10	21	256
WEST KUILIMA DRAIN	8	5	
	9	9	
	11	11	
	12	46	
	13	4	
	14	6	
	15	3	
	16	4	88
PUNAHOOLAPA MARSH	G	132	
	H	298	
	25	10	
	26	5	
	27	31	
	28	68	
	29	28	
	30	11	
	31	13	
	32	22	
	33	40	
	34	5	
	36	98	
	37 por.	93	854
EAST MAIN DRAIN	E	1555	
	F	109	
	17	4	
	18	6	
	19	8	
	20	27	
	21	9	
	22	6	
	23	12	
	24	15	
	35	46	
	37 por.	15	1812

conditions, the golf course and Punahoolapa Marsh would experience temporary flooding to depths of 2 - 3 feet. The volume flows under 10-year, 50-year, and PMP conditions at the four main drains and at several interior drainage points before and after proposed drainage modifications are presented in Figure 13. Major volume flow changes will result from the diversion of part of the flow of Kawela Stream from Kawela Bay to Turtle Bay via the West Main Drain. Kawela Bay currently receives 1,644, 2,192, and 6,200 cubic feet per second (cfs) of storm runoff under 10-, 50-year and PMP conditions, respectively. After the proposed stream diversion, Kawela Bay would receive only 472, 629, and 1,700 cfs, or less than 30% of the pre-diversion flow. This diverted flow would enter Turtle Bay, which currently receives 600, 799, and 2,400 cfs under 10-, 50-year, and PMP rainfall. Post-diversion West Main Drain flows would be 1,772, 2,362, and 6,800 cfs, increases of almost 200%.

The volume flow through the West Kuilima Drain will not be altered by proposed development activities. Current flows are 149, 198 and 700 cfs under 10-, 50-year and PMP conditions.

In order to alleviate sump conditions which currently exist on the eastern portion of the KRD, Punahoolapa Marsh will be incorporated into a newly-designed drainage/reservoir system, the Punahoolapa Marsh Drainage System (PMD). Storm runoff from 430 off-site acres and 424 acres within the KRD will drain into the Marsh. The PMD will not have a direct outlet to the ocean; instead, runoff from the PMD will merge with the East Main Drain approximately 400 feet inland from the shoreline (Figure 13). Flow from the PMD will be controlled by a weir which will be necessary to prevent backflow of saltwater from entering the Marsh. No storm runoff currently enters the ocean from the Punahoolapa Marsh and its watershed areas; this water currently pools and slowly seeps into the ground. After completion of the PMD, the volume flows at the weir based on drainage area are projected to be 1,561, 2,081 and 6,750 cfs under 10-, 50-year and PMP conditions. The presence of the weir, however, and the fact that water levels are projected to be +2.5 feet in the Marsh and +4.5 feet in East Main Drain (P. Low, pers. comm), will decrease the flow actually entering the East Main Drain. Most of the water entering the PMD will remain behind the weir and slowly discharge into the ground.

The East Main Drain is presently the major drainage point for the KRD. Offsite drainage areas amount to 1664 acres, of which 1555 acres are the watershed for Oio Stream. The East Main Drain, which discharges into the central portion of Kuilima Bay, is essentially the relocated mouth of Oio Stream, which at one time discharged into Kuilima Cove. Drainage modifications will consist of channeling the flow from the Punahoolapa Marsh Drainage System into the East Main Drain. Current discharge volumes are approximately 2,012, 2,684 and 12,000 cfs under 10-, 50-year and PMP conditions. With the addition of the flow from the PMD which discharges over the weir, volume flows are projected to be 3,684, 4,913 and 14,000 cfs at the shoreline.



KUILIMA RESORT
FIGURE 13
MAP SHOWING ESTIMATED STORM RUNOFF AND

IMPACT OF PROPOSED DRAINAGE MODIFICATIONS ON THE NEARSHORE MARINE ENVIRONMENT

Storm water runoff entering the nearshore marine environment may result in several different types of impact: water quality may change (increase or decrease), and benthic communities may be affected directly by the discharge flow or indirectly by material carried by the flow and deposited on the ocean floor.

Water Quality

The current water quality conditions within Kawela Bay, Turtle Bay, Kuilima Bay and off Kahuku are presented in Table 6; also presented are the current State of Hawaii water quality Standards criteria for open coastal marine environments (because of their relatively large mouth area:volume ratio, none of the bays studied here fit the classification of "embayment" as defined by the Standards; State of Hawaii, 1984). Under dry conditions, turbidity levels in Kawela Bay, Turtle Bay, Kuilima Bay and the Kahuku coast all exceed the Standard geometric mean (MEAN) level but, with the exception of the falling tide value at Kahuku, which was higher than the Not-To-Exceed (NTE) level, are less than the Not-To-Exceed 10% of the time (NTE 10%) level. Filterable solids concentrations in Kawela Bay, Turtle Bay and Kuilima Bay all exceeded the NTE level under dry conditions; concentrations along the Kahuku coast were well below the MEAN level. These high (compared to the water quality Standards) levels of turbidity and filterable solids loads probably reflect the suspension of particulate material by wave action in these areas. The open nature of the Kahuku coast, with its continuous flushing by long-shore currents, probably results in less fine material remaining on the bottom to be suspended by wave action, thus the low filterable solids concentrations observed there.

Water quality Standards were exceeded (NTE 10%) under dry conditions for nitrate-nitrite in Kawela Bay, Turtle Bay and Kuilima Bay; omitting a single high nearshore sample value, the Kahuku concentrations of nitrate-nitrite were less than the Standard MEAN level. Ammonium concentrations in Kawela Bay and along the Kahuku coast exceeded the NTE 10% level; ammonium concentrations in Turtle Bay and Kuilima Bay exceeded the NTE level. Phosphate concentrations were at or above the NTE 10% level in Turtle Bay and Kuilima Bay, but less than the MEAN level in Kawela Bay and along the Kahuku coast. These patterns of high dissolved nitrate-nitrite and ammonium levels and low phosphate levels may reflect the influence of groundwater (which is normally higher in nitrate-nitrite and lower in phosphate) and seepage of water from septic systems (which is generally high in ammonium) near the shore. None of the other water quality parameters exceeded the Standard MEAN value. Surface runoff during dry conditions is minimal to nonexistent, so water quality conditions during this period are determined by physical processes (wave action and currents), flushing rates and groundwater influx rates.

SUMMARY

LOCATION	PERIOD		Temp (deg C)	Salinity (ppt)	pH (units)	Dis O2 (ml/l)	Turb (NTU)	T Sol (mg/l)	NO2-NO3 (uM)	NH4 (uM)	PO4 (uM)	Chl a (ug/l)	Phaeo (ug/l)	T Coli (#/100 ml)	F Coli (#/100 ml)	F Strep (#/100 ml)
KAWELA BAY	DRY	MEAN	24.6	33.8		4.99	0.7	29.3	0.73	0.43	0.16	0.14	0.35	0	0	2
		ST DEV	0.7	0.7		0.21	0.4	0.7	0.45	0.31	0.14	0.05	0.10	0	0	2
	WET	MEAN	23.3	32.5		6.08	4.3	29.4	1.48	0.11	0.18	0.65	1.11	74	1	13
		ST DEV	0.4	1.7		0.21	7.6	27.7	1.46	0.14	0.05	0.99	1.64	110	1	18
TURTLE BAY	DRY	MEAN	23.1	34.7		4.74	0.5	29.1	0.47	0.62	0.37	0.09	0.23	0	0	0
		ST DEV	0.2	0.1		0.23	0.1	2.0	0.06	0.66	0.27	0.02	0.08	0	0	0
	WET	MEAN	24.0	34.7		6.10	0.4	33.7	0.40	0.16	0.22	0.74	0.48	8	1	2
		ST DEV	0.0	0.0		0.87	0.1	3.4	0.11	0.33	0.25	0.04	0.11	5	1	1
KUILIMA	DRY	MEAN	27.0	34.4	8.38	6.21	0.4	48.2	0.48	2.01	0.26	0.06	0.07	0	0	4
		ST DEV	0.0	0.5	0.03	0.47	0.4	19.8	0.24	1.21	0.12	0.02	0.03	0	0	16
KAHUKU	DRY/FALLING	MEAN	26.1	35.6	8.00	6.56	1.2	1.4	0.25	0.37	0.07	0.03				
		ST DEV	0.0	0.2	0.02	0.55	0.5	0.6	0.14	0.15	0.03	0.01				
	DRY/RISING	MEAN	26.4	35.5	8.05	7.44	0.6	1.9	0.30	0.25	0.07	0.03				
		ST DEV	0.2	0.1	0.07	0.44	0.5	1.1	0.17	0.11	0.04	0.01				
H. STANDARD	DRY	MEAN			8.10	NLT	0.2	10.0	0.25	0.14	0.16	0.15				
		NTE 10%				75%	0.5	15.0	0.71	0.36	0.29	0.50				
		NTE	+1/-1	+10%/-10%	7.6-8.6	SAT	1.0	20.0	1.43	0.64	0.42	1.00				
	WET	MEAN			8.10	NLT	0.5	20.0	0.36	0.25	0.23	0.30				
		NTE 10%				75%	1.3	30.0	1.00	0.61	0.39	0.90				
		NTE	+1/-1	+10%/-10%	7.6-8.6	SAT	2.0	40.0	1.78	1.07	0.55	1.75				

Table 6. Summary of water quality data for nearshore waters off Kuilima and Kahuku and current State of Hawaii water quality standards criteria.

Water quality data under wet conditions are available only for Kawela Bay and Turtle Bay; conditions in Kuilima Bay and along the Kahuku coast may be similar. Under wet conditions, turbidity (NTE), filterable solids, nitrate-nitrite and chlorophyll (all NTE 10%) in Kawela Bay exceeded the Standard NTE level; only filterable solids and nitrate-nitrite levels exceeded the Standard MEAN level (all NTE 10%) in Turtle Bay.

In order to assess the impact of changes in the current drainage patterns on the water quality of the marine environment, it is necessary to determine the discharge volumes and loads of sediment and nutrients carried by these flows, and to compare the load fluxes before and after changes are made. Changes in land use will also result in changes in the concentrations of materials carried by storm runoff. It can be assumed that water quality conditions during dry conditions are determined by factors other than runoff, and thus the following discussion considers conditions only during wet conditions.

Tables 7 and 8 present the volume flows discharged by each of the KRD drains; the concentration of solids and nutrients carried by those flows from land areas with different uses, and the total loads discharged into the nearshore marine environment before and after drainage modification, respectively. Volume flows are taken from EDP Hawaii (1984). Estimates of PMP flows based on acreages are approximate, and totals may differ slightly from those in the EDP Hawaii report. The differences are minor and do not significantly affect the conclusions drawn from the data. Concentrations of solids and nutrients from undeveloped and/or agricultural areas and urban areas are taken from Dugan (1984); it is assumed that most of the nitrogen is in the from of nitrate and most of the phosphorus is in the form of phosphate. The assumption has also been made that no changes in use of agricultural land mauka of Kamehameha Highway will accompany the KRD development, and that the runoff characteristics of those areas (A-H) will remain unchanged. Areas 9-22 are assumed to be presently urban development with the runoff characteristics of such areas; Areas 1-8 and 23-37 are assumed to presently be undeveloped in nature. Post-development urban areas are assumed to include Areas 1-37.

The summaries of the data in Tables 7 and 8 which are presented below give the projected amounts of solids and nutrients which will be discharged into Kawela Bay, Turtle Bay and Kuilima Bay. The impact analysis of the changes in loading is based on the relative increase (or decrease) of loading caused by development when compared to ambient conditions in the nearshore marine environment under the present calculated loading. No attempt has been made to assess the impact of absolute amounts of discharged materials; what is important is to come to some estimate of how the changes in discharge character will affect ambient conditions.

The loads of solids, nitrate and phosphate discharged into Kawela Bay under 10-year, 50-year and PMP conditions before and

Table 7. Volume flow discharge, concentration of solids and nutrients in each flow, and total loads discharged into the marine environment before drainage system modification and resort development.

Area	Runoff area	Acres	Runoff (cfs) 10-year	Runoff (cfs) 50-year	Runoff (cfs) PMP	Solids (mg/l)	NO3 (mg/l)	PO4 (mg/l)	Solids (kg/day) 10-year	Solids (kg/day) 50-year	Solids (kg/day) PMP	NO3 (g/day) 10-year	NO3 (g/day) 50-year	NO3 (g/day) PMP	PO4 (g/day) 10-year	PO4 (g/day) 50-year	PO4 (g/day) PMP
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 8. Volume flow discharge, concentration of solids and nutrients in each flow, and total loads discharged into the marine environment after drainage system modification and resort development.

[illegible]

after stream diversion and resort development are summarized below. In all cases, the load of material discharged into the Bay will decrease significantly. The change from rural to urban land use and the associated decrease in solids load combines with the diversion of Kawela Stream away from the Bay to drastically decrease the amount of solids discharged into the Bay. Water quality conditions within Kawela Bay, especially turbidity and sediment load, could be expected to improve.

	BEFORE DEVELOPMENT			AFTER DEVELOPMENT		
	SOLIDS (kg/d)	NO3 (g/d)	PO4 (g/d)	SOLIDS (kg/d)	NO3 (g/d)	PO4 (g/d)
10-YEAR	761	558	56	218	162	19
50-YEAR	1015	744	74	290	215	25
PMP	3070	2252	225	749	559	68

The loads of solids, nitrate and phosphate discharged into Turtle Bay under 10-year, 50-year and PMP conditions before and after stream diversion and resort development are summarized below. The character of the discharge from the West Kuilima Drain will not change since no alteration in watershed area or land use from that presently existing is proposed.

	BEFORE DEVELOPMENT			AFTER DEVELOPMENT		
	SOLIDS (kg/d)	NO3 (g/d)	PO4 (g/d)	SOLIDS (kg/d)	NO3 (g/d)	PO4 (g/d)
West Kuilima Drain						
10-YEAR	18	30	24	18	30	24
50-YEAR	23	40	32	23	40	32
PMP	69	134	116	69	134	116
West Main Drain						
10-YEAR	269	199	23	755	573	81
50-YEAR	358	265	30	1006	764	108
PMP	1037	782	104	3203	2412	319
Total						
10-YEAR	297	229	57	773	603	105
50-YEAR	381	305	62	1029	804	140
PMP	1108	916	220	3272	2546	435

The diversion of Kawela Stream into Turtle Bay results in a 2-3X increase in solids and nutrients discharged into the Bay. Water quality within Turtle Bay may not be degraded as severely as these number suggest, however. Turtle Bay is much more open to the action of waves, and typically is much better flushed than Kawela Bay. A strong current runs westward along the shore of Turtle Bay and a rip current run offshore along the western edge of the Bay under almost all sea conditions (AECOS, 1979). These currents would tend to quickly sweep any discharge into the Bay out to deeper waters where strong offshore currents would disperse the discharge plume. This action would be most pronounced in winter, when surf along the north shore of Oahu is generally highest; high surf conditions frequently coincide with wet weather periods.

The loads of solids, nitrate and phosphate discharged into Kuilima Bay under 10-year, 50-year and PMP conditions before and after stream diversion and resort development are summarized below. Under present conditions, the discharge into Punahoolapa Marsh does not reach Kuilima Bay; the data for the Marsh give some indication of the amount of material entering the Marsh which may tend to aid in its natural progression from marsh to grassland.

	BEFORE DEVELOPMENT SOLIDS (kg/d)	NO3 (g/d)	PO4 (g/d)	AFTER DEVELOPMENT SOLIDS (kg/d)	NO3 (g/d)	PO4 (g/d)
Punahoolapa Marsh						
10-YEAR	716	525	52	422	407	161
50-YEAR	954	700	70	563	543	214
PMP	3096	2270	227	2065	1857	607
East Main Drain						
10-YEAR	942	704	86	860	671	116
50-YEAR	1257	939	115	1147	895	155
PMP	5514	4083	457	5336	4012	522
Total						
10-YEAR	942	704	86	987	793	164
50-YEAR	1257	939	115	1315	1057	161
PMP	5514	4083	457	5995	4569	704

After the Punahoolapa Marsh Drainage system is completed, approximately 30% of the runoff into the Marsh will flow over the weir and into the ocean through the East Main Drain. The figures above assume no change in runoff water quality for flow through the marsh. It is more likely that some decrease in solids due to

settlement in the quiet flow of the marsh and some uptake of nutrients by emergent vegetation will occur. The Total East Main Drain figures, then, are probably overestimates of actual conditions.

The amount of solids and nitrate discharged into Kuilima Bay after resort development and completion of the Punahoolapa Marsh Drainage system will not be significantly different from that which reaches the ocean presently. The amount of phosphate discharged will increase by a factor of 1.4-1.9X. The impact of this increased phosphate load on the nearshore marine environment will probably not be detectable. Kuilima Bay also experiences rapid flushing during almost all surf conditions; strong long-shore currents and one or more rip currents develop which would rapidly move any runoff out to the offshore current system. In addition, there is little likelihood of a biostimulatory effect of additional supplies of phosphate. Almost all marine systems tend to have phosphate available in excess; the addition of more would not result in any blooms of phytoplankton.

Benthic Communities

The impact of terrestrial runoff on nearshore marine benthic communities generally takes the form of immediate mortality due to exposure to fresh or low-salinity water, mortality of corals due to the deposition of sediment, or changes in community structure such as increases in algal populations due to increased availability of nutrients. The changes in sediment load and nutrient addition to Kawela Bay, Turtle Bay, and Kuilima Bay have been described above. The volume flows into these three bays under three rainfall conditions are summarized below.

	BEFORE DEVELOPMENT 10-YEAR (cfs)	50-YEAR (cfs)	PMP (cfs)	AFTER DEVELOPMENT 10-YEAR (cfs)	50-YEAR (cfs)	PMP (cfs)
Kawela Bay	1660	2213	6695	488	650	1695
Turtle Bay	749	998	3100	1921	2560	8100
Kuilima Bay	2139	2853	12280	2607	3477	14305

The flow of storm runoff into Kawela Bay will decrease to less than 30% of current conditions after the diversion of Kawela Stream into Turtle Bay. Given the previously described decreases in sediment loading and nutrient addition, it may be reasonable to expect that the coral communities of Kawela Bay will increase in size and horizontal extent, and that fishes and invertebrates which depend upon corals for shelter will become increasingly abundant. In general, conditions within Kawela Bay will likely approach the more complex and well-developed benthic communities seen in Turtle Bay and Kuilima Bay.

Storm runoff into Turtle Bay will increase by a factor of 2.5% after diversion of Kawela Stream. The major discharge will be located in the western corner of the Bay, in an area which is either a high energy subtidal bench (Biotope 1) or an area of sand and rubble pockets (Biotope 4). Both these biotopes are characterized by low coral coverage (less than 1%) and few (1) algal species. A rip current is present along this shoreline, and the discharge from the West Main Drain will be rapidly carried out to sea. There is little likelihood of changes in benthic communities in the discharge area, given the low coral and algal coverage and the strong local currents.

Flow into Kuilima Bay is projected to increase by only 20% after completion of development plans. The character of the discharged storm water will also not change significantly. The East Main Drain currently discharges a large volume of water, mainly from the Oio Stream watershed, into the nearshore marine environment. Strong longshore currents and rip currents tend to move this discharge offshore rapidly, and strong surf throughout most of the year (especially during the wet winter season) produces well-flushed conditions within the Bay.

Substratum is an important parameter governing the structure, diversity, and density of organisms in any benthic community. Areas of considerable structural relief (habitat heterogeneity) will harbor a more diverse and greater standing crop of fish and invertebrates (Brock, 1954; Risk, 1972; Brock et al., 1979). Sand flats are areas typically of low relief; the opposite extreme (in the Kuilima - Kahuku Point study area) are areas with mature coral communities or areas with large undercut channels and collapsed limestone caves, all of which provide structural relief (shelter) to the habitat. In general, corals, a major structural element of this third dimension, cannot become established in areas of shifting substratum, such as sand or loose rubble (Edmondson, 1928; Maragos, 1972) and need areas of hard bottom to survive. Thus, the texture of the substratum is an important component in any ecological consideration of benthic communities.

An important modifier of this structural component is water motion. If too severe, water motion may cause scouring or burial (by sand) of benthic communities, leading to lower diversity. A certain level of water motion is, however, beneficial, and, in fact, required for coral growth (Jokiel, 1978). Water motion carries food and nutrients, as well as disperses larvae for the sessile components of the benthic community.

The nearshore area between Kawela Bay and Kahuku Point is exposed to surf coming from the north and northwest. Most of this coastline has little shallow reef to break up the force of these incoming waves. The paucity of macroinvertebrates, corals and fish in the area may be indirectly related to wave activity causing a scouring of the substratum.

Much of the diversity inherent in any community of organisms may be related to the heterogeneity in the habitats present. Thus, in a coral reef system, a sand flat harbors fewer species and individuals than does an adjacent coral community. Habitat heterogeneity may be increased by dimensionality, i.e., going from a two-dimensional system to a three-dimensional one and by physically increasing the third dimension. This increase in dimensionality not only provides shelter for resident organisms but will serve to dissipate impinging wave energy, thus lowering substratum scouring.

The diversity of fish species (numbers of species and individuals) encountered in the Kuilima area is not particularly great relative to other local studies. Bienfang and Brock (1980) found 105 fish species in their ecological reconnaissance of the West Beach, Oahu area. A major difference in the latter study (which used the same assessment techniques) is that it was conducted in the relatively protected (lee) part of the island where coral communities and the third dimension (shelter) are well developed. In the Kahuku Point area, the coral communities and habitat relief (third dimension) are not particularly well developed (see below). This lack of development may result in a less diverse habitat available to fish. Thus, the low fish species diversity found in the present study may be related to the degree of habitat development (heterogeneity).

Many of the corals encountered in the present survey displayed prostrate growth forms; such growth patterns are indicative of high energy conditions. In this study, 13 species of coral were recorded. This represents about 35% of the species of the known shallow Hawaiian coral fauna (Maragos, 1977) and probably a much larger percentage of the common fauna. Thus corals are reasonably well represented in the biotopes surveyed in the vicinity of Kahuku Point. Coral coverage is relatively low, ranging from less than 1% to over 21%. In well developed leeward coast Hawaiian coral communities, local coverage values of 60 to 80% are not uncommon (Bienfang and Brock, 1980). Like prostrate growth forms, low coral coverage is probably related to the habitat being subjected to high energy conditions caused by storm surf.

The colonial soft coral, Anthelia edmondsoni, is known only from the Hawaiian Islands where it is frequently found in embayments (Devaney, 1977). Among ecologists, A. edmondsoni is known as an indicator of freshwater input; thus its common occurrence in a marine community is indicative of some intermittent level of mixhalinity. In the survey of Kuilima Bay (Brock, 1985), A. edmondsoni was found in the Smooth Limestone Bench Biotope and in the Biotope of Surge Channels. The distribution of this species suggests that freshwater input occurs over a significant part of that area.

The results of the several marine surveys (Bienfang and Brock, 1981; Brock, 1982; Brock, 1985) suggest that the relatively high energy conditions that seasonally prevail in the

Kahuku Point area probably have determined the degree and direction of benthic community development. Thus, species that are present are those able to succeed under periodic high surf conditions; this is particularly true for sessile forms such as the corals.

The widespread presence of *A. edmondsoni* suggests that nearshore marine communities are subjected to some freshwater input. It is suspected that much of this freshwater input has, in the past, occurred along the beach near the midpoint of the large bay between Kahuku and Kuilima Points. This supposition is partially based on the presence of the large and extensive onshore-offshore channel development in the area affronting the midpoint of the bay. Natural point source freshwater discharge (streams) into fringing coral reef communities frequently results in the formation of a channel directly opposite the stream mouth cutting through the fringing reef in an orientation perpendicular to the shore and reef. Examples of this phenomenon are common along the windward Oahu coastline from Kualoa to Kahuku.

No obvious adverse impact to the nearshore benthic communities in the study area are apparent from episodic freshwater drainage. This statement is supported by the presence of large *Porites lobata* colonies no more than 75 m offshore and 400 m east of the major channel area (a presumed drainage path). Like most other corals, *Porites lobata* cannot tolerate much exposure to freshwater or to lowered salinities.

The growth rates of Hawaiian *Porites lobata* are known to vary between 1 to 2 cm per year (S.V. Smith, pers. comm.). The largest *Porites lobata* colony in the Biotope of Large *Porites* Colonies was estimated to be 4 m in diameter; this colony is situated in about 2 m of water. Assuming isometric growth, this *Porites* colony is estimated to be between 100 and 200 years of age, suggesting that ecological conditions at this site have been appropriate for that length of time.

This information suggests that if hinterland drainage patterns are not greatly altered during any proposed development and that the volume of water discharged does not greatly change, little negative impact due to freshwater input should occur to the extant marine communities in the Kahuku Point area. This, of course, assumes no change in sediment inputs.

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Appendix A1

Water Quality Survey of Kuilima Bay and the Area East of Kahuku Point, Oahu

OI Consultants, Inc.

Introduction

The object of this survey was to describe the ambient water quality under dry weather conditions in Kuilima Bay, a semi-enclosed body of water located on the north shore of Oahu, Hawaii.

Materials and Methods

Water quality conditions were sampled at twelve stations within Kuilima Bay and in the area east of Kahuku Point (Figure A1-1). Samples were taken from a small boat at Stations 1-5 and 7-9 on September 20, 1984, using an opening-closing Go-Flo water sampler suspended from a wire marked in meters. Stations close to shore could not be sampled from the boat because of surf conditions; these stations (6 and 10-12) were sampled on October 8, 1984, by a swimmer starting from the shoreline and using a hand-held sampling bottle. At stations with water depths greater than 5 m (Stations 1, 3, 4, 7 and 8), samples were taken from 1 m below the surface, 1 m above the bottom, and a depth midway between the surface and the bottom. At stations with water depths between 2 and 5 m (Stations 2, 5, and 9), samples were taken 1 m below the surface and 1 m above the bottom. At stations with water depths less than 2 m (Stations 6, 10, 11, and 12), a single sample was taken at 1 m depth.

Samples were taken for analysis of physico-chemical parameters (temperature, dissolved oxygen, salinity, pH, turbidity, filterable solids), nutrients (nitrate+nitrite, ammonium, phosphate), phytoplankton biomass (chlorophyll and phaeopigments), and enteric bacteria (total coliforms, fecal coliforms, fecal streptococci). The temperature of the sample was determined immediately after collection with a thermometer calibrated to 0.5°C. Samples for dissolved oxygen determinations were taken into 300 ml BOD bottles and immediately fixed with reagents as described in Strickland and Parsons (1972). Water samples for the remaining analyses were placed on ice in an insulated container immediately after being collected and were returned to the laboratory for analysis.

Determinations of dissolved oxygen followed the thiosulphate titration procedure outlined in Strickland and Parsons (1972). Salinity was measured to 0.5 ppt on a hand-held refractometer calibrated against seawater of known salinity (Copenhagen water). Sample pH was determined using an Orion Model 701 digital pH meter and combination pH electrode calibrated against buffers of known pH. Turbidity was measured on a Turner Designs turbidity meter calibrated with a 20 NTU latex particle standard. A measured volume of water was filtered through a tared Whatman GF/C glass fibre filter, dried to constant weight at 60°C, and weighed to 0.1 mg on a Sartorius hanging pan balance.

Dissolved nutrient (nitrate+nitrite, ammonium and phosphate) concentrations were determined on a Technicon AutoAnalyzer II interfaced with an Apple//e computer and IHI

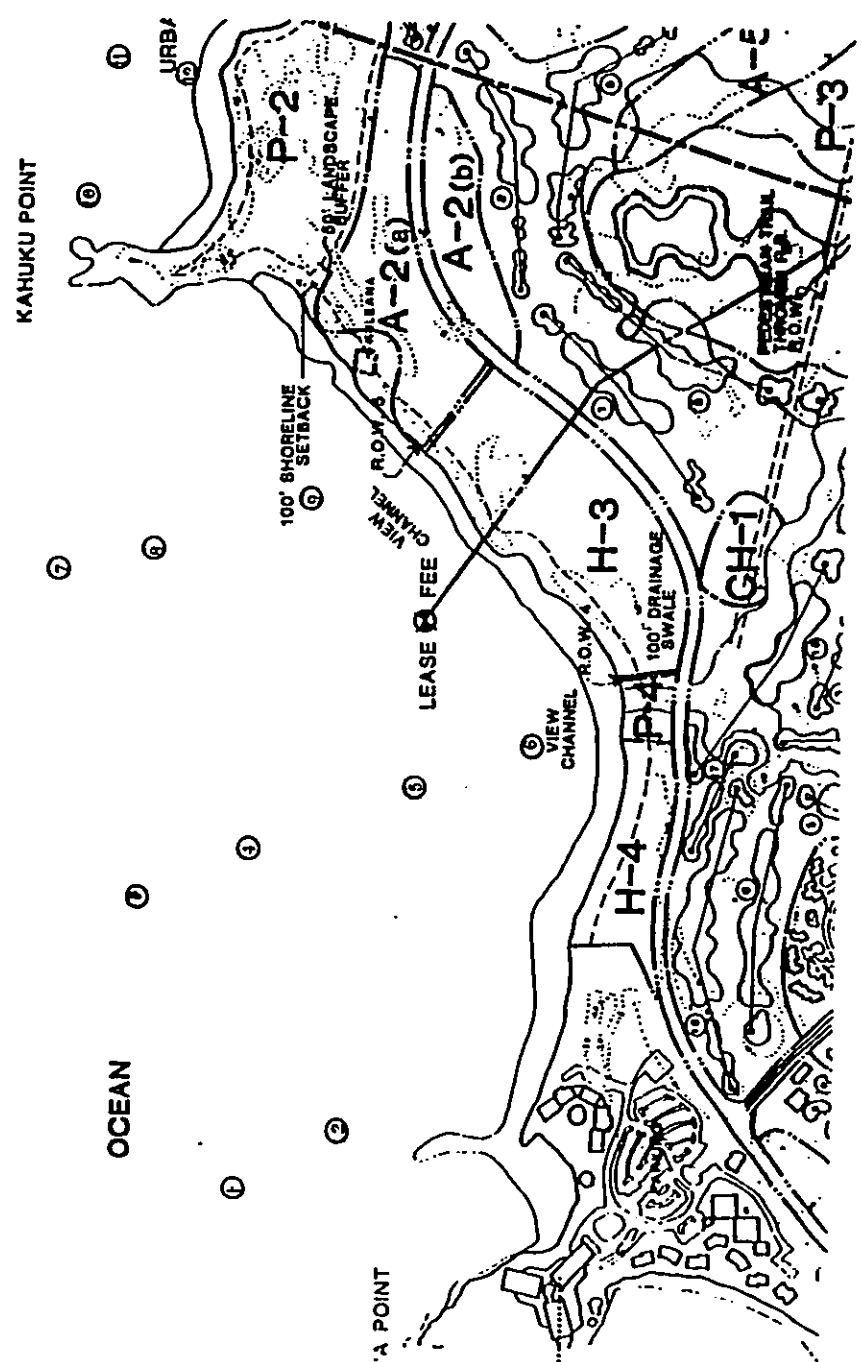

Figure A1-1. Location of water quality stations within Kuilima Bay and east of Kahuku Point under dry weather conditions.

analog-digital converter using the methods of Strickland and Parsons (1972), Solorzano (1969), and Grasshoff, et al (1983), respectively. Standards of known concentration were run before and after the samples, and calculated concentrations were corrected for optical blanks.

Chlorophyll and phaeopigment concentrations were determined by the methods described in Strickland and Parsons (1972). Samples were filtered onto 25 mm Whatman GF/C filters and extracted overnight in a freezer in 90% acetone. Extracts were measured on a Turner Designs fluorometer which had been calibrated with pure chlorophyll extracts. Extracts were acidified and remeasured to give phaeopigment concentrations.

Enteric bacterial determinations followed the procedures outlined in Standard Methods (APHA-AWWA-WPCF, 1976). Samples were filtered onto Millipore 0.45 um filters, placed in disposable plastic petri dishes containing on agar layer with the proper medium, and incubated for 24 or 48 hours at the required temperatures in a temperature- and humidity-controlled incubator. Colonies were counted after the required incubation period under a magnifying viewer.

Results

The results of the analyses of samples from twelve nearshore stations in the Kuilima area and the overall means and standard deviations for each analysis are presented in Table A1-1. Water quality conditions were relatively uniform both vertically and between stations. Temperature at all stations and depths was 27°C; mean salinity was 36.4 ppt (standard deviation = 0.5). The mean pH was 8.38 (SD = 0.03), and the mean dissolved oxygen concentration was 6.21 ml/l (SD = 0.47). These values are typical of nearshore marine waters around Hawaii; the low standard deviations reflect the uniform character of the area.

Turbidity values had an overall mean of 0.4 NTU (SD = 0.4); stations nearest the shoreline (Stations 6, 10, 11, and 12) had higher turbidity levels (1.0 - 1.9 NTU) than did those stations further removed from shore (0.1 - 0.9 NTU). These higher nearshore levels reflect the presence of particles stirred up into the water by wave action. However, filterable solids concentrations did not show a clear difference between near shoreline and further offshore samples; the overall mean was 48.2 mg/l (SD = 19.8). This apparent contradiction may be due to the presence of detrital or benthic algal material in the nearshore samples (see below) which caused higher turbidity readings but did not contribute significantly to filterable solids weights.

Concentrations of nitrate-nitrite (M = 0.48 uM; SD = 0.24), ammonium (M = 2.01 uM; SD = 1.21) and phosphate (M = 0.24 uM; SD = 0.12) were typical of nearshore ocean conditions. One sample (Station 4, 6 m depth) was apparently contaminated; the high nutrient levels observed, if real, could only have come from some groundwater source near the sampling site. Other water quality parameters (especially temperature and salinity) showed no evidence (i.e., lower temperature and salinity) of groundwater influence which would support such a hypothesis. The data for Station 4, 6 m depth were not included in the above calculations of nutrient means and standard deviations.

Chlorophyll levels ranged from 0.110 ug/l at Station 6, 1m depth to 0.030 ug/l at Station 7, 5 m depth. The mean chlorophyll concentration was 0.060 ug/l (SD = 0.021). Phaeopigment levels ranged from 0.157 ug/l at Station 6, 1 m depth to 0.014 ug/l at Station 7, 1 m depth. The mean phaeopigment level was 0.065 ug/l (SD = 0.030). The highest concentrations of chlorophyll and phaeopigments were found at the stations closest to shore (Stations 6, 11 and 12). These higher values are probably the result of the suspension of benthic algal material by wave action in the surf zone.

Enteric bacterial levels were generally low throughout the area surveyed. Total coliform and fecal coliform tests found no evidence of the presence of these bacteria, which are rapidly killed off in seawater. Fecal streptococcus levels were also generally low (less than 10 per 100 ml); at the stations nearest the shoreline (Stations 6 and 12), however, higher counts (72 and 44 colonies per 100 ml) were observed. These higher counts may indicate the presence of seepage of groundwater at or near the shoreline; however, the other water quality parameters, especially dissolved nutrients, did not exhibit higher concentrations which would be expected with groundwater influx.

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Table A1-1. Results of water quality analysis from stations in Kuilima Bay and east of Kahuku Point under dry weather conditions.

Station	Depth (m)	Temp (deg C)	Salinity (ppt)	pH (units)	Dis O2 (ml/l)	Turb (NTU)	F Sal (ug/l)	NO2-NO3 (uM)	NH4 (uM)	PO4 (uM)	Chl a (ug/l)	Phaeo (ug/l)	T Coli (#/100 ml)	F Coli (#/100 ml)	F Strep (#/100 ml)
1	1.0	27.0	37.0	[illegible]	[illegible]	[illegible]	32.0	0.37	1.56	0.37	0.04	0.06	0	0	0
	[illegible]	27.0	37.0	[illegible]	[illegible]	[illegible]	32.0	0.59	3.17	0.33	0.05	0.06	0	0	0
	[illegible]	27.0	37.0	[illegible]	[illegible]	[illegible]	124.0	0.39	1.49	0.55	0.05	0.05	0	0	0
2	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	48.0	0.33	1.38	0.30	0.03	0.06	0	0	0
	[illegible]	27.0	37.0	[illegible]	[illegible]	[illegible]	50.0	0.20	0.89	0.30	0.07	0.09	0	0	0
3	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	44.0	1.06	1.90	0.28	0.05	0.05	0	0	0
	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	42.0	0.30	1.66	0.23	0.05	0.06	0	0	0
	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	38.0	0.48	5.53	0.23	0.05	0.06	0	0	0
4	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	44.0	1.01	3.38	0.18	0.07	0.08	0	0	[illegible]
	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	30.0	0.57	1.13	0.29	0.07	0.07	0	0	0
	[illegible]	27.0	37.0	[illegible]	[illegible]	[illegible]	44.0	101.10	31.06	1.87	0.05	0.05	0	0	0
5	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	32.0	0.36	1.20	0.15	[illegible]	[illegible]	0	0	[illegible]
	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	22.0	0.27	0.63	0.21	0.08	0.08	0	0	[illegible]
6	1.0	27.0	37.0	8.34	[illegible]	1.9	58.0	0.57	2.01	0.37	0.11	0.16	0	0	72
7	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	34.0	0.57	[illegible]	0.09	0.02	[illegible]	0	0	[illegible]
	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	40.0	0.85	[illegible]	0.20	0.03	0.01	0	0	[illegible]
	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	62.0	0.51	1.56	0.14	0.03	0.04	0	0	0
8	[illegible]	27.0	[illegible]	[illegible]	[illegible]	[illegible]	48.0	0.43	2.17	0.18	0.06	0.04	0	0	0
	[illegible]	27.0	37.0	[illegible]	[illegible]	[illegible]	38.0	0.37	3.25	0.42	0.06	0.07	0	0	0
	[illegible]	27.0	37.0	[illegible]	[illegible]	[illegible]	48.0	0.33	0.93	0.11	0.07	0.07	0	0	0
9	1.0	27.0	37.0	[illegible]	[illegible]	[illegible]	34.0	0.75	1.69	0.12	0.03	0.05	0	0	[illegible]
	[illegible]	27.0	36.0	[illegible]	[illegible]	[illegible]	44.0	0.42	1.26	0.07	0.05	0.06	0	0	[illegible]
10	1.0	27.0	36.0	8.37	6.56	1.0	53.0	0.23	1.15	0.23	0.07	0.06	0	0	3
11	1.0	27.0	36.0	8.37	6.56	1.1	56.0	0.39	2.23	0.29	0.09	0.10	0	0	1
12	1.0	27.0	36.0	8.40	6.56	1.1	67.0	0.15	2.19	0.15	0.10	0.13	0	0	44
Mean		27.0	36.4	8.38	6.31	0.4	48.2	0.48	2.01	0.24	0.06	0.06	0	0	[illegible]
SD		0.0	0.5	[illegible]	0.47	0.4	19.8	0.34	1.21	0.12	0.02	0.03	0	0	16

APPENDIX A2

An Ecological Reconnaissance of the Nearshore Benthic Communities in the Vicinity of Kahuku Point, Oahu

Dr. R. E. Brock

Introduction

With the proposed expansion of the Turtle Bay Hilton and general development of the Kahuku Point region, the necessity to identify possible environmental impacts on nearby marine communities was established. Thus the need for a predevelopment field survey of the present status of the marine macrobiota (e.g. fish, coral, and other benthic invertebrate populations) was identified. The purpose of this survey is (1) to locate, identify, and describe the macrobiotic resources in the areas between Kuilima and Kahuku Points, east to the project boundary and (2) to note potential short- and long-term impacts incident to these communities due to present and future drainage patterns.

To our knowledge, there exists no previous study with any comprehensive detail on extant marine communities in the boundaries of the present survey. Thus, the present ecological reconnaissance may be viewed as a baseline document for the area under question.

Materials and Methods

The fieldwork which provided the database for this survey of the marine macrobiota in the vicinity of Kahuku Point, Oahu was conducted between 25 September, 1984 and 8 June, 1985. The span in sampling dates reflects high surf conditions persisting in the study area between September, 1984 to May, 1985. The majority of the field work was carried out in the May-June period. The area encompassed in this survey is shown in Figure 1; it includes the nearshore region from shore seaward to an imaginary straight line drawn from the tips of Kuilima to Kahuku Points (approximately the 10 m isobath). A second small area to the east of Kahuku Point was also examined (Figure 1).

The quantitative sampling of macrofaunal marine communities presents a number of problems; many of these are related to the scale on which one wishes to quantitatively enumerate organism abundance. Marine communities in the Kahuku Point region may be spatially defined in a range on the order of a few 100 cm^2 (such as the community residing in a Pocillopora meandrina coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, as well as having preliminary inventory information for the area in question, we designed a sampling program that attempted to delineate the major extant communities in the limits of the study area and to quantitatively describe these communities. Thus, a number of techniques were used. The methods here are the same as those used in our previous surveys of Turtle Bay and Kawela Bay (Bienfang and Brock, 1981). Description of these methods is purposely quite explicit so that any subsequent survey seeking to evaluate changes in the area can benefit from the use of the same or comparable techniques.

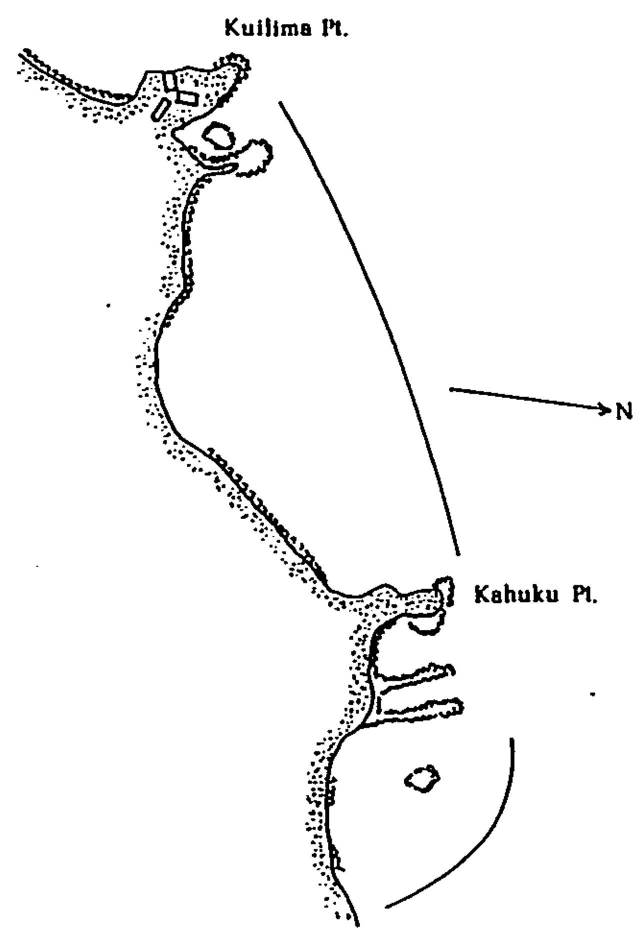

Figure 1. Map of Kahuku and Kuilima Points, Oahu and vicinity depicting the boundaries (solid lines) of the present survey. (Scale: 1 cm = 146 m)

To obtain an overall perspective on the extent of the major communities or "zones" occurring in the study area, a diver was slowly towed behind a skiff over most of the study area from shore seaward to the 10 m contour or isobath (the outer limits for this study). This exercise allowed the qualitative delineation of four major biotopes based partly on large structural elements (e.g., amount of sand, hard substratum, fish abundance, coral coverage or dominant coral species). Within each of these major areas, a number of stations were established and quantitative studies were conducted, including visual enumeration of fish, counts along benthic transect lines, and cover estimates in benthic quadrats. In addition to these quantitative measures, a qualitative reconnaissance was made in the vicinity of each station by swimming and noting the presence of visually important species not encountered in the transects. All assessments were carried out using SCUBA.

The location of stations was subjectively chosen as being representative of a given biotope. Immediately following site selection, a visual fish census was undertaken to estimate the abundance of fishes. These censuses were conducted over a 20 x 4 m corridor and all fishes within this area to the water's surface were counted. A single diver equipped with SCUBA, transect line, slate and pencil would enter the water, count and note all fishes in the prescribed area (method modified from Brock, 1954). The 20 m transect line was paid out as the census progressed, thereby avoiding any previous underwater activity in the area which could frighten wary fishes.

Fish abundance and diversity is often related to small-scale topographical relief over short linear distances. A long transect may bisect a number of topographical features (e.g. coral mounds, sand flats, and algal beds), thus sampling more than one community and obscuring distinctive features of individual communities. To alleviate this problem, a short transect (20 m in length) has proven adequate in sampling many Hawaiian benthic communities (Bienfang and Brock, 1981)

In addition to frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels (Family Muraenidae) and nocturnal species, e.g., Squirrelfishes (Family Holocentridae), aweoweos (Family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage affording numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus--Family Scorpaenidae; the flatfishes--Family Bothidae) might still be missed. Obviously, the effectiveness of the visual census technique is reduced in turbid water (not a problem in the present survey), and species of fishes which move quickly and/or are very numerous may be difficult to count. Additionally, bias related to the experience of the diver conducting counts should be considered in making any comparisons between surveys. In spite of these drawbacks, the visual census technique probably provides the most accurate nondestructive assessment of diurnally active fishes presently available (see Brock, 1982).

After the assessment of fishes, an enumeration of epibenthic invertebrates (excluding corals) was undertaken using the same transect line as established for fishes. Exposed invertebrates usually >2 cm in some dimension (without disturbing the substratum) were counted in a 20 x 4 m area. As with the fish census technique, this sampling methodology is quantitative for only a few invertebrate groups, e.g., some echinoderms and holothurians. Most coral reef invertebrates (other than corals) are cryptic or nocturnal in their habits, which makes accurate assessment of them in areas of topographical relief very difficult. This, coupled with the fact that the majority of these cryptic invertebrates are small, necessitates the use of methods beyond the scope of this survey (e.g., Brock and Brock, 1977). Recognizing constraints on time and the scope of this survey, the invertebrate censusing techniques used here attempted only to assess those few macroinvertebrate species that are diurnally exposed.

Exposed sessile benthic forms such as corals and macrothalloid algae were quantitatively surveyed by use of quadrats and the point-intersect method. The point-intersect technique only notes the species of organisms or substratum type directly under a point. Along the previously set fish transect line, 40 such points were assessed (once every 50 cm). These data have been converted to percentages. Quadrat sampling consisted of recording benthic organisms, algae and substratum present as a percent cover in five one m^2 frames placed at 5 m intervals along the transect line established for fish censusing (at 0, 5, 10, 15, and 20 m).

Macrothalloid algae were assessed as percent cover in the 1 x 1 m quadrats or under one of the 40 points; microalgal species were common but are difficult to identify in the field and no attempt to quantify these organisms was made.

Simple methods of data reduction and analysis have been used and are described where met with in the text. Diversity (H') is calculated as described by Pielou (1966) where:

$$H' = -p_i \ln p_i$$

where p_i is that proportion of the individuals censused belonging to species i. This is the Shannon-Wiener index.

Results

Four major zones or biotopes were recognized in the area of this study. The physical extent of each is shown in Figure 2. It should be noted that the boundaries of each zone are not sharp but rather graded from one to another; these are ecotones or zones of transition. Biotopes were delimited by physical characteristics including water depth, relative exposure to wave

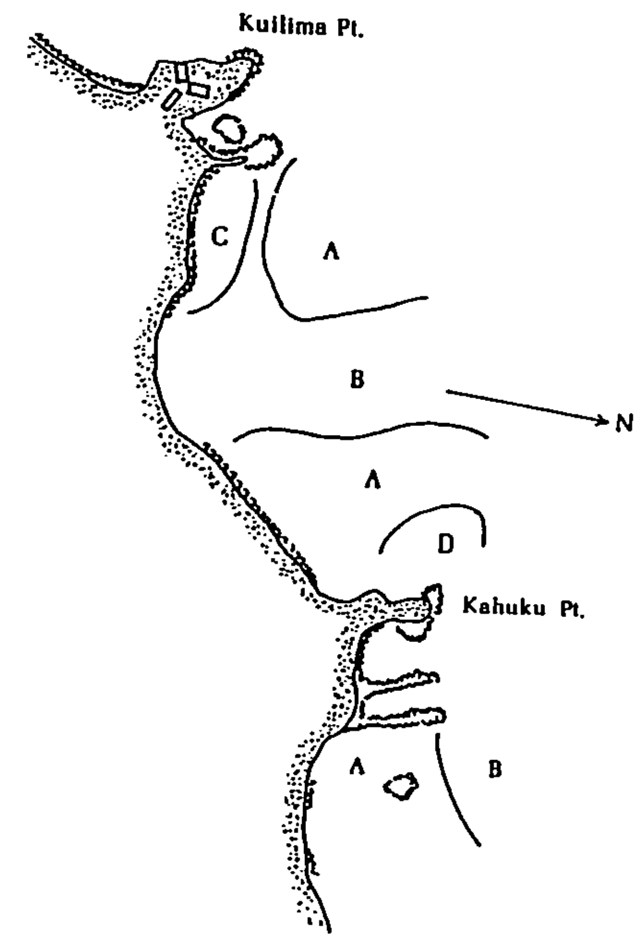

Figure 2. Map of Kahuku Point, Oahu and vicinity showing the approximate boundaries (solid lines) of the four Biotopes noted in this study. These biotopes are:
Biotope A--Smooth Limestone Bench Biotope;
Biotope B--Biotope of Surge Channels;
Biotope C--Biotope of Large *Porites* Colonies;
Biotope D--Biotope of Complex Sinkholes and Reticulations.
(Scale: 1 cm = 146 m)

action and the major structural composition of the benthic communities. The latter included the amount of sand, hard substratum, and vertical relief present as well as the biological attributes of relative coral coverage, fish abundance, and dominant species of the coral community. Biotopes were named for distinctive features of each as shown in Figure 2.

The shallow marine biotopes in the vicinity of Kahuku Point are dominated by hard corralline or limestone substrate and have benthic communities representative of high energy areas. Thus much of the substratum is a continuous limestone bench that in areas may be relatively uniform and flat (Biotope A--Smooth Limestone Bench Biotope), sculptured having channels cut into it oriented perpendicular to shore (Biotope B--Biotope of Surge Channels) or faulted where slabs of limestone have collapsed forming pits (Biotope D--Biotope of Complex Sinkholes and Reticulations). In the western part of the study area shoreward of Biotope A (Figure 2) is a relatively anomalous low energy biotope (Biotope C--Biotope of Large Porites Colonies) that in a seaward direction, is protected by a small fringing reef.

These four major zones are described in more detail below.

Biotope A: Smooth Limestone Bench Biotope

This biotope is dominated by a limestone substratum affording little cover for invertebrates and fishes. This biotope occurs as a near-continuous band across the seaward sector of the study area bissected only by the biotope of surge channels. What little substratum relief is present is provided by either occasional large loose boulders (only in the western corner of this biotope) that range from 0.75 to 2 m across and are spaced 50 to 70 m apart or more commonly by potholes or depressions in the limestone that may be from 0.5 to 5 m across and to approximately 1 m in depth. These features are usually spaced from 20 to 100 m apart.

The apparent scoured appearance of much of the substratum and the presence of prostrate growth forms of corals suggests that considerable wave energy impinges on this biotope. Species present are those characteristic of subtidal high energy Hawaiian habitats. These include the corals Pocillopora meandrina and Porites lobata, the small sea urchin Echinometra mathaei, sea cucumbers Actinopyge mauritiana, cone shells Conus lividus and C. ebraeus and in patches a relatively diverse algal community. Common algal species include Galaxaura rugosa, Dictyosphaeria cavernosa, Dictyota spp., Dictyopteris spp., Sargassum spp., Halimeda discoidea, and the heavily calcified Porolithon gardineri. Because of the little available shelter, fishes are not a particularly conspicuous component of the community. Fish species present include the surgeonfishes--ma'i'i'i (Acanthurus nigrofuscus), manini (A. triostegus), hineleas (Thalassoma duperryi, T. umbrostigma), and a variety of other species: o'ili-uwi'uwi (Pervagor spilosoma), damselfish (Abudefduf imparipennis), po'o-pa'a (Cirrhitus pinnulatus), humuhumu

(Rhinecanthus rectangulus) and moano (Parupeneus multifasciatus).

Four stations quantitatively sampled this biotope (Figure 3: Stations 1, 7, 8, and 10). The assemblage of fishes in this biotope is not particularly diverse. The results of the visual fish censuses are given in Appendix 1. Eighteen species of fish were censused; only one species (Thalassoma duperryi) was encountered at all stations. Fish transects conducted in the Smooth Limestone Bench Biotope yield a mean of 9 families, 9 species, and 33 individuals per station. Average coral coverage varied from 0.3 to 5.1% (quadrat method). A total of 7 coral species were encountered in the quantitative stations done in this biotope; Porites lobata and Pocillopora meandrina are the most conspicuous coral species.

Station 1 is located about 250 m seaward of the shoreline east of the hotel (Figure 3) in water of about 7 m in depth. The substratum at this station is a limestone pavement with small depressions 1 to 5 m in greatest lateral dimension and 0.75 m in depth. These potholes are spaced from 5 to 30 m apart. In the 20 x 4 cm census area were 23 individual fish comprising 9 species; the o'ili-uwi'uwi (Pervagor spilosoma) and hinelea (Thalassoma duperryi) were the most abundant (Appendix 1). Table 1 presents the results of the benthic survey of this station. Five invertebrate species were noted; among these was one pearl oyster (Pinctada margaritifera). Five coral species (Porites lobata, Montipora verrucosa, M. patula, Pavona varians, and Cyphastrea ocellina) having an average coverage of 3.7% were recorded in the $5 m^2$ of substratum sampled at this station.

In the vicinity of Station 1 were seen the corals Montipora verrilli, Pocillopora meandrina, and P. molokensis; other invertebrates seen in the area include the sea cucumber Actinopyge mauritiana and the polychaete, Loimia medusa. Macroalgal species in the area include Halimeda sp., Dictyopteris sp. and Porolithon onkodes. Fishes seen away from the 20 x 4 m census area include the nunu (Aulostomus chinensis), a'awa (Bodianus bilunulatus), moano (Parupeneus multifasciatus), po'o-pa'a (Cirrhitus pinnulatus), na'ena'e (Acanthurus olivaceus), palani (Acanthurus dussumieri), manini (Acanthurus triostegus), and ma'i'i'i (Acanthurus nigrofuscus), all of which have some commercial importance. Other fishes seen include the hinelea 'aki-lolo (Coris gaimardi), kihikihi (Zanclus canescens), pili-ko'o (Paracirrhites arcatus), humuhumu (Rhinecanthus rectangulus), filefish (Cantherhines sandwichiensis), damselfish (Chromis vanderbilti), and puhi (Gymnothorax flavimarginatus).

Station 7 also sampled Biotope A (the Smooth Limestone Bench Biotope). This station is located approximately 180 m from shore in about 3 m of water (Figure 3). The substratum at this station is a limestone flat with scattered depressions ranging in diameter from 0.5 to 3 m and to 1 m deep spaced 10 to 30 m apart.

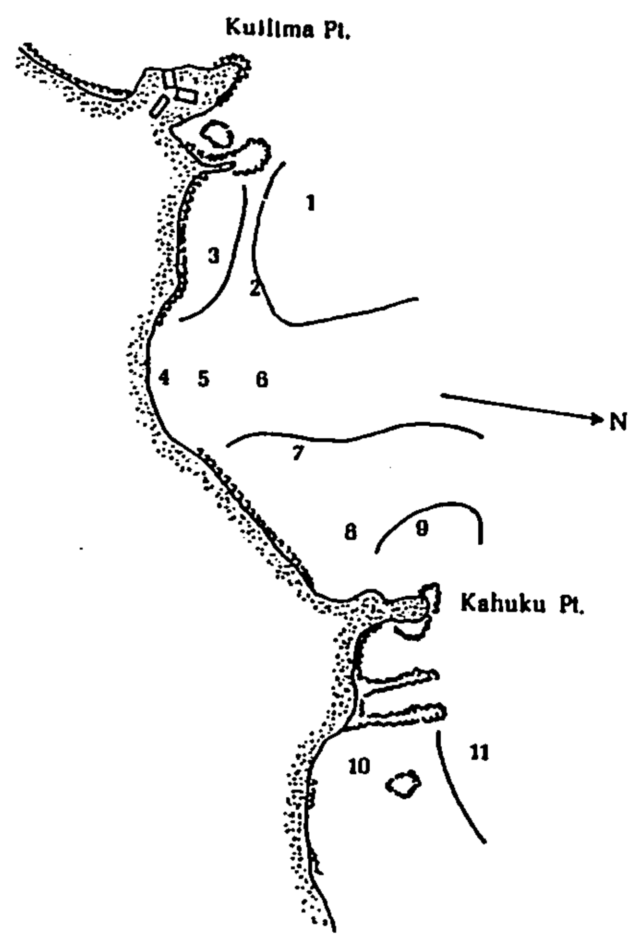

Figure 3. Map of Kahuku Point, Oahu and vicinity showing the approximate boundaries (solid lines) of the four biotopes (as in Figure 2) and the locations (numbered) of the 11 quantitative stations sampling those biotopes. (Scale: 1 cm = 146 m)

Table 1. Summary of the benthic survey conducted at Station 1 in the Smooth Limestone Bench Biotope in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) are given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ~7 m; mean coral coverage ~3.7% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	6	8	0.7	1	
Montipora verrucosa		1.5	0.1		0.5
M. patula		0.5	0.1		
Pavona varians			0.1		
Cyphastrea ocellina			0.1		
Algae					
Jania sp.	0.5	0.1	1	1	
Sand	70			60	40
Hard Substratum	29.5	92	91.6	38.2	57.5

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	8
Montipora verrucosa	3
M. patula	3
Algae	
Jania sp.	3
Sand	23
Hard Substratum	60

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Mollusca	
Family Vermetidae	9
Conus lividus	1
Pinctada margaritifera	1
Phylum Arthropoda	
Trapezia sp.	1
Phylum Chordata	
Ascidia nigra	3

D. Fish Census (20 x 4 m)
9 species
23 individuals
Diversity (H') = 1.85

As with the previous station, there is very little topographical relief present. Only five fish species (16 individuals) were censused in the 20 x 4 m transect area; the most abundant species is the hinalea, *Thalassoma duperryi* (Appendix 1). Table 2 presents the results of the benthic inventory conducted at this station. Mean coral coverage is 2.5% and two species (*Porites lobata* and *Montipora verrilli*) are the most abundant. Macroalgae are a dominant benthic component at this station--six species were recorded in the 5m^2 quadrat study area (these are species with a minimum coverage of 0.1% per m^2). Four invertebrate species were recorded: two mollusc species (*Conus lividus* and *Drupa morum*) and two sea urchin species (*Echinometra mathaei* and *Echinostrephus aciculatum*).

In the vicinity of Station 7 were seen the polychaete (*Loimia medusa*), soft coral (*Anthelia edmondsoni*), wana (*Echinothrix diadema*), macroalgae (*Codium arabicum* and *Trichogloea requienii*), corals (*Pavona duerdeni* and *Pocillopora meandrina*), and fishes: sharpback puffer (*Canthigaster amboienais*), humuhumu (*Rhinecanthus rectangulatus*), damselfish (*Chromis ovalis*, *Abudefduf imparipennis*), butterflyfish (*Chaetodon miliaris*), ʻomaka (*Stethojulis balteata*), hilu pilikoa (*Paracirrhites forsteri*), and poʻo-paʻa (*Cirrhites pinnulatus*).

Station 8 sampled the Smooth Limestone Bench Biotope in the eastern corner of the large bay under study (Figure 3). This station is about 120 m from shore in 2.4 m of water. The limestone substratum has scattered across it small surge channels and depressions. The surge channels are not well developed and are usually oriented perpendicular to shore. These channels attain maximum dimensions of up to 1 to 1.5 m across, 1 m in depth and are spaced 20 to 50 m apart. In some cases, undercutting into the sides of these channels has created shelter space for a variety of invertebrates and fishes. Potholes over the area range in size from 0.5 to 2 m across, to 1 m in depth and are spaced 5 to 30 m apart. The physical characteristics present at this station are a mix of those for Biotope A (Smooth Limestone Bench Biotope) and Biotope B (Biotope of Surge Channels). The shallow depth of the area and lack of surge channel development place this station in Biotope A.

Table 3 presents a summary of the benthic survey conducted at this station. Coral coverage is low (0..3%) and only *Porites lobata* was recorded in the 5 m^2 quadrat survey area. A number of macroalgal species contribute to the benthic coverage. These species include *Porolithon gardineri*, *Turbinaria ornata*, *Spatoglossum solierii*, and *Halimeda discoidea*--all species common to high energy areas. Seven invertebrate species were censused in the 20 x 4 m survey area; the most common was the sea urchin *Echinometra mathaei* and the cone shell, *Conus lividus*. In the survey area, 11 fish species (28 individuals) were enumerated (Appendix 1). The most common species are the hinalea (*Thalassoma duperryi*) and the maʻiʻiʻi (*Acanthurus nigrofuscus*).

Table 2. Summary of the benthic survey conducted at Station 7 in the Smooth Limestone Bench Biotope in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ~3 m; mean coral coverage ~2.5% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	5	0.75	1.5	0.5	1
Montipora verrilli	1		0.5	2	
Algae					
Galaxaura rugosa	0.5		0.5	1.5	2
Porolithon gardineri	3				
Turbinaria ornata	2	1	3	1	1
Dictyota acutiloba	0.5	1	3	4	2
Dictyosphaeria cavernosa			1	1	
Padina japonica				0.5	
Hard Substratum	88	97.25	90.5	89.5	94

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	5
Montipora verrilli	2.5
Hard Substratum	92.5

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Mollusca	
Drupa morum	1
Conus lividus	5
Phylum Echinodermata	
Echinometra mathaei	9
Echinostrephus aciculatum	1

D. Fish Census (20 x 4 m)

5 species
16 individuals
Diversity (H') = 1.04

In the vicinity of Station 8 were seen the macroalgae (*Amphiroa fragilissima*, *Padina thivyi*, and *Dictyosphaeria cavernosa*), corals (*Montipora verrucosa*, *M. verrilli* and *Pocillopora meandrina*), the soft coral (*Anthelia edmondsoni*) and the spiny lobster (*Panulirus pencillatus*). A number of commercially important fish species were seen. These include kumu (*Parupeneus porphyreus*), weke'ula (*Hulloidichthys vanicolensis*), mempachi (*Myripristes amaenus*), nenue (*Kyphosus bigibbus*), po'o-pa'a (*Cirrhites pinnulatus*), uhus (*Scarus perspicillatus*, *Scarops rubroviolaceus*, and *Calotumus carolinus*), moano (*Parupeneus multifasciatus*), munu (*Parupeneus bifasciatus*), mamo (*Abudefduf abdominalis*), kala (*Naso unicornis*), palani (*Acanthurus dussumieri*), maikoiko (*Acanthurus leucoparieus*), and na'ena'e (*Acanthurus divaceus*). Other fish species include opule (*Anampses cuvier*), ala'ihi (*Adioryx lacteoguttatus*), humuhumu (*Rhinecanthus rectangulatus*), kihikihi (*Zanclus canescens*), hilu (*Coris flavovittata*), wrasse (*Labroides phthirophagus*) and boxfish (*Ostracion meleagris*).

A fourth station that sampled the Smooth Limestone Bench Biotope was Station 10. This station is located about 245 m east of Kahuku Point about 60 m offshore in 2.2 m of water (Figure 3). The substratum at this station is smooth limestone with shallow depressions scattered over it. These depressions range from 1 to 5 m in diameter and are to 1 m in depth; they are spaced from 2 to 30 m apart. About 50 m east of the quantitative station is an approximate 10 x 30 depression filled with sand.

Table 4 presents the results of the benthic survey at Station 10. Coral coverage is about 5% (quadrat method) and there are three species (*Porites lobata*, *Pocillopora meandrina*, and *Montipora verrilli*) in the 5 m^2 quadrat survey. The soft coral, *Anthelia edmondsoni*, was also present as were three macroalgal species. Five invertebrate species, the most common being the sea urchins *Echinometra mathaei* and *Echinothrix diadema* were present and 11 species of fish (63 individuals) were censused in the 20 x 4 m survey area (Appendix 1). The most common fish species were the hinelea *Thalassoma duperryi* and *T. umbrostigma*, as well as the manini, *Acanthurus triostegus*.

In the vicinity of Station 10 were seen the macroalgae *Porolithon gardineri* (spaced about 10 m apart), *Amansia glomerata*, *Padina thivyi*, *Ralfsia pangoensis*, and *Dictyosphaeria cavernosa*. Fishes in the area include pili-ko'a (*Cirrhitops fasciatus*), hinelea (*Thalassoma fuscum*), and sharpback puffer (*Canthigaster amboiensis*); macroinvertebrates present include the coral *Pocillopora damicornis* and the octopus or he'e (*Octopus cyanea*).

Table 3. Summary of the benthic survey conducted at Station 8 in the Smooth Limestone Bench Biotope in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth '2.4 m; mean coral coverage '0.3% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	1	0.5			0.1
Algae					
Porolithon gardineri	0.5				
Turbinaria ornata	0.1	0.1			
Spatoglossum solierii			0.1	15	12
Halimeda discoides			0.1		0.1
Hard Substratum	98.4	99.4	99.8	85	87.8

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	5
Hard Substratum	95

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Cnidaria	
Palythoa tuberculosa	1 colony
Phylum Mollusca	
Drupa morum	1
Conus lividus	4
C. ebraeus	2
Phylum Echinodermata	
Echinothrix diadema	3
Echinometra mathaei	23
Tripneustes gratilla	1

D. Fish Census (20 x 4 m)

11 species
28 individuals
Diversity (H') = 1.84

Table 4. Summary of the benthic survey conducted at Station 10 in the Smooth Limestone Bench Biotope in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ~2.2 m; mean coral coverage ~5.1% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	7	5	1		2
Pocillopora meandrina	3			3	
Montipora verrilli		2	0.7	1	1
Soft Coral					
Anthelia edmondsoni					0.5
Algae					
Galaxaura rugosa	1	1	2	2	2
Codium arabicum				0.5	
Jania sp.				2	
Hard Substratum	89	92	96.3	91.5	94.5

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	7.5
Montipora verrilli	5
Soft Coral	
Anthelia edmondsoni	2.5
Hard Substratum	85

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Mollusca	
Drupa morum	3
Phylum Echinodermata	
Actinopyge mauritiana	1
Holothuria atra	2
Echinometra mathaei	7
Echinothrix diadema	4

D. Fish Census (20 x 4 m)

11 species
63 individuals
Diversity (H') = 1.61

Biotope B: Biotope of Surge Channels

For the most part, the Biotope of Surge Channels has its greatest development in deeper waters where it occurs as a near continuous band seaward (and outside) of the present study area. This biotope is present in the shallow study area as a shoreward extension essentially dividing the study area into two (east and west) sectors (see Figure 2).

The distinctive feature of the Biotope of Surge Channels is the presence of a limestone substratum through which are cut surge channels that are usually oriented perpendicular to shore. These surge channels vary in width from 0.5 to 20 m across and cut down into the substratum between 1 to 4 m. Individual channels vary in length from a few to over 50 m; they are spaced from 5 to 50 m apart. Channels are frequently undercut, thus providing considerable cover for large invertebrates and fish. The substratum in some of the larger channels has a veneer of loose rock or rubble.

Coral coverage in the biotope varies from less than one to over 21% (mean = 9% for the five stations sampled quantitatively). The most common species are *Porites lobata* (encrusting form) and *Pocillopora meandrina*. In total, 10 coral species were noted in the quantitative stations. Forty-one species of fish (mean = 17 species per station) were censused in the 20 x 4 m areas of the five stations. Present at every station were the ma'i'i'i (*Acanthurus nigrofuscus*), manini (*Acanthurus triostegus*), hinelea aki-lolo (*Coris gaimardi*), hinelea (*Thalassoma duperryi*), oili 'uwi'uwi (*Pervagor spilosoma*), and damselfish (*Stegostes fasciolatus*). Most abundant species were *Thalassoma duperryi* and *Acanthurus nigrofuscus*. the average number of fish censused per station was 107 individuals. Seven macroinvertebrate species were seen in the 20 x 4 m quantitative survey areas of the five stations; larger exposed invertebrates were not particularly common and this may be related to the obvious exposure of the entire biotope to high energy conditions.

Station 2 sampled the Biotope of Surge Channels. This station is located about 150 m offshore of the beach in about 5 m of water (Figure 3). The substratum at this station is limestone bisected by surge channels. These channels are from 1 to 5 m in width, 0.5 to 3 m in depth, and are spaced from 2 to 30 m apart.

Table 5 presents the results of the quantitative survey conducted at Station 2. Mean coral coverage at this station is 15% (quadrat method) and three species contribute to this coverage. *Porites lobata* and *Montipora verrilli* are the most important species present.

Two colonial macroinvertebrate species were censused in the 20 x 4 m survey area; the most abundant is *Anthelia edmondsoni*. Eleven species of fish (38 individuals--see Appendix 1) were counted. The most common fish species were the hinelea

Table 5. Summary of the benthic survey conducted at Station 2 in the Biotope of Surge Channels in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth '5 m; mean coral coverage is 15% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	10	8	4	8	2
Pocillopora meandrina		3			
Montipora verrilli	27		2	1	10
Soft Coral					
Anthelia edmondsoni			4		
Hard Substratum	63	89	90	91	88

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	18
Hard Substratum	82

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Cnidaria	
Zoanthus sp.	1 colony
Anthelia edmondsoni	19 colonies

D. Fish Census (20 x 4 m)

11 species
38 individuals
Diversity (H') = 2.09

(Thalassoma duperryi), the damselfish (Chromis vanderbilti), and the oili 'uwi'uwi (Pervagor spilosoma).

In the vicinity of Station 2 were seen the corals Porites compressa and Pavona duerdeni as well as the sharpback puffer (Canthigaster amboiensis), blenny (Cirripectus vanderbilti, pili-ko'a (Chaetodon fremblii). Other fish species present with some commercial value include the palani (Acanthurus dussumieri), po'o-pa'a (Cirrhitus pinnulatus and the munu (Parupeneus bifasciatus).

Station 4 also sampled the Biotope of Surge Channels. This station is located about 35 m offshore of the beach in the area affronting a proposed drainage swale (see Figure 3). The station is situated in a wide surge channel in 3 m of water where the substratum is dominated by rubble. This channel appears to be the largest in the study area and has an orientation perpendicular to shore. Smaller channels and topographical irregularities parallel and form a network joining this large channel giving one the overall perspective of a sink. Also present at this station are patches of emergent limestone that are 2 to 5 m across, spaced 5 to 15 m apart. Nearby, about 70 m to the west of this station is a depression approximately 50 m in diameter filled with sand.

Table 6 presents the results of the quantitative survey undertaken at Station 4. Coral coverage at this station is the lowest of any site sampled in this survey (mean = 0.6%). Three species of coral (Porites lobata, Lepastrea purpurea, and Cyphastrea ocellina) were present as was the soft coral, Anthelia edmondsoni. Four other invertebrate species were recorded from this station; the ubiquitous cone shell, Conus lividus, was the most numerous. Fourteen fish species were censused (108 individuals) in the 20 x 4 m sampling area (Appendix 1). The most abundant fish species were the ma'i'i'i (Acanthurus nigrofuscus), the manini (Acanthurus triostegus), and the hinalea (Thalassoma duperryi).

A number of other species of fish, algae and invertebrates were seen in the vicinity of Station 4. Algal species present include Amphiroa fragilissima, Amansia glomerata and the calcareous Porolithon gardineri. Coral species seen include Pocillopora molokensis, P. meandrina, P. damicornis and the zoanthid, Palythoa tuberculosa. Fishes present in the area include pili-ko'a (Cirrhitops fasciatus), butterflyfish (Chaetodon miliaris and C. fremblii), damselfish (Chromis vanderbilti), wrasse (Coris venusta) and the commercially important kumu (Parupeneus porphyreus).

A third station sampling the Biotope of Surge Channels is Station 5. This station is located about 110 m seaward of Station 4 in 4.6 m of water (Figure 3). The substratum at this station is primarily limestone with scattered depressions and surge channels. The depressions are from 1 to 3 m in diameter and up to 1 m in depth. The bottom of some depressions and surge

Table 6. Summary of the benthic survey conducted at Station 4 in the Biotope of Surge Channels in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ~3 m; mean coral coverage is 0.6% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	1.5		1		
Lepastrea purpurea					0.1
Cyphastrea ocellina	0.5				
Soft Coral					
Anthelia edmondsoni			1		
Algae					
Galaxaura rugosa			0.5		
Rubble	28	100	97.5	50	29.9
Hard Substratum	70			50	70

B. 40-Point Analysis

Species	Percent of Total
Rubble	90
Hard Substratum	85

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Annelida	
Loimia medusa	1
Phylum Mollusca	
Conus lividus	2
C. miliaris	1
Phylum Echinodermata	
Holothuria atra	1

D. Fish Census (20 x 4 m)

14 species
108 individuals
Diversity (H') = 2.00

channels has rubble-rock (5 to 75 cm size) and sand present. The surge channels are from 1 to 5 m in width and to 2 m in depth; they frequently merge with depressions and both are spaced from 3 to 30 m apart.

Table 7 presents a summary of the survey carried out at Station 5. Like Station 4, the coral coverage at Station 5 is low (mean = 0.7%, quadrat method) and two coral species were recorded: Porites lobata and Montipora verrilli. Two macroinvertebrate species were seen in the census area and 15 species of fishes (73 individuals) were noted (Appendix 1). The most common fishes are the ma'i'i'i (Acanthurus nigrofuscus), the manini (Acanthurus triostegus), the hinelea (Thalassoma duperryi), and the damselfish (Stegastes fasciolatus).

In the vicinity of this station, the corals Porites compressa, Pocillopora meandrina, Montipora patula, and the polychaete, Loimia medusa, were seen. Also present were the macroalgae Laurencia obtusa and Liagora papenfussii. A number of fish species were also noted in the area, including the kihikihi (Zanclus canescens), the hinelea (Thalassoma umbrostigma), the butterflyfish (Chaetodon fremblii) and several species of commercial importance. Among the latter species were the na'ena'e (Acanthurus olivaceus), the 'api (Acanthurus guttatus), the kala (Naso unicornis), the a'awa (Bodianus bilunulatus), the ala'ihi (Adioryx lacteoguttatus), the mamo (Abudefduf abdominalis), the moano (Parupeneus multifasciatus), and the kumu (Parupeneus porphyreus).

A fourth station that samples the Biotope of Surge Channels is Station 6. This station is seaward and in line with Stations 4 and 5, being about 105 m from Station 5 or 250 m from the shoreline in 5.5 m of water (Figure 3). The substratum at this station is limestone bisected by surge channels that are from 1 to 10 m wide and 0.5 to 3 m in depth. These channels are spaced 20 to 50 m apart and have an orientation roughly perpendicular to shore. Sand is present as a veneer in some channels.

Table 8 summarizes the quantitative data collected at Station 6. Six coral species were present in the quadrat survey; Porites lobata (prostrate growth form) contributed the most to the coverage which had a mean value of 21%. The soft coral, Anthelia edmondsoni, was also present. Only one macroinvertebrate, Conus lividus, was noted in the quantitative counts but 20 species of fish (83 individuals) were censused. The most common fish species were the ma'i'i'i (Acanthurus nigrofuscus) and the hinelea (Thalassoma duperryi).

In the area surrounding this station, two additional coral species (Porites evermanni and Pocillopora molokensis) were seen. Also present were the boxfish or moa (Ostracion meleagris), kihikihi (Zanclus canescens), ala'ihis (Adioryx lacteoguttatus and A. xantherythus) and of greater commercial value, the nenue (Kyphosus bigibbus), the mamo (Abudefduf abdominalis), po'o-pa'a (Cirrhites pinnulatus), the menpachi (Myripristes berndti),

Table 7. Summary of the benthic survey conducted at Station 5 in the Biotope of Surge Channels in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ~4.6 m; mean coral coverage is 0.7% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	1	0.5		2	
Algae					
Galaxaura rugosa	6				
Porolithon gardineri	1.5				
Turbinaria ornata		0.5			
Sand		5	15	2	20
Rubble			85	15	30
Hard Substratum	91.5	94		81	50

B. 40-Point Analysis

Species	Percent of Total
Corals	
Montipora verrilli	2.5
Sand	7.5
Rubble	25
Hard Substratum	65

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Mollusca	
Conus lividus	2
Phylum Echinodermata	
Holothuria atra	1

D. Fish Census (20 x 4 m)

15 species
73 individuals
Diversity (H') = 2.15

Table 8. Summary of the benthic survey conducted at Station 6 in the Biotope of Surge Channels in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ~5.5 m; mean coral coverage is 21.2% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	7	30	35	25	4
P. compressa			0.1		
Montipora patula				1	
M. verrucosa					3
Pocillopora meandrina				0.5	0.1
Pavona varians				0.1	
Soft Coral					
Anthelia edmondsoni		0.5			
Algae					
Liagora papenfussii	1.5	2			
Hard Substratum	91.5	67.5	64.9	73.4	92.9

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	20
Pocillopora meandrina	2.5
Sand	20
Hard Substratum	57.5

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Mollusca	
Conus lividus	1

D. Fish Census (20 x 4 m)

20 species
83 individuals
Diversity (H') = 2.14

the aweoweo (Priacanthus cruentatus) and the pualo (Acanthurus xanthopterus). A number of spiny lobsters (Panulirus marginatus and P. pencillatus) were also seen.

Station 11 is the fifth station to sample the Biotope of Surge Channels. This station is located about 245 m east of Kahuku Point and is approximately 215 m offshore in 7.6 m of water (Figure 3). The substratum at this station is limestone bissected by occasional wide channels ('20 to 30 m in width) that continue for 30 to 80 m oriented perpendicular to shore. These channels range in depth from 1 to 5 m and are spaced from 50 to over 100 m apart. Interspersed between the channels are small depressions 1 to 2 m in diameter and up to 0.5 m in depth. These depressions are spaced from 10 to 30 m apart.

Table 9 summarizes the data collected at Station 11. Mean coral coverage is 7.8% (quadrat method) and 6 species contribute to it (Porites lobata, Montipora verrucosa, M. patula, M. verrilli, Pavona duerdeni, and Pocillopora meandrina). Important macroalgae present are Galaxaura rugosa and Spatoglossum solierii.

Only one macroinvertebrate species (the colonial Palythoa tuberculosa) was noted in the 20 x 4 m census area. The large channel, the edge of which was sampled by this station, provides considerable substratum relief and shelter for fish. Twenty-six fish species (232 individuals) were censused in the 20 x 4 m area; more fish were found at Station 11 than any other in this study. Part of this large number is due to the chance encounter of a wandering school of approximately 100 manini (Acanthurus triostegus) that passed through the census area during the counts. The most common fish species in the area were the manini (Acanthurus triostegus), palani (Acanthurus dussumieri) and the mamo (Abudefduf abdominalis). Both the palani and mamo appeared to be resident to the census area.

In the area immediately surrounding the census site is a large limestone flat with little topographical relief, thus, not unexpectedly, few other species were seen. Species encountered in the surrounding area include the hinelea (Thalassoma duperryi), blenny (Cirripectus vanderbilti), puhi (Gymnothorax undulatus), and the omilu (Caranx melampygus).

Table 9. Summary of the benthic survey conducted at Station 11 in the Biotope of Surge Channels in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth '7.6 m; mean coral coverage is 7.8% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	15	5			4
Montipora verrilli					0.1
M. verrucosa		0.5			3
M. patula			0.1		5
Pocillopora meandrina		3	3		
Pavona duerdeni		0.5			
Algae					
Galaxaura rugosa	6				
Spatoglossum solierii	1				
Hard Substratum	88	91	96.9	100	87.9

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	7.5
Pocillopora meandrina	2.5
Hard Substratum	90

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Cnidaria	
Palythoa tuberculosa	1 colony

D. Fish Census (20 x 4 m)

26 species
232 individuals
Diversity (H') = 2.15

Biotope C: Biotope of Large Porites Colonies

The Biotope of Large Porites Colonies begins about 215 m east of Kuilima Point and parallels the shoreline as a band for about 300 m extending approximately 120 m seaward (Figure 2). This biotope is situated shoreward of a shallow limestone reef that effectively serves as a barrier to high waves impinging in the area. The biotope is bordered by a shoreline on two sides and a shallow reef on the third (seaward) side. It is shallow (no deeper than about 2 m) and the substratum over most of the biotope is sand and rubble. Emergent limestone occurs along the bench and reef crest areas of the biotope.

A dominant component through the central part of this biotope is the presence of large Porites lobata colonies. Most of these colonies are situated closer to the seaward reef crest than to shore; in this area they are spaced from 2 to 50 m apart. The P. lobata colonies range in size from 1.5 to about 4 m in diameter. The average diameter is about 2 m. Also present in this shallow biotope are scattered Porites compressa colonies (up to about 50 cm in diameter). The presence of P. compressa suggests that the area is relatively protected from high surf. In this biotope, coral coverage ranges from about 2 to 15%.

Other than a number of holothurian species (sea cucumbers), most fish and invertebrates seen in this biotope are small. Common under the rubble are brittlestars (Ophiocoma spp.); small hermit crabs (Calcinus spp.) are present as are occasional cone shells (Conus lividus and C. pulicarius). Most fish seen in this biotope are juveniles of species seen further offshore. Important species are juvenile wrasses or hinaleas (Thalassoma duperryi, Stethojulis balteata, and Thalassoma umbrostigma) as well as herbivorous fish such as the manini (Acanthurus triostegus) and the ma'i'i'i (A. nigrofuscus) and damselfish (Stegastes fasciolatus).

Station 3 samples the Biotope of Large Porites Colonies. This station is located about 75 m seaward of the shoreline and is in approximately 2 m of water (Figure 3). Table 10 presents a summary of the observations made at Station 3. The station is situated on an emergent limestone and rubble-sand substratum adjacent several large Porites lobata colonies. The emergent limestone forms small flats from 1 to 3 m across spaced 10 - 15 m apart; between these areas are patches of rubble and sand. Porites lobata colonies in the area have a mean diameter of about 2.5 m and locally are spaced from 2 to 20 m apart. Also present are small colonies of Porites compressa attaining a size of about 50 cm in diameter and spaced from 1 to 10 m apart.

In the quadrat survey were noted four coral species (Porites lobata, P. compressa, Pocillopora meandrina, and P. damicornis). These corals have a mean coverage of about 12% at this station. Macroalgae are an important benthic component, contributing about 13% to the local benthic coverage. The most abundant species are Dictyosphaeria cavernosa and Spyridia filamentosa. Most of the

Table 10. Summary of the benthic survey conducted at Station 3 in the Biotope of Large Porites Colonies in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ~2 m; mean coral coverage is 11.9% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata				6	1.5
P. compressa	12	35	1		
Pocillopora damicornis	0.5		0.1		
P. meandrina					3.5
Algae					
Porolithon gardineri		2			
Dictyosphaeria cavernosa		22			
Spyridia filamentosa			40		
Padina thivyi				0.1	
Halimeda discoidea				0.1	
Rubble	2.5		10	93.8	95
Hard Substratum	85	41	48.9		

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites compressa	5
P. lobata	2.5
Pocillopora meandrina	2.5
Sand	2.5
Rubble	40
Hard Substratum	47.5

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Mollusca	
Hexabranchus aureomarginatus	1
Phylum Echinodermata	
Echinometra mathaei	8
Actinopyge mauritiana	1
Holothuria atra	8
Holothuria sp.	3

D. Fish Census (20 x 4 m)

8 species
42 individuals
Diversity (H') = 1.46

D. cavenosa is in association with the coral Porites compressa (residing in the interstices between the vertical fingers of coral).

Five species of invertebrates were seen in the 20 x 4 m census area; the most common were the sea urchin, Echinometra mathaei, and the sea cucumber, Holothuria atra. Eight species of fish were counted in the census area (42 individuals). The most abundant fishes were the hinalea (Thalassoma duperryi), the ma'i'i'i (Acanthurus nigrofuscus) and the damselfish (Stegastes fasciolatus).

In the vicinity of Station 3 were seen the mollusca (Conus pulicarius, C. lividus and Cerithium sinense), algae (Amansia glomerata and Laurencia succisa), a polychaete (Loimia medusa), coral (Montipora verrucosa) and a number of fish species: aki'lolo (Gomphosus varius), damselfish (Plectroglyphidodon johnstonianus), kihikihi (Zanclus canescens) and blenny (Cirripectus vanderbilti).

Biotope D: Biotope of Complex Sinkholes and Reticulations

The Biotope of Complex Sinkholes and Reticulations is relatively small in areal extent, encompassing about 1.8 ha adjacent and just west of Kahuku Point (Figure 2). The substratum of this biotope is limestone; over this area are depressions that form small channels or reticulations between which are mounds of limestone that are 1 to 5 m long, 0.5 to 2 m wide and up to 1.5 m in height. These mounds are spaced from 2 to 10 m apart. Scattered throughout the area of the mounds and reticulations are larger depressions that range from 15 to 40 m across and 1 to 3 m in depth. These depressions appear to have been formed by a collapse of limestone leaving "sheets" of limestone (2 to 8 m across and up to a meter in thickness) tumbled into the depression giving the appearance of a "sinkhole." These sinkholes are spaced about 50 to 70 m apart.

The area of mounds and reticulations provides relatively little cover or shelter for fish and invertebrates but the shelter is much greater around the sinkholes. The distribution of fish in the biotope reflects the abundance of cover. Common fishes in the biotope include the parrotfish or uhus (Family Scaridae), goatfishes (Family Mullidae), squirrelfish (Family Holocentridae), surgeonfish (Family Acanthuridae), all of which have some commercial importance. Commercially valuable invertebrate species present include octopus and lobsters. Coral coverage in the biotope ranges from about 1 to 15%; Porites lobata, Montipora patula, and Pocillopora meandrina are the visually dominant species.

Station 9 sampled the Biotope of Complex Sinkholes and Reticulations. This station is located about 120 m offshore of the eastern side of Kahuku Point in 7 m of water (see Figure 3). The substratum at this station is limestone dominated by grooves and mounds. The limestone mounds are from 1 to 5 m in length,

0.5 to 2 m in width and 2 to 10 m apart. Intervening grooves or reticulations are from 1 to 2 m in width and up to 1 m in depth. Adjacent the quantitative station ('35 m away) is a sinkhole about 30 m in diameter.

Table 11 presents the results of the survey at Station 9. Mean coral coverage is 10% (quadrat method) and 4 species contribute to this coverage (Porites lobata, Montipora patula, M. verrucosa, and Pocillopora meandrina). Five algal species provide an average algal coverage of about 18%. The most abundant species is Spatoglossum solierii. Seven macroinvertebrate species were censused in the 20 x 4 m survey area. The sea urchin, Echinometra mathaei, and an unidentified encrusting black sponge (Porifera sp.?) are the two most common macroinvertebrate species. Nine fish species (25 individuals) were counted in the census area; however, just outside the survey site around the nearby sinkhole were a number of other fish species. In the census area, the hinalea (Thalassoma duperryi) and the damselfish (Chromis vanderbilti) were the most abundant fish species.

In the vicinity of this station was seen the zoanthid (Palythoa tuberculosa), the sea cucumber (Actinopyge mauritiana), corals (Pavona varians and Pocillopora molokensis) and the relatively rare soft coral, Sinularia abrupta. A small octopus or he'e (Octopus cyanea) and several juvenile lobsters (Panulirus penicillatus and P. marginatus) were also seen. Fishes in the area include kihikihi (Zanclus canescens), butterflyfish (Chaetodon miliaris, C. quadrimaculatus, and C. fremblii), damselfish (Stegastes fasciolatus), humuhumu (Sufflamen bursa), sharpback puffer (Canthigaster jactator), hilu pili-ko'a (Paracirrhites forsteri) and pili-ko'a (Cirrhitops fasciatus). Fishes of greater commercial importance present in the area include manini (Acanthurus triostegus), na'ena'e (Acanthurus olivaceus), ma'i'i'i (Acanthurus nigrofuscus), pualu (Acanthurus xanthopterus), 'api (Acanthurus guttatus), nenue (Kyphosus bigibbus), a'awa (Bodianus bilunulatus), uhus (Scarus dubius and S. perspicillatus), mamo (Abudefduf abdominalis), kumu (Parupeneus porphyreus), wekeula (Mulloidichthys vanicolensis), ala'ihia (Adioryx lacteoguttatus and A. xantherythrus), aholehole (Kuhlia sandvicensis), aweoweo (Priacanthus cruentatus), menpachi (Myripristes berndti), and moano (Parupeneus multifasciatus).

Discussion

In general, a small change of topography and structural relief (on a scale of a few meters) will result in a localized change in the composition of benthic marine communities. However, if one considers communities on a larger scale (hundreds of meters to kilometers) one sees a mosaic of habitat patches which are usually smaller than this but display a degree of regularity and repetitiveness, hence predictability to most nearshore geographic areas. Thus, one can think of benthic marine communities as being comprised of a series of patches that form a continuum or biotope, e.g., areas of corals, of rubble,

Table 11. Summary of the benthic survey conducted at Station 9 in the Biotope of Complex Sinkholes and Reticulations in the vicinity of Kahuku Point, Oahu. Results of the 5 m^2 quadrat sampling of the benthic community present (expressed in percent cover) is given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth '7 m; mean coral coverage is 10.4% (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Corals					
Porites lobata	3	3	4	30	6
Montipora patula		0.1	0.5		0.5
M. verrucosa				1.5	1
Pocillopora meandrina	2		0.5		
Algae					
Galaxaura rugosa		1	2	0.1	1
Spatoglossum solierii	25	18	17	6	7
Halimeda discoidea		0.5	0.5	0.1	
Padina thivyi			0.1		
Dictyosphaeria cavernosa			2	0.5	8
Hard Substratum	70	77.4	73.4	61.8	76.5

B. 40-Point Analysis

Species	Percent of Total
Corals	
Porites lobata	22.5
Montipora verrucosa	2.5
Pocillopora meandrina	2.5
Hard Substratum	72.5

C. Invertebrate Census (20 x 4 m)

Species	No.
Phylum Porifera	
Porifera sp.? (black encrusting)	29
Phylum Mollusca	
Drupa morum	1
Conus abraeus	1
Phylum Arthropoda	
Calcinus sp.	1
Phylum Echinodermata	
Echinostrephus aciculatus	3
Echinometra mathaei	21
Echinometra diadema	1

D. Fish Census (20 x 4 m)

9 Species
25 individuals
Diversity (H') = 1.85

of sand, of scoured hard bottom, etc.

This survey has recognized four such biotopes comprising the benthos at Kahuku Point, Oahu. The areal extent and names of these are given in Figure 2. The characters used in delimiting biotopes are both physical and biological. Physical parameters include water depth and relative exposure to wave action (both are correlated) as well as structure of the substratum (e.g., relative proportions of sand, limestone, etc.) on which the biological components reside. Biological attributes of importance to this study in determining a biotope are (1) relative coral coverage and (2) species dominance in the coral community, as well as (3) the abundance and diversity of fishes and invertebrates present.

Substratum is an important parameter governing the structure, diversity, and density of organisms in any benthic community. Areas of considerable structural relief (habitat heterogeneity) will harbor a more diverse and greater standing crop of fish and invertebrates (Brock, 1954; Risk, 1972; Brock et al., 1979). Sand flats are areas typically of low relief; the opposite extreme (in the Kahuku Point study area) are areas with mature coral communities or areas with large undercut channels and collapsed limestone caves, all of which provide structural relief (shelter) to the habitat. In general, corals, a major structural element of this third dimension, cannot become established in areas of shifting substratum, such as sand or loose rubble (Edmondson, 1928; Maragos, 1972) and need areas of hard bottom to survive. Thus, the texture of the substratum is an important component in any ecological consideration of benthic communities.

An important modifier of this structural component is water motion. If too severe, water motion may cause scouring or burial (by sand) of benthic communities, leading to lower diversity. A certain level of water motion is, however, beneficial, and, in fact, required for coral growth (Jokiel, 1978). Water motion carries food and nutrients, as well as disperses larvae for the sessile components of the benthic community.

The nearshore area under consideration in this study is exposed to surf coming from the north and northwest. Most of the study area has little shallow reef to break up the force of these incoming waves. The paucity of macroinvertebrates, corals and fish in the study area may be indirectly related to wave activity causing a scouring of the substratum. As previously stated, much of the diversity inherent in any community of organisms may be related to the heterogeneity in the habitats present. Thus, in a coral reef system, a sand flat harbors fewer species and individuals than does an adjacent coral community. Habitat heterogeneity may be increased by dimensionality, i.e., going from a two-dimensional system to a three-dimensional one and by physically increasing the third dimension. This increase in dimensionality not only provides shelter for resident organisms but will serve to dissipate impinging wave energy, thus lowering substratum scouring.

Making accurate assessments in the field of this third dimension and of the numbers of fish and invertebrates present in it is very difficult. Coral coverage may or may not reflect the size of the third dimension because it is a two-dimensional measurement carried out in a three-dimensional system. Additionally, where habitat heterogeneity is well developed, it becomes increasingly more difficult to assess fish and invertebrate populations; this is particularly true of invertebrate populations.

In this survey of the Kahuku Point region, 47 species of fish were censused in the 20 x 4 m visual census areas of the 11 stations. The diversity of fish species (numbers of species and individuals) encountered in this study is not particularly great relative to other local studies. Bienfang and Brock (1980) found 105 fish species in their ecological reconnaissance of the West Beach, Oahu area. A major difference in the latter study (which used the same assessment techniques) is that it was conducted in the relatively protected (lee) part of the island where coral communities and the third dimension (shelter) are well developed. In the Kahuku Point area, the coral communities and habitat relief (third dimension) are not particularly well developed (see below). This lack of development may result in a less diverse habitat available to fish. Thus, the low fish species diversity found in the present study may be related to the degree of habitat development (heterogeneity).

Many of the corals encountered in the present survey displayed prostrate growth forms; such growth patterns are indicative of high energy conditions. In this study, 13 species of coral were recorded. This represents about 35% of the species of the known shallow Hawaiian coral fauna (Maragos, 1977) and probably a much larger percentage of the common fauna. Thus corals are reasonably well represented in the biotopes surveyed in the vicinity of Kahuku Point. Coral coverage is relatively low, ranging from less than 1% (Stations 4, 5, and 8) to over 21% (Station 6). In well developed leeward coast Hawaiian coral communities, local coverage values of 60 to 80% are not uncommon (Bienfang and Brock, 1980). Like prostrate growth forms, low coral coverage is probably related to the habitat being subjected to high energy conditions caused by storm surf.

In simple ecological surveys such as the present one, thorough assessment of the resident macroinvertebrates is a difficult task. Problems arise with field identification and/or with the use of inappropriate sampling procedures. Only some echinoderms and corals are relatively easily identified in the field and are large enough to be reasonably sampled by the techniques used in most studies.

The present study has certainly underestimated resident invertebrates due to their size and cryptic habits. The majority of the invertebrate species on Hawaiian and other coral reefs are

small cryptic forms. In coralline habitats, abundance values are frequently on the order of 60,000 to 200,000 organisms per m^2 (Brock and Brock, 1977) and their quantitative assessment requires specialized techniques. Recognizing that these small cryptic and infaunal forms have not been sampled in the present survey (beyond the scope of this study), we can turn our attention to the larger, more diurnally exposed species. Other than corals, these invertebrates are mostly in the Phylum Echinodermata and, due to their nonconcealing habits, only the sea urchins were probably quantitatively assessed.

Four sea urchin species were encountered in the 20 x 4 m quantitative surveys at each of the 11 stations. These species are *Echinostrephus aciculatum*, *Echinometra mathaei*, *Echinothrix diadema*, and *Tripneustes gratilla*. Sea urchins ranged in density from 0 to 0.3 individual per m^2 and, overall, stations had an average density of 11 per m^2. The most ubiquitous species, *Echinometra mathaei*, appeared in all biotopes except the Biotope of Surge Channels. Only in the Smooth Limestone Bench Biotope were all four species seen.

The colonial soft coral, *Anthelia edmondsoni*, is known only from the Hawaiian Islands where it is frequently found in embayments (Devaney, 1977). Among ecologists, *A. edmondsoni* is known as an indicator of freshwater input, thus its common occurrence in a marine community is indicative of some intermittent level of mixhalinity. In the present study, *A. edmondsoni* was found in the Smooth Limestone Bench Biotope (Stations 7, 8, and 10) and in the Biotope of Surge Channels (Stations 2, 4, and 6). The distribution of this species suggests that freshwater input occurs over a significant part of the study area (see Figure 3).

The results of this survey suggest that the relatively high energy conditions that seasonally prevail in the Kahuku Point area probably have determined the degree and direction of benthic community development. Thus, species that are present are those able to succeed under periodic high surf conditions; this is particularly true for sessile forms such as the corals.

The widespread presence of *A. edmondsoni* suggests that nearshore marine communities are subjected to some freshwater input. It is suspected that much of this freshwater input has, in the past, occurred along the beach near the midpoint of the large bay between Kahuku and Kuilima Points. This supposition is partially based on the presence of the large and extensive onshore-offshore channel development in the area affronting the midpoint of the bay. [Stations 4, 5, and 6 (Figure 3) sampled this main channel area.] Natural point source freshwater discharge (streams) into fringing coral reef communities frequently results in the formation of a channel directly opposite the stream mouth cutting through the fringing reef in an orientation perpendicular to the shore and reef. Examples of this phenomenon are common along the windward Oahu coastline from Kualoa to Kahuku.

No obvious adverse impact to the nearshore benthic communities in the study area are apparent from episodic freshwater drainage. This statement is supported by the presence of large *Porites lobata* colonies (in the Biotope of Large *Porites* Colonies) no more than 75 m offshore and 400 m east of the major channel area (a presumed drainage path). Like most other corals, *Porites lobata* cannot tolerate much exposure to freshwater or to lowered salinities.

The growth rates of Hawaiian *Porites lobata* are known to vary between 1 to 2 cm per year (S.V. smith, pers. comm.). The largest *Porites lobata* colony in the Biotope of Large *Porites* Colonies was estimated to be 4 m in diameter; this colony is situated in about 2 m of water. Assuming isometric growth, this *Porites* colony is estimated to be between 100 and 200 years of age, suggesting that ecological conditions at this site have been appropriate for that length of time.

Based on the results of the present study, several points emerge regarding the shallow marine communities in the area of Kahuku Point. These are:

1. Much of the study area is subjected to some level of freshwater input (probably episodic);

2. Submarine topographical conditions and extant marine communities suggest that much of the freshwater .input exits the immediate area via the major channel present in the center of the study area;

3. The relatively high wave energy impinging on the area retards the complete development of the sessile benthos (particularly corals) but probably aids in the flushing and lower water residence times;

4. Freshwater input has, overall, had a relatively minor impact on the shallow benthos of the area over the last 100 to 200 years as evidenced by the presence and apparent health of large *Porites lobata* colonies in the area.

This information suggests that if hinterland drainage patterns are not greatly altered during any proposed development and that the volume of water discharged does not greatly change, little negative impact due to freshwater input should occur to the extant marine communities in the Kahuku Point area surveyed in this study. This, of course, assumes no change in sediment inputs.

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Appendix A2-1. Results of the 20 x 4 m visual fish censuses conducted at 11 stations in the Kahuku Point study area. Numbers in the body of the table represent counts of individual fish. Totals and a diversity index (H') are given at the end of the appendix.

SPECIES	STATION NUMBER 1	2	3	4	5	6	7	8	9	10	11
ACANTHURIDAE											
Acanthurus achilles		1									
A. dussumieri										1	24
A. leucopareius				1		1					
A. nigrofuscus		4	6	37	19	35	1	4		5	3
A. olivaceus				9						1	4
A. triostegus		1	1	17	7	3	2	1		8	'100
Ctenochaetus strigosus		1									
Naso literatus	1										
N. unicornis						2			1		
APOGONIADAE											
Apogon kallopterus				1							
BALISTIDAE											
Rhinecanthus rectangulus					4	1			4	2	
BLENNIDAE											
Exallias brevis						1					
Plagiotremus goslinei								1			
CANTHIGASTERIDAE											
Canthigaster jactator	2		1		2	1					1
CHAETODONTIDAE											
Chaetodon fremblii						1					1
C. lunula		1									
C. quadrimaculatus										1	
CIRRHITIDAE											
Cirrhitus pinnulatus				1	1				1	1	
Paracirrhites arcatus									1		
P. forsteri			1							1	
Cirrhitops fasciatus	1					1				5	
KYPHOSIDAE											
Kyphosus vaigiensis										5	
HOLOCENTRIDAE											
Adioryx xantherythrus										5	

Appendix A2-1 (cont.)

SPECIES	STATION NUMBER 1	2	3	4	5	6	7	8	9	10	11
LABRIDAE											
Bodianus bilunulatus											1
Coris gaimardi		1		3	2	4					2
C. flavovittata					1						1
C. venusta					4						
Labroides phthirophagus	2										1
Stethojulus balteatus	2		2	6	3	1		2			
Thalassoma ballieui				1	1	2		1			
T. duperryi	4	9	21	19	19	14	11	13	6	33	8
T. umbrostigma								1		8	
MONACANTHIDAE											
Cantherhines sandwichiensis							1				1
Pervagor spilosoma	9	5	1	3	1	1	4	1	1		1
MULLIDAE											
Parupeneus bifasciatus											1
P. multifasciatus				1		1					6
P. porphyreus											7
MURAENIDAE											
Gymnothorax petelli									1		
G. flavimarginatus						1					
OSTRACIONTIDAE											
Ostracion meleagris					1						
POMACENTRIDAE											
Abudefduf abdominalis											35
A. imparipennis	1	3			1			1		1	
Chromis vanderbilti		8				4	1	1	8	2	
Stegastes fasciolatus	1	4	9	7	7	3		2			4
SCARIDAE											
Scarus perspicillatus											1
Scarops rubroviolaceus						2			2		
ZANCLIDAE											
Zanclus canescens				2							

	STATION NUMBER 1	2	3	4	5	6	7	8	9	10	11
SPECIES	9	11	8	14	15	20	5	11	9	11	26
INDIVIDUALS	23	38	42	108	73	83	16	28	25	63	232
DIVERSITY	1.85	2.09	1.46	2.00	2.15	2.14	1.04	1.84	1.85	1.61	2.15

APPENDIX D

VEGETATION SURVEY

VEGETATION SURVEY FOR THE PROPOSED
KUILIMA RESORT, ISLAND OF OAHU

by
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October 1984

VEGETATION SURVEY FOR THE PROPOSED
KUILIMA RESORT EXPANSION, ISLAND OF OAHU

INTRODUCTION

The proposed Kuilima resort expansion will occupy approximately 808 acres of land on the northern tip of Oahu, adjacent to the present Turtle Bay Hilton and Country Club facilities. Descriptive baseline surveys of existing resources are required to facilitate meaningful change evaluation and environmental impacts assessment. This document summarizes the findings of such baseline surveys made of the flora in the proposed project area by Earthwatch, a Honolulu-based environmental consulting firm. A reconnaissance-level vegetation survey of the proposed resort area was originally conducted by Earthwatch in 1978 for Belt, Collins & Associates (Elliott & Hall, 1978). Current surveys of the marsh and dune vegetation were conducted by Earthwatch at the request of Group 70 to update information for these more sensitive areas; these surveys were conducted on August 25, 26 and September 9, 10, 1984 by Erin M. Hall, ecologist and Evangeline Funk, botanist.

The primary objectives of this study were to survey and describe the existing vegetation in the marsh and dune areas, to inventory the flora, and to look for any listed or proposed endangered plant species, in order to assess the impact of development on the existing flora. Survey methods and findings are summarized in the following report submitted to Group 70 for use in preparation of an environmental assessment for the Kuilima Resort Expansion.

METHODOLOGY

Available maps and aerial photographs were examined prior to the field survey in order to gain familiarity with the study area. Aerial photographic signatures were tentatively delineated to facilitate field identification of vegetation cover types. Government agencies including the US Fish & Wildlife Service and the State Division of Forestry & Wildlife were contacted concerning the possible presence of endangered plant species in the area. Although no listed or proposed threatened or endangered species have been recorded for the project area, the agencies indicated that there is always the possibility that rare or endangered species could be present; therefore careful observations were made of plants encountered during the survey.

Field Survey

Intensive walk-through surveys were made through each cover type encountered or predicted from aerial photographic signature interpretation. As some areas of the marsh are very inaccessible to a walk-through survey, ground verification of signatures was made primarily around the edges of the marsh and inside areas were viewed as much as possible from higher areas of the marsh (trees, bunkers, higher ground, etc.). Vegetation patterns and associations, floristic composition, vegetative structure, and relative cover and abundance were evaluated subjectively in the field. Plant species observed were recorded and those which could not be verified positively in the field were collected for subsequent identification with the University of Hawaii Botany Dept. or Bishop Museum.

Analysis

After field surveys were completed, all data were synthesized into the checklists, map and written summaries presented here. Although the aerial photo-based map is not corrected for geometric scale distortions, it serves to illustrate the distribution of general vegetation cover types in Punahoolapa Marsh. Evaluations were made of the significance of findings and the potential impacts of development upon the flora of the project area.

ENVIRONMENTAL SETTING

The Kahuku coastal plain is characterized by moderate rainfall, averaging 30 to 40 inches annually, and severe exposure to northeast trade winds. The project area lies within an area of generally level topography; elevation ranges from 0 feet above sea level to about 12 feet above sea level on the average, except in the coastal region nearest Kahuku Point where hilly dune formations may rise to 25 or 30 feet.

The proposed project area falls within the potential vegetation zone of "Lantana-koa haole shrubs" according to Ripperton and Hosaka (in Armstrong, 1973). Potential vegetation is the vegetation which would be expected for an area given the existing climate, elevation and available plant species. The lantana-koa haole shrub zone is typical of areas below 3000 feet elevation receiving 20-40 inches of rainfall per year, and is characterized by species such as lantana, koa haole and ilima. While these species were commonly observed within the project area, they were only occasionally observed within the more specialized ecosystems of the dune and marsh areas. Actual species observed and existing vegetation cover types determined by field survey for this study are described in the following section.

RESULTS OF THE VEGETATION SURVEY

Results of the botanical field surveys indicate that four major vegetation cover types occur within Punahoolapa Marsh: Shrub thickets, Marshlands, Mudflats (and associated vegetation), and Open water (and associated vegetation). However, for mapping purposes, Marshlands are divided into three categories based on aerial photo signatures; these categories are defined by the dominant plant species within the signature as identified in the field (great bulrush, native mangrass and California grass). There are many gradations and variations within each cover type, and often one cover type grades into another in the field and no particular plant species may be dominant in some cases. However, since mapping units needed to be defined to help describe the marsh vegetation, those indicated are considered the most representative. Cover types are based on vegetative structure (height, physiognomy, stratification, cover/abundance), floristic composition (dominant plant species), and habitat association (site and terrain characteristics).

The dune vegetation could primarily be mapped as one unit. Beach naupaka is the dominant species of the dunelands, with other coastal strand species common along the seaward edge of the dune vegetation.

Separate plant species checklists are provided for the marsh and the dunes in the Appendix.

Marsh Vegetation Cover Types

Shrub thickets. Most of the shrub thickets surrounding the marsh are dominated by Indian pluchea (*Pluchea indica*), an exotic species forming dense stands which often define the transition from marsh to surrounding scrub or woodland vegetation. Pluchea shrubs are also found scattered within the marshland cover, surrounding the mudflat areas, and even around the edges of some open water areas. Pluchea is a very persistent weedy shrub which spreads rapidly and can quickly inhabit open areas of a wetland and turn them into nearly impenetrable thickets. Pluchea is also sometimes found in association with Christmasberry (*Schinus terebinthifolius*) shrubs and trees, along edges of the marsh and on raised areas within the marshland, such as the railroad right-of-way. Hau (*Hibiscus tiliaceus*) forms dense thickets on the southern and eastern sides of the marsh, but since the hau thickets cannot easily be distinguished from pluchea or Christmasberry thickets on the aerial photo, they are all defined as Shrub thickets and mapped as one cover type. Other plant species found less commonly within this cover type include koa-haole (*Leucaena leucocephala*); ironwood (*Casuarina equisetifolia*)--a species which occurs often but is usually scattered within this cover type rather than forming closed canopy; and Java plum (*Eugenia cumini*).

__Marshlands__. Most of the vegetation within Punahoolapa Marsh is dominated by a dense mixture of sedges and grasses which form the "marshlands"--tall (averaging 6-8 feet height), emergent herbaceous species including great bulrush (*Scirpus validus*), native sawgrass (*Cladium leptostachyum*) and California grass (*Brachiaria mutica*). Bulrush appears to be the most dominant plant species throughout the marsh as a whole, in some areas forming almost monotypic stands, in others mixed with sawgrass, California grass or both. Marshland associations are mapped according to the dominant species of the signatures as identified in the field: Bulrush Marshland (M-B), Sawgrass Marshland (M-S), and California grass Marshland (M-C); however, all of these cover types grade into each other and are not always easily distinguishable in the field. Cover types are generalized and mapped here primarily to facilitate descriptions of vegetation. Native sawgrass is an endemic species, the bulrush species most frequently observed is an indigenous species, and California grass is an exotic plant species. All three species are commonly found in marshes throughout the Hawaiian Islands. Other plant species less commonly observed in this cover type include primrose willow (*Ludwigia octivalvis*), cattail (*Typha angustata*), ironwood trees and shrubs (often rooted within the wetland), pluchea and Christmasberry (often rooted in raised areas, slightly above the water level).

__Mudflats and Associated Vegetation__. Two mudflat areas large enough to be mapped were identified during the field survey, as well as a few which were too small to be delineated separately. One mudflat located on the northern edge of the marsh (F) had decreased in size by more than half since the 1978 survey. 'Akulikuli (*Sesuvium portulacastrum*) covers most of this mudflat, which is almost entirely surrounded by dense pluchea thickets. Water quality measurements which had been taken during the 1978 vegetation survey indicated this area as more brackish than other parts of the marsh. The other mudflat area on the southeastern side of the marsh is characterized by water hyssop (*Bacopa monnieria*), sedges (*Cyperus* spp.) and spike rush (*Eleocharis geniculata*). This mudflat is partially utilized as pasture. A few small 'akulikuli and water hyssop flats were found in the midst of pluchea thickets on the southwestern side of the marsh. Other plant species observed less commonly within this cover type include 'ohelo-kai (*Lycium sandwicense*), pohuehue (*Ipomoea brasiliensis*) and *Fimbristylis seiboldii*, a rush not previously identified for Hawaii (Whistler, 1984), and apparently introduced into the marsh since 1978.

__Open Water and Associated Vegetation__. The large open water areas on the southern side of Punahoolapa Marsh are surrounded primarily by ironwood trees, California grass, hau and great bulrush. While ironwood is not usually considered a wetland species, within this marsh it was usually observed rooted in water or muck (as opposed to Christmasberry which was usually observed rooted in soil slightly above the marsh level, and would

be considered a more transitional or marginal species). Other plant species observed in this cover type include cattail, Bermuda grass (*Cynodon dactylon*), duckweed (*Lemna minor*) and native sawgrass. Smaller open water areas occur throughout the marsh and are typically surrounded by Bulrush Marshland.

__Dune Vegetation__

Vegetation plays an important part in forming as well as in stabilizing sand dunes. Dunes are formed when strong winds pass over exposed reef and sand flats, carrying lighter particles of sand landward. If an obstacle is met such as a beach plant, a rock or piece of wood, sand accumulates and a small dune is formed. Over time, more sand is deposited and the dune grows, especially if vegetation is present to capture the passing sand particles. The dune may migrate landward in its early stages, but as its vegetative cover becomes more complete and younger dunes block sand movement, the older dune becomes stabilized. If some disturbance such as trampling or excavation breaks the vegetative cover of an older stable dune, blowouts may occur (this has happened in some areas used by the dunebuggies), and in some cases entire dunes may become mobile again due to undermining of the remaining vegetative cover.

Most of the dunes in the project area are stabilized by dense growths of beach naupaka (*Scaevola taccada*), which have become more extensive since the 1978 survey. Beach naupaka thickets most often define the landward boundary of the sand dunes, with mixed koa-haole, Christmasberry and lantana thickets occuring when the dunes grade into areas with more soil. Along the seaward edge of the dunes, typical coastal strand vegetation includes tree heliotrope (*Messerschmidia argentea*), hinahina (*Heliotropium anomalum*), koko (*Euphorbia degeneri*), beach dropseed (*Sporobolus virginicus*), pohuehue and pohinahina (*Vitex ovata*). Of 40 species observed in this cover type, 15 are native plant species, and 2 are endemic species found naturally only in Hawaii (koko and pa'u-o-hi'i-'aka)--see Plant Species Checklist, Kuilima Dunes. Ironwood groves occur on some of the dunes, and comparisons of current aerial photos with ones used for the 1978 vegetation survey indicate that some of the ironwood trees have filled in dunes which had previously been more open.

__Endangered or Rare Plant Species__

No proposed, listed or candidate endangered or threatened plant species were observed within the proposed resort expansion area in either the 1984 survey or the 1978 survey.

SIGNIFICANCE OF FINDINGS

Effects of development on vegetation throughout the proposed resort site would be similar to those suggested in the 1978 vegetation survey by Earthwatch. In summary: with the exception of the dune and marsh areas, most of the existing vegetation within the project area is dominated by exotics, many of these undesirable weeds. Removal of weedy cover and replanting may improve the appearance of many areas, but construction of buildings, parking lots and roads will result in an overall reduction of vegetative resources. The use of native Hawaiian and Polynesian-introduced plant species is encouraged for future replanting and landscaping. Species should be suited to the harsh windy conditions of this coastal environment, and should include as many native plants as possible which currently inhabit the area. Some species which may be considered include hinahina, ilima, koko, pohuehue, and pohinahina. Rare species which may grow well in the environment should also be considered, such as beach sandalwood, dwarf naupaka and 'ohai.

Current development plan effects on marsh and dune areas should be examined apart from the rest of the project site, since these areas represent unique and diminishing ecosystems throughout the state. While the individual species observed may not by themselves seem botanically significant, together they form habitat resources that should be preserved wherever possible.

<u>Dunes</u>. Development plans would necessitate removal of portions of the secondary dune vegetation. A buffer zone comprised of the primary dunes has been proposed for areas where primary dunes exist. In all other areas, a minimum 100 foot setback is proposed. While beach naupaka covers most of the dunes, the removal of this vegetation cover type would not be an irreplaceable or irreversible loss of vegetative resources since that species can be easily replanted, and is found on dunelands outside the project boundary. However, since disturbance to dune vegetation may reduce dune stability, care should be exercised in development activities which may affect the secondary dunes adversely. Replanting of vegetation should be initiated in keeping with a natural dune ecosystem.

Since the highest diversity of coastal species and greatest number of native species occurs in a thin strand of coastal vegetation on the seaward side of the dune vegetation, the plan as proposed would protect most of these species as part of the setback or primary dunes. The dunes and their native vegetation cover are not only unique and attractive coastal features, they are also important protective barriers against wind and storm waves. Keeping the setting as natural as possible can only enhance the resort environment.

<u>Punahoolapa Marsh</u>. Significance of findings in the marsh and their relevance to development plans can best be viewed with the vegetation map of the marsh. Although mapping units are generalized, they indicate which cover types will be most affected by the proposed fill areas. Shrub thickets and California grass marshland are cover types within which most of the proposed fill occurs. Both cover types are dominated by exotic species, and form such dense stands that they are not suitable for waterfowl habitat. Species found in these cover types are found elsewhere not only in this marsh but in similar marsh habitats throughout the Hawaiian Islands. Transects taken through these cover types into the marsh indicate that these areas are probably transitional zones, seasonally wet, and may define the outer limits of the perennially wet marshlands. No native species were observed within the pluchea shrub thickets (S) on the western side. Shrub thickets to be affected on the northeastern side are primarily ironwood, pluchea and Christmasberry, common exotic species which may sometimes be considered pests, botanically, but which may serve here as a buffer or vegetative screen for herbaceous and open water areas of the marsh. A small area of bulrush marsh which may be affected by fill would probably host native wetland vegetation such as bulrush, sawgrass and perhaps other sedges, however this cover type is the most common cover type throughout the marsh and its loss would not be expected to significantly affect the marsh ecosystem as a whole.

The small 'akulikuli mudflat (F) on the northern edge of the marsh is a relatively limited wetland subtype within Punahoolapa Marsh. Comparison of the actual mudflat area (part of the mapped unit includes a pluchea transition zone which was not mapped separately at this scale) to the same mudflat area surveyed in 1978 indicates that the pluchea shrub thicket is encroaching on the open wetland; I would estimate that the present open mudflat area is approximately 1/3 the size of the 1978 mudflat area, indicating that eventually the pluchea thickets may fill in the open areas anyway. Marsh expansion areas are proposed nearby and may be designed to open additional mudflat areas since these are attractive to certain wetland birds such as stilt. Vegetation for the expansion could include species which would maintain the open character of a mudflat wetland environment and thus provide an alternative wetland habitat to the prevailing dense herbaceous marshlands.

Finally, enhancement of the railroad right-of-way to create an elevated walkway over the marsh would enable visitors to the area to view marsh vegetation and hopefully have a positive educational value in respect to wetland ecosystems. Current vegetation over the old right-of-way consists of koa-haole, pluchea, and other weedy shrubs which have overgrown the area (the entire length could be walked in 1978, but efforts to forge through or over the vegetation during the current surveys proved fruitless). As the species currently overgrowing the right-of-way may easily extend into the marsh and eventually encroach upon the wetland areas, efforts to clear this weedy vegetation would most likely have a positive effect on the surrounding marshland.

CONCLUSIONS

In conclusion, although no listed or proposed endangered or threatened plant species were observed in the project area, the marsh and dunelands are considered unique and diminishing resources which should be preserved as much as possible throughout the Hawaiian Islands. Development plans propose protection of both of these resources as well as enhancement of the marsh to provide more waterfowl habitat. If these plans are implemented, no significant adverse environmental impacts relative to vegetation are anticipated as a result of the project.

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APPENDIX

PLANT SPECIES CHECKLISTS; KUILIMA RESORT

Families are arranged according to St. John (1973). Genera and species are listed alphabetically within each family. Taxonomy and nomenclature generally follows St. John except where more commonly accepted names are listed.

For each species the following information is provided:

1. Scientific name with author citation.
2. Common English name and/or Hawaiian name, when known.
3. Status of the species:

E = Endemic to the Hawaiian Islands; occurring naturally nowhere else in the world.

I = Indigenous: native to the Hawaiian Islands but also occurring naturally elsewhere in the world.

P = Polynesian Introduction: plants brought by the Polynesian immigrants prior to contact with the Western World.

X = Exotic: plants of accidental or deliberate introduction after contact.

PLANT SPECIES CHECKLIST, PUMANOOLAPA MARSH

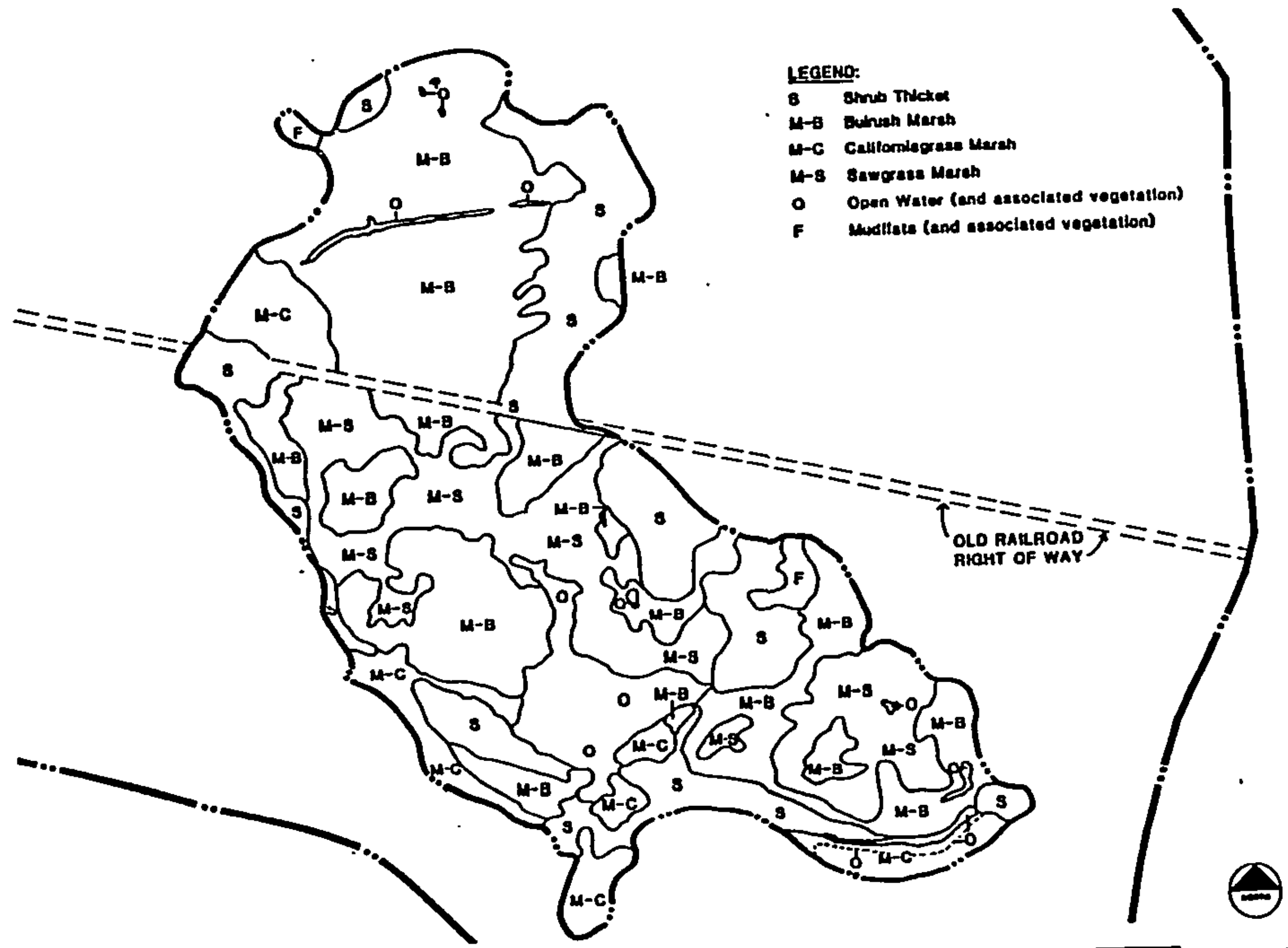
SCIENTIFIC NAME	COMMON NAMES	STATUS
MONOCOTYLEDONEAE		
TYPHACEAE (Cattail Family)		
Typha angustata Bory & Chaubard	Cattail	X
GRAMINEAE (Grass Family)		
Brachiaria mutica (Forsk.) Stapf	Californiagrass	X
Cynodon dactylon (L.) Pers.	Bermuda grass; manienie	X
CYPERACEAE (Sedge Family)		
Cladium leptostachyum Nees & Meyen	Native sawgrass; 'uki	E
Cyperus diformis L.	-	X
Cyperus javanicus Houtt.	Marsh cyperus; 'ahu'awa	I
Cyperus polystachyus Rottb.	-	I
Eleocharis geniculata (L.) R.& S.	-	X
Fimbristylis seiboldii		X
Scirpus californicus (C.A.Meyer)Steud	Great bulrush	I
Scirpus valides Vahl	Great bulrush; neti	I
LEMNACEAE (Duckweed Family)		
Lemna minor L.	Duckweed	X
DICOTYLEDONEAE		
CASUARINACEAE (Casuarina Family)		
Casuarina equisetifolia Sticks.	Common ironwood	X
AIZOACEAE (Carpetweed Family)		
Sesuvium portulacastrum (L). L.	'Akulikuli; sea purslane	I
BASELLACEAE (Basella Family)		
Basella alba L.	Ceylon spinach; 'inita	X
LEGUMINOSAE (Pea Family)		
Leucaena leucocephala (Lam.) de Wit	Koa-haole	X
ANACARDIACEAE (Mango Family)		
Schinus terebinthifolius Raddi	Christmas berry; nani-o-hilo	X
MALVACEAE (Mallow Family)		
Hibiscus tiliaceus L.	Hau	I
MYRTACEAE (Myrtle Family)		
Eugenia cumini (L.) Druce	Java plum; palama	X
ONAGRACEAE (Evening Primrose Family)		
Ludwigia octivalvis (Jacq.) Raven	Primrose willow	X

CONVOLVULACEAE (Morning glory Family)		
Ipomoea brasiliensis (L.)Sweet	Beach morning glory; pohuehue	I
BORAGINACEAE (Heliotropium Family)		
Heliotropium amplexicaule Vahl	Heliotrope	I
SOLANACEAE (Nightshade Family)		
Lycium sandwicense Gray	'Ohelo-kai	I
SCROPHULARIACEAE (Figwort Family)		
Bacopa monnieria (L.) Wettst.	Water hyssop	I
PLANTAGINACEAE (Plantain Family)		
Plantago major L.	Common plantain; laukahi	I
COMPOSITAE (Sunflower Family)		
Pluchea x fosbergii Cooperrider & Galang	-	I
Pluchea indica (L.) Less.	Indian pluchea	I
Pluchea odorata (L.) Cass.	Pluchea; sourbush	I

PLANT SPECIES CHECKLIST, KUILIMA DUNES

SCIENTIFIC NAME	COMMON NAMES	STATUS
MONOCOTYLEDONEAE		
PANDANACEAE (Screw Pine Family)		
Pandanus odoratissimus var. odoratissimus L.	Hala; pandanus	I
GRAMINEAE (Grass Family)		
Cynodon dactylon (L.) Pers.	Bermuda grass; manienie	I
Eleusine indica (L.) Gaertn.	Wiregrass; manienie-ali'i	I
Sporobolus virginicus (L.) Kunth	Beach dropseed; 'aki'aki	I
Trichachne insularis (L.) Nees	Sourgrass	I
CYPERACEAE (Sedge Family)		
Cyperus polystachos Rottb.	-	I
Fimbristylis pycnocephala Hbd.	-	I
DICOTYLEDONEAE		
CASUARINACEAE (Casuarina Family)		
Casuarina equisetifolia Stickm.	Common ironwood	I
CHENOPODIACEAE (Goosefoot Family)		
Atriplex semibaccata R.Br.	Australian saltbush	I
Chenopodium album L.	Lamb's quarters; 'aheahea	I
AMARANTHACEAE (Amaranth Family)		
Alternanthera sessilis (L.)R.Br. ex R. & S.	Joyweed	I
Amaranthus spinosus L.	Spiny amaranth; pakai-kuku	I
NYCTAGINACEAE (Four o'clock Family)		
Boerhavia diffusa L.	Alena	I
AIZOACEAE (Carpetweed Family)		
Sesuvium portulacastrum (L). L.	'Akulikuli; sea purslane	I
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	Common purslane; 'ihi	I
LEGUMINOSAE (Pea Family)		
Desmanthus virgatus (L.) Willd.	Virgate mimosa	I
Leucaena leucocephala (Lam.) de Wit	Koa-haole	I
Vigna marina (Burm.) Merr.	Nanea; beach pea	I
EUPHORBIACEAE (Spurge Family)		
Euphorbia degeneri Sherff	Koko; beach spurge	E
Euphorbia prostrata Ait.	Prostrate spurge	I

MALVACEAE (Mallow Family)		
Hibiscus tiliaceus L.	Hau	I
Malvastrum coromandelianum (L.) Garcke	False mallow; hauuoi	X
PASSIFLORACEAE (Passion Flower Family)		
Passiflora foetida L.	Love-in-a-mist; pohapoha	X
CONVOLVULACEAE (Morning glory Family)		
Ipomoea brasiliensis (L.)Sweet	Beach morning glory; pohuehue	I
Jacquemontia sandwicensis Gray	Pa'u-o-hi'i-'aka	E
BORAGINACEAE (Heliotrope Family)		
Heliotropium anomalum H.& A. var. argenteum Gray	Hinahina-ku-kahakai	I
Heliotropium curassavicum L.	Nena; seaside heliotrope	I
Messerschmidia argentea (L.f.) Johnston	Tree heliotrope	X
VERBENACEAE (Verbena Family)		
Lantana camara L.	Lantana; lakana	X
Vitex ovata Thunb.	Pohinahina; beach vitex	I
ACANTHACEAE (Acanthus Family)		
Asystasia gangetica (L.)T.Anders	Asystasia; Chinese violet	X
GOODENIACEAE (Naupaka Family)		
Scaevola taccada (Gaertn.) Roxb.	Beach naupaka; naupaka-kahakai	I
COMPOSITAE (Sunflower Family)		
Bidens pilosa var. minor (Bl.)Sherff	-	I
Bidens pilosa var. pilosa L.	Beggar's tick; ko'oko'olau	X
Pluchea x fosbergii Cooperrider & Galang	-	X
Pluchea indica (L.) Less.	Indian pluchea	X
Pluchea odorata (L.) Cass.	Pluchea; sourbush	X
Reichardia picroides (L.) Roth	Picridium	X
Sonchus oleraceus L.	Sow thistle; pua-lele	X
Verbesina encelioides (Cav.) B.&H. ex Gray	Golden crown-beard	X



VEGETATION ASSOCIATIONS OF PUNAHOOLAPA MARSH
(EARTHWATCH, 1984)

GROUP 70

APPENDIX E

DESCRIPTION OF PRIMARY AND SECONDARY SAND DUNES

Dames & Moore
1144 10th Avenue, Suite 200
Honolulu, Hawaii 96816
(808) 735-3585
Cable address: DAMEMORE

November 5, 1984

Group 70, Inc.
924 Bethel Street
Honolulu, Hawaii 96813

Attention: Ms. Sheryl B. Seaman

Gentlemen:

Final Letter Report
Description of Primary and Secondary Sand Dunes
Proposed Kuilima Resort Expansion
Kahuku, Oahu, Hawaii

Pursuant to our revised proposal of August 15, 1984, and our subsequent contract, this letter report presents the results of our field reconnaissance delineating the primary and secondary sand dunes along the beachfront of the Kuilima resort property.

DEFINITION OF PRIMARY AND SECONDARY DUNES

The primary dunes, located directly behind the beach zone, are greatly influenced by wind and water. The height and movement of these dunes are determined by wind direction and intensity. Because the prevailing winds are onshore, the dunes tend to migrate inland. Storm winds and waves deplete the dunes, shifting the sand seaward. The dune vegetation impedes the rate of sand movement. The cycle of accretion and depletion of primary dunes occurs over a time scale of years (as compared to months or tens of years). Vegetation characteristic of the primary dunes are low growing species that are extremely tolerant of salt water, strong winds, and sandy soil. These include grasses, succulent herbs, and herbaceous vines. Species prevalent at Kuilima are the pohuehue, naupaka, and akulikuli.

The secondary dunes are located inland of the primary dunes and are characterized by more mature vegetation — shrubs and trees, such as the ironwoods prevalent at Kahuku. Formed by the accretion of wind blown sand, these dunes act as a second barrier against severe wind and wave erosion. The secondary dunes are occasionally destroyed by storm or tsunami waves but not as frequently as the primary dunes (on the scale of tens of years).

PURPOSE OF OUR SERVICES

The purpose of our field reconnaissance of September 1984 was to delineate the locations of primary and secondary dunes for your land use planning efforts. The reconnaissance delineated approximate locations — i.e. no precise locational or survey methods were utilized.

During the field reconnaissance, vegetation type and location relevant to the shoreline were used in distinguishing between primary and secondary dunes. In some instances, primary dunes were absent due to shoreline erosion. At these locations, secondary dune type vegetation existed directly behind the beach zone.

In other areas, more specifically where the existing resort and residential homes are located, only primary dunes were evident. Any secondary dunes that could have been present at one time were likely removed during construction of the golf course and resort structures.

FINDINGS

Dunes are dynamic structures that are greatly influenced by physical processes and, therefore, change with time. The mylar previously sent to you shows the locations of the existing primary and secondary dunes as determined in our field reconnaissance of September 1984.

Generally, in the area between Kuilima Point and eastern Kahuku Point, the majority of the beach sand exists in either the active (primary) dunes or in the more stabilized (secondary) dunes. Behind the dunes, sand covers large areas of the abandoned airfield. In addition to wind caused sand movement, the literature suggests much of this sand was deposited through historical tsunami activity (DPED, 1981).

From Kuilima Point to Kawela Bay, the back beach area that would normally have secondary dunes has been graded extensively. This has resulted in generally flat, sandy areas, with mature vegetation behind the primary dunes. The areas have vegetation similar to secondary dunes, and are therefore more resistant than primary dunes to wind erosion, but lack the topographic relief characteristic of secondary dunes.

RECOMMENDATIONS

No structures should be constructed on the primary dunes, nor should they be modified in any way, so as to reduce their ability to absorb and dissipate energy. We recommend that before locating any structures on or adjacent to the secondary dunes, further investigations be conducted concerning tsunami and wave runup elevations. In the historical past, the area under

Dames & Moore

investigation has been subject to extensive wave damage by both tsunami and storm waves.

Yours very truly,

DAMES & MOORE

Jennifer J. Klevens

Jennifer J. Klevens
Assistant Environmental Scientist

JJK:ob(1501A/208A:13993-001-11)

(Two copies submitted)

Attachments: References

cc: Kuilima Development Corporation
Attention: Roy Takeyama

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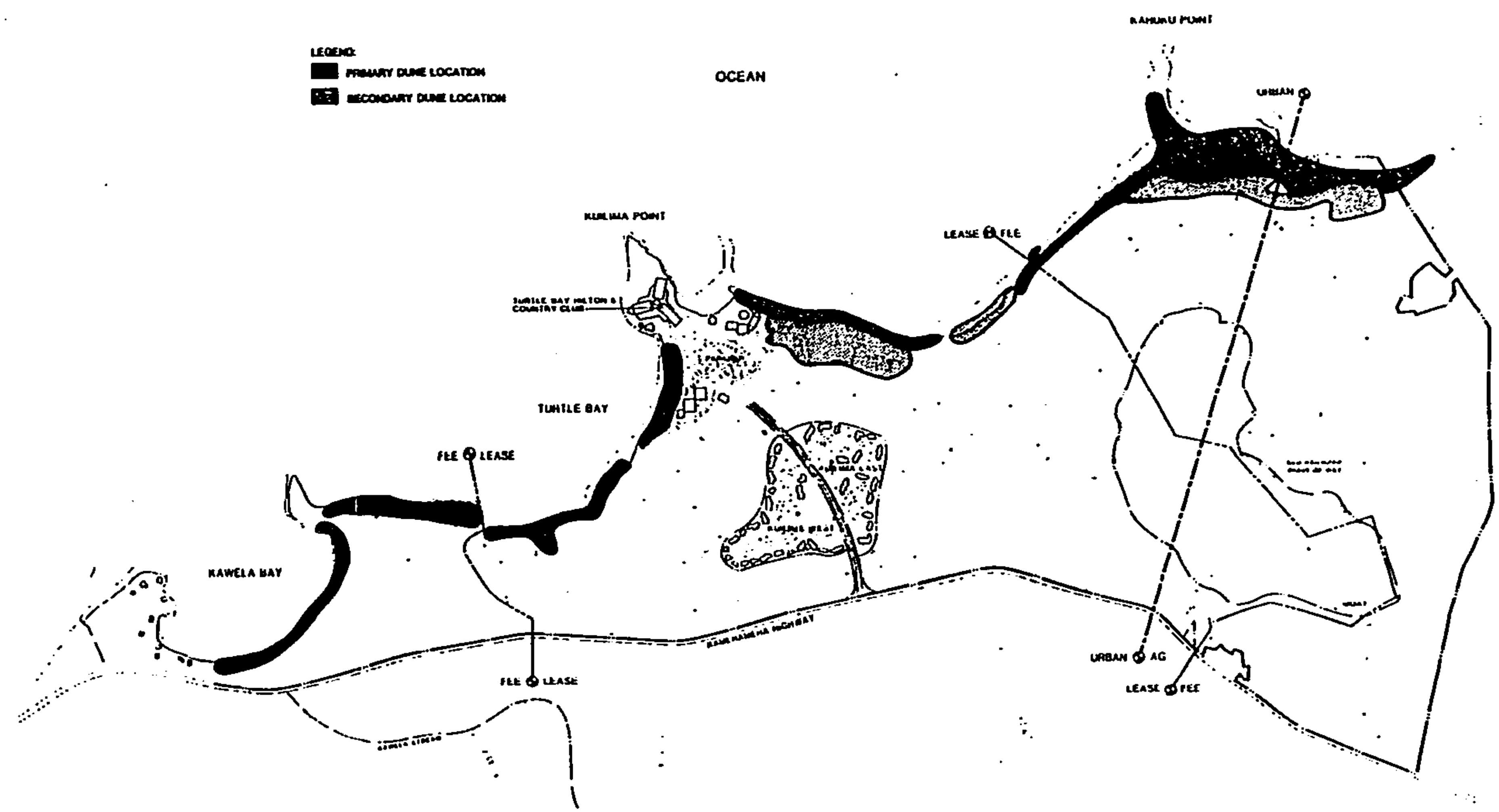

KUILIMA RESORT

• BASE MAP
• DUNE LOCATION MAP

GROUP 70
ARCHITECTS AND PLANNERS
NORTH

APPENDIX F

TERRESTRIAL VERTEBRATES REPORT

TERRESTRIAL VERTEBRATES OF THE KUILIMA RESORT PROPERTIES AUGUST 1984

BY ANDREW J. BERGER

This study was made at the request of Ms. Sheryl B. Seaman and Mr. Vincent Shigekuni of Group 70, Honolulu. In her letter to me of 13 July 1984, Ms. Seaman instructed me to:

1. Update Phillip Bruner's 1978 survey of the birds of Punahoolapa Marsh, including any birds, mammals, reptiles, or amphibians in the area;

2. Describe the changes of the marsh avifauna habitat since the 1978 survey;

3. Assess the impacts of proposed activities in and around the marsh area (clearing vegetation in the marsh, construction of a golf course and residential structures near the perimeter of the marsh), on the fauna of the marsh; and

4. Assess the impacts of removing the open water habitat provided by the existing waste stabilization pond, which would be removed.

My field work at the site was conducted on 10, 25 and 31 August 1984. On 31 August, I had the opportunity to examine the marsh area in detail in the company of: John Emmerson, U.S. Corps of Engineers; Stewart Fefer, Jim Krakowski, Andy Yuen, David Woodside and Peter Stine of the U.S. Fish and Wildlife Service; and Timothy Burr and Ralph Saito of the State Division of Forestry and Wildlife. During this difficult but highly successful field trip, we examined a considerable portion of the marsh area itself and also all of the proposed "fill" area on the map provided by John Emmerson. Woodside, Saito, Stine, and I also checked the birds on the pond at the present sewage disposal installation.

BIRDS OF THE KUILIMA AREA

I will discuss the birds first because this is the only class of terrestrial vertebrates with threatened or endangered endemic species.

I. Endemic Birds

These are birds that are unique to the Hawaiian Islands; they occur naturally nowhere else in the world. Many of these endemic birds are classified as threatened or endangered by the U.S. Fish and Wildlife Service, as well as by the State Division of Forestry and Wildlife. Most of these endangered species, however, are forest birds and there is no suitable habitat for them for many miles from the project site. Four species of waterbirds, all endangered species, do occupy the Punahoolapa marsh region. These are as follows:

1. Koloa or Hawaiian duck, Anas wyvilliana.

The Koloa was classified as a game bird until 1939, with a bag limit of 25 ducks per day. The species became extinct on Oahu during the 1950's. In 1972, a Koloa restoration project was initiated at Pohakuloa, Hawaii, and as of April 1979, 347 captive-raised Koloa had been released on Oahu: 199 birds at Kawainui swamp, 103 at Waimea Falls Park, and 45 at Kuupia pond on the Kaneohe Marine Corps Station. Birds from these release sites have spread to the James Campbell National Wildlife Refuge at Kahuku and to Punahoolapa marsh. We estimated that we flushed between 40 and 50 Koloa from open water areas at Punahoolapa. Neither Shallenberger (1977) nor Bruner (1978) found any evidence of nesting by the Koloa at Punahoolapa, but a great deal of time would have to be spent in the area in order to find the hidden ground nests of this duck.

2. Hawaiian gallinule or 'Alae 'Ula, Gallinula chloropus sandvicensis.

This is an endemic subspecies of the common gallinule of North America and Eurasia. Although once more widely distributed, the gallinule is thought now to inhabit only Kauai and Oahu. During the January 1982 census by personnel of the State Division of Forestry and Wildlife, only 194 gallinules were counted in the State. Bruner (1978:10) wrote that "censusing this species, as mentioned is difficult. Most of my data are based on vocalization records. Only 26% of the observations were visual. Average count per man/day was 16. I found gallinule distributed throughout the study area, but they were more concentrated along the edges of ponds than in the dense bulrush." Bruner did observe an adult with three small young on 20 March 1978. Gallinules are much shyer than other waterbirds and they typically seek cover when they hear people approaching. They inhabit ponds and marshes that have emergent vegetation, which they use for feeding, hiding, and nesting.

3. Hawaiian coot or 'Alae Ke'oke'O, Fulica americana alai.

This also is a subspecies of the American coot that has an extensive breeding range from Canada southward to Panama. Coots occupy the same general habitats as gallinules but prefer more open water and they often are seen on brackish water. Their need for deeper water results partly because coots build large, floating nests of aquatic vegetation. Coots typically are not shy birds, so that it is much easier to census them. I counted two coots on the existing waste stabilization pond on 10 August and five there on 31 August. They were generally distributed throughout the open water areas of the marsh.

The endangered status of the Koloa, gallinule, and coot results from a number of factors. Eggs and newly hatched young of all species are easy prey to mongooses, cats, and dogs. The downy young also enter the water shortly after hatching, where they are prey to bass, bullfrogs, and black-crowned night herons (Berger, 1981). Sudden changes in water level also cause the destruction of nests. Of equal importance to these predators is the historical destruction of so many lowland marsh areas (to be discussed later).

4. Hawaiian stilt or Ae'O, Himantopus mexicanus knudseni

This is a subspecies of the North American black-necked stilt. The largest populations now occur on Maui and Oahu. Bruner (1978:6) saw a maximum of six stilts on any one day of his survey. He pointed out that "at present little or no habitat conducive to successful stilt nesting exists in the Punahoolapa wetland. Where mud flats or open water are found, a variety of predators have ready access." Stilts are vulnerable to the same predators that kill Koloa, gallinules, and coots. Bruner also pointed out: "although cattle don't prey on stilt they do inhibit nesting by their constant movement through an area." David Woodside also has seen stilt in the Punahoolapa marsh area, although we did not see any during our field work there.

II. Indigenous Birds

These are species that occur naturally in Hawaii and also in some other part of the world. These birds are native to the Hawaiian Islands but are not unique to them. In this category are 22 species of sea birds, the Hawaiian black-crowned night heron, and a number of migratory species that spend their winter or non-breeding season in the islands.

1. Black-crowned night heron, Nycticorax n. hoactli

The 'Auku'u is considered to be an indigenous, rather than an endemic, species because the Hawaiian birds have not been recognized as subspecifically distinct from the North American birds. Hence, it is not classified as threatened or endangered even though its fate depends upon the preservation of suitable wetlands. There were 10 herons along the edges of the waste stabilization pond on 10 August and five on 31 August; a minimum of 30 herons was observed on 31 August in various parts of the marsh. Although the herons feed predominantly on aquatic insects, fish, frogs, and mice, they also sometimes prey on the downy young of terns and probably on the other marsh birds.

2. Winter Residents

August is too early for most of the winter residents. Bruner (1978: Table 2) reported seven species of wintering ducks and shorebirds. I found only one species: Golden plover, Pluvialis dominica fulva. The first migrants typically reached the Hawaiian Islands during August. In Hawaii these birds winter from sea level to 10,000 feet elevation on Maui and Hawaii. The birds frequent lawns in residential areas, golf courses, weedy pastures, open areas in mountains, and mud flats along beaches and ponds. They are common winter residents in the Kuilima region.

3. Stragglers or Chance Visitors

Nearly 100 species of birds have found their way to the Hawaiian Islands at least once, even though their migratory paths do not come near the islands. One of these is the Osprey (Pandion haliaetus), which has a wide distribution throughout the world except for oceanic islands. We watched one bird flying over the marsh area on 31 August. The Osprey has been reported on Oahu at least 12 other times since 1939 (Berger, 1981).

III. Introduced or Alien Birds

More than 170 species of alien birds have been introduced to the Hawaiian Islands by man since 1796 (Berger, 1981). I identified the following species in the Kuilima area, including the Punahoolapa marsh.

A. Order Cinconiiformes

1. Family Ardeidae, Herons

a. Cattle Egret, Bubulcus ibis.

This sepcies was imported to Hawaii to aid "in the battle to control house flies, horn flies, and other flies that damage hides and cause lower weight gains in cattle" (Breese, 1959). Most of the funds for insect control were provided by ranchers to have the birds released on their land. Cattle Egrets were released on Oahu in 1959 and 1961. Thistle (1962) reported that the population of egrets on Oahu exceeded 150 birds by July 1962. Some 700 egrets were counted during July 1983 by personnel of the State Division of Forestry and Wildlife. The first nesting colony discovered on Oahu was at Kahuku in 1960 (Elepaio, 21:39-40). Bruner (1978) found the Cattle Egret to be "uncommon" in the Punahoolapa marsh, but this species is abundant in the vicinity of the acquaculture ponds nearby. I saw a few Cattle Egrets in the marsh area, as well as on the golf course.

B. Order Columbiformes

1. Family Columbidae, Pigeons and Doves

a. Spotted or Lace-necked Dove, Streptopelia c. chinensis

This Asian dove was introduced to the Hawaiian Islands at an early date; the exact date is unknown, but the birds were said to have been common on Oahu by 1879 (Caum, 1933). Now common to abundant on all of the islands, this dove is classified as a gamebird. Although it occurs in areas where the rainfall exceeds 100 inches per year, the highest densities are found in drier areas where the alien kiawe and koa haole are dominant plants. Schwartz and Schwartz (1949), for example, found densitites as great as 200 birds per square mile in dry areas on Molokai. The diet was found by the Schwartzes to consist of 77 percent weed seeds and about 23 percent fruits; animal matter was "almost negligible." Tapeworm parasitism, however, was heavy, thus indicating that the small amount of animal material eaten by the doves was important in contracting the worm parasite. The Spotted Dove is common throughout the project area.

b. Barred Dove or Zebra Dove, Geopelia striata

This dove is said to have been introduced to the islands from Australia sometime after 1922 (Bryan, 1958). It is now abundant on all of the islands. Barred Doves also prefer drier areas where weed seeds are available. Schwartz and Schwartz (1949) reported densities as great as 400 to 800 birds per square mile on Oahu (e.g., Barber's Point to Makaha) and on Molokai in 1947, less than 25 years after the doves had been introduced to the islands. The diet consist of about 97 percent seeds and other plant materials; the 3 percent animal matter includes several species of beetles, weevils, and wireworm larvae. This dove also is classified as a gamebird in Hawaii. The birds are common throughout the project area.

C. Order Strigiformes

1. Family Tytonidae, Barn Owls

a. Barn Owl, Tyto alba pratincola

Barn Owls differ from other owls in that they have a heart-shaped facial disc of feathers, hence the name "monkey-faced owls." Barn Owls were brought to the islands (1958 through 1963) in the hopes that they would control rats in sugarcane fields. They did not. The few food habits studies that have been conducted suggest that the owls subsist largely on house mice (e.g., Tomich, 1971). Moreover, Byrd and Telfer (1980) reported that Barn Owls had killed more than 100 seabirds and their chicks on Kauai and Kaula Island. Barn Owls are nocturnal in habits and I did not see any during my field work, but Bruner (1978) saw one owl in the ironwood habitat in the marsh region.

D. Order Passeriformes.

1. Family Timaliidae, Babblers and Their Allies

a. Melodious Laughing-thrush, Garrulax canorus

This bird is a member of the babbler family even though it has been called the Chinese thrush or Hwa-mei in Hawaii. The species is native to the Yangtze Valley in China and southward to Laos, and it occurs in Formosa. The birds were brought to Hawaii as cage birds. "A number obtained their freedom at the time of the great fire in the Oriental quarter of Honolulu in 1900, and took to the hills behind the city" (Caum, 1933). Birds later were imported and released on other islands. These are shy birds that have a loud clear song, so that the birds more often are heard rather than seen. I heard the song in several areas.

2. Family Pycnonotidae, Bulbuls

a. Red-vented Bulbul, Pynonotus cafer

Although all members of this Old-world family are "prohibited entry" in Hawaii by the quarantine division of the Department of Agriculture, two species are now well established on Oahu. The history of the spread of the Red-vented Bulbul since the mid-1960's has been discussed by Berger (1975, 1981). It has now reached the north shore of Oahu, and I found the birds on the golf course and the margins of the marsh.

3. Family Turdidae, Thrushes, Bluebirds

a. Shama, Copsychus malabaricus

Shama is the Indian name for this species, which is native to India, Nepal, Burma, Malaysia, and throughout Indonesia. The Hui Manu imported Shamas in 1940 and released them in Nuuanu Valley "and at some homes in the 2400 block on Makiki Heights road" (Harpham 1953). The Shama now is common on both the windward and leeward sides of Oahu. The birds prefer areas of lush vegetation. I heard the songs at several sites in the marsh area.

4. Family Sylviidae, Old-world Warblers

a. Japanese Bush Warbler, Cettia diphone cantans

This species was introduced to Oahu by the Territorial Board of Agriculture and Forestry in 1929 and "several times after that by the Hui Manu and by private individuals" (Caum, 1933). The Japanese name is Uguisu. They are shy and secretive birds, typically occurring in habitats with dense underbrush. Bruner (1978) found this bird to be common during his field work in March and April 1978. In other areas I have heard the songs from January to mid-July. The birds were not singing during August 1984, but on 31 August, we found an abandoned nest with one egg in the California grass near the old railway right-of-way (now densely overgrown with grasses, shrubs, and trees).

5. Family Zosteropidae, White-eyes and Silver-eyes

a. Japanese White-eye, Zosterops japonicus

Long a favorite cage bird in the Orient, this white-eye was first imported for release from Japan to Oahu by the Territorial Board of Agriculture and Forestry in 1929 (Caum, 1933). Later importations were made by the Hui Manu. The Japanese name is Mejiro, and Mejiro clubs held singing competitions with these birds. The Japanese White-eye rivals the House Sparrow and the European Starling in North America as a successful alien species, and it now is undoubtedly the most abundant song bird in the Hawaiian Islands. It occurs from sea level to 10,000 feet elevation on Hawaii, and it occurs in near desert areas and in those with an annual rainfall of more than 300 inches. I found it throughout the Kuilima properties.

6. Family Sturnidae, Starlings and Mynas

a. Common Indian Myna, Acridotheres tristis

This myna is native to Sri Lanka, India, Nepal, and adjacent regions. It "was introduced from India in 1865 by Dr. William Hillebrand to combat the plague of army worms that was ravaging the pasture lands of the islands. . .reported to be abundant in Honolulu by 1879, it now is extremely common throughout the Territory" (Caum, 1933). The Myna continues to be abundant on Oahu, and it occurs both in the vicinity of buildings, on the golf course, and in the marsh itself.

7. Family Ploceidae, Weaverbirds and Their Allies

a. Spotted Munia or Ricebird, Lonchura punctulata

This munia has a wide distribution in Sri Lanka, India, Nepal, Burma, and southward into Malaysia and the Indo-Chinese subregion, and in the Philippines. The species was introduced to Hawaii about 1865 by Dr. William Hillebrand. Caum wrote that this species feeds "on the seeds of weeds and grasses and does considerable damage to green rice." Rice no longer is grown in Hawaii, but the birds continue to be destructful of crops (see explanation under House Finch). Ricebirds are highly gregarious, and flocks of 100 or more birds are not uncommon. It is a prolific species that nests throughout the year. They are not inhabitants of dense thickets or forests, but occur wherever there are open spaces, e.g., the golf course, along dirt roads through the casuarina groves. The Ricebird is a common species in the project area.

b. Black-headed Munia, Lonchura malacca atricapilla

Also called the Chestnut Mannikin, this species was first reported near Pearl Harbor in 1959 (Udvardy, 1960). This munia frequents golf courses, grassy roadsides, the weedy margins of cane fields, and nearly any open area where seeds are available. Bruner saw only three birds during his 1978 studies, but the population has grown since that time.

c. House Sparrow, Passer domesticus

Incorrectly called the English Sparrow (it has a wide distribution in Europe and Asia), this sparrow was first imported to Oahu in 1871, when nine birds were brought in from New Zealand (where they had previously been introduced from England). Caum (1933) wrote that "the species was reported to be numerous in Honolulu in 1879." The House Sparrow became a serious pest in North America, and many thousands of dollars were spent in attempts to control the population. This sparrow apparently never became a pest in Hawaii. It is omnivorous in diet, eating weed seeds as well as insects and their larvae. The House Sparrow typically is found in the vicinity of man and his buildings, but they also occur along the margins of the marsh.

d. Red-eared Waxbill, Estrilda troglodytes

Other names for this species are Common Waxbill and Black-rumped Waxbill. This African species is a popular cage bird; the first report of wild birds was for the Diamond Head area of Oahu in 1965. As many as 48 birds were reported there during December 1975. I observed a flock of 20 to 25 birds in sugarcane fields at West Beach during November 1973, and 15 birds were seen at Kuilima Pond near Kahuku during November 1977 (Elepaio, 38:105). Bruner (1978, Table 1) recorded 12 birds during his field work. The population has grown considerably since 1978, and I saw flocks of 45 birds during my field work during August 1984.

8. Family Fringillidae, Cardinals, Buntings, Sparrows

a. Red-crested Cardinal, Paroaria coronata

This species was long called the Brazilian Cardinal in Hawaii, but the native range of this South American species includes Uruguay, Paraguay, Brazil, and parts of Bolivia and Argentina. The species was released several times between 1928 and 1931 (Caum, 1933). This cardinal is a very common species on Oahu, and it is found not only in the residential section of Kuilima but also on the golf course and into the casuarina groves that border the marsh.

b. Cardinal, Cardinalis cardinalis

This North American bird is known as the Kentucky Cardinal, Virginia Cardinal, and Redbird. Its native range is the eastern part of North America east of the plains and northward into Ontario. The Cardinal was released on Oahu several times between 1929 and 1931 (Caum, 1933). It now is a common species in residential and rural areas. It is generally distributed in the project area, and I heard both adults and young calling in the introduced vegetation surrounding the marsh area.

c. House Finch, Carpodacus mexicanus frontalis

The House Finch was introduced to Hawaii from California "prior to 1870, probably from San Francisco" (Caum, 1933). The House Finch now is an abundant species on all of the islands, and probably is the second most common song bird in the islands. Although House Finches sometimes eat overripe papaya and other soft fruits (thus the name of Papayabird), the species is predominantly a seed eater. House Finches and Spotted Munias caused great damage to experimental sorghum crops on Hawaii and Kauai during 1971 and 1972. A report by the Senate Committee on Ecology, Environment, and Recreation said that "ricebirds and linnets (House Finches) caused a 30 to 50 percent loss in the sorghum fields at Kilauea on Kauai last year. . .seed-eating birds at Kohala ate 50 tons of sorghum grain in a 30-acre experimental field that was supposed to produce 60 tons" (Honolulu Advertiser, 14 March 1972, p. B-2). The House Finch also is a common bird throughout the project area. Hence, there now are four species of seed-eating birds in this section of Oahu that will make the growing of small grain crops nearly impossible: House Finch, Spotted Munia, Black-headed Munia, and Red-eared Waxbill.

MAMMALS OF THE KUILIMA REGION

I. Endemic Mammals

The only endemic land mammal in the Hawaiian Islands is the Hawaiian bat (Lasiurus cinereus semotus), a subspecies of the North American hoary bat. The Hawaiian bat is found primarily on Hawaii and Kauai (Kramer, 1971; Tomich, 1969). I know of no evidence that there is a resident population on the island of Oahu.

II. Introduced Mammals

All of the introduced species of mammals have proven highly detrimental to man, his buildings, products, agricultural crops, and/or to the native forests and their birdlife. None is an endangered species and none are of concern as far as detrimental effects resulting from the proposed use of the land for this project. In fact, if it were possible to exterminate the mongoose and the rodents, it would be a great boon for man and the native fauna.

With the possible exception of the house mouse (Mus musculus), all of the smaller introduced or alien mammals prey on birds, their eggs, and young. These small mammals include the roof rat (Rattus rattus), Polynesian rat (Rattus exulans), Norway rat (Rattus norvegicus), small Indian mongoose (Herpestes auropunctatus), feral cat (Felis catus), and feral dog (Canis familiaris). Because all of these mammals are serious pests, I did not set traplines in order to catch the nocturnal rodents. It is reasonable to assume that all of the rodents occur in the project area (Tomich, 1969; Kramer, 1971). The diurnal mongoose does occur throughout the area. Bruner (1978:21) has recommended that "cattle currently grazing on the eastern edge of the site should be removed." I agree with that recommendation.

REPTILES AND AMPHIBIANS

There are no endemic amphibians or land reptiles in the Hawaiian Islands. All, therefore, have been introduced (either intentionally or accidentally) by man. None are endangered species and none are of significance for an environmental impact statement.

I. Reptiles

A. Blind Snake, Typhlina bramina

"This small, secretive snake was apparently introduced from the Philippines in the dirt surrounding plants that were brought in for landscaping the campus of the Kamehameha Boys School in Honolulu. It was first found there in January of 1930" (Oliver and Shaw, 1953). These blind, worm-like snakes are rarely seen until they are flooded from underground burrows by heavy rains or unless one looks for them under branches and other debris on the ground. These small, harmless snakes are of no significance for an environmental impact study, and I did not look for them. They are found on all of the islands (McKeown, 1978).

B. Skinks and Geckos

Eleven species of skinks (family Scincidae) and geckos (family Gekkonidae) occur on Oahu. All are insect eaters and all adapt well to urban and rural areas.

II. Amphibians

A. American Bullfrog, Rana catesbeiana

Oliver and Shaw (1953) wrote that this "was probably one of the first species of amphibians to be introduced into the Hawaiian Islands and may have been one of the frogs that was imprted prior to 1867." It occurs on all of the islands. Bullfrogs are active primarily at night, and I did not happen to see any during my field work. However, Shallenberger (1977:245) noted that bullfrogs "were heard at all sites" (that is, at Punahoolapa, Punamano, and Kii ponds).

Bullfrogs are serious predators on the small downy young of waterbirds. I have found the remains of young Koloa in the stomach of a bullfrog, and two small ducklings were taken from the stomach of a bullfrog at Waimea Falls Park in 1982.

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B. Wrinkled Frog, Rana rugosa

This frog was introduced to Hawaii from Japan in 1896 (McKeown, 1978). It is most common in mountain streams, although Shallenberger (1977:245) found this species at Punahoolapa pond. McKeown noted that the wrinkled frog and the bullfrog rarely are found together because the latter species is such an aggressive feeder.

C. Giant Neotropical Toad, Bufo marinus

This toad was first introduced to the islands in 1932, "when Dr. C. E. Pemberton brought 148 adult toads from Puerto Rico. Eighty of these were liberated in a taro patch near Waipio, Oahu, and 69 were released in a swampy part of Manoa Valley" (Oliver and Shaw, 1953:77). "In a little over two years more than 100,000 descendents of the original stock were distributed through Dr. Pemberton's activities throughout the islands." Hunsaker and Breese (1967) wrote that this toad was "the commonest species of amphibian" in Hawaii. They are active primarily at night, and I did not happen to see any during my field work, although they surely occupy much of the habitat in the project area.

UPDATE OF BRUNER'S 1978 STUDY

Bruner (1978, 3 and Table 1) recorded 20 species of "non-wetland birds" during his 1978 field work. This included three species that I did not find during August 1984: one Great Frigatebird, Fregata minor, a native seabird that he saw flying over the marsh; and two introduced gamebirds, Ring-necked Pheasant, Phasianus colchicus, and Erckel's Francolin, Francolinus erckelii. The breeding season for the gamebirds was over in August, hence the birds were quiet and I did not find any. Bruner also noted one endemic Hawaiian Owl or Pueo, Asio flammeus sandwichensis, in flight over the marsh on one occasion during his four man/days of field work. I have not discussed the Pueo because this diurnal owl forages over a wide home range, and because there is no evidence that it nests in the project site.

I have discussed 17 species of introduced birds, including one (Melodious Laughing-thrush) not included in Bruner's Table 1. In addition, there has been a considerable increase in the population of some of the introduced finches since 1978, notably the Red-eared Waxbill and the Black-headed Munia.

In addition to updating Bruner's 1978 survey, I have also discussed the introduced mammals, reptiles, and amphibians of the project site.

There has been no significant change in the marsh avifauna since Bruner's 1978 survey.

IMPACTS OF DEVELOPMENT AROUND PUNAHOOLAPA MARSH

I was asked to "assess the impacts of the proposed activities in and around the marsh (clearing vegetation within the marsh, construction of golf course, and residential structures near the perimeter of the marsh) on the fauna of the marsh."

The answers to these questions depend primarily on the nature and history of Punahoolapa marsh. David Woodside (who has more than 30 years of experience with Hawaiian fauna and flora and who now is with the U.S. Fish & Wildlife Service) told me that the water table of the marsh and the nearby Federal refuge ponds is so high that four pumps were kept in operation continually in order to remove water so as to allow the growing of sugarcane in the makai regions of Kahuku. This means that Punahoolapa, Punamano, and Kii ponds occupy a natural marsh ecosystem. This habitat is of critical importance to the future welfare of all of the endangered Hawaiian waterbirds on Oahu, primarily because of the historical loss of so much excellent waterbird habitat on this island. Two prime examples of the destruction of outstanding waterbird habitat on Oahu are a Kaelepulu pond (now "Enchanted Lake" in Kailua) and Salt Lake on leeward Oahu. During the 1940's, more than 1,000 Coots inhabited Kaelepulu pond (Schwartz and Schwartz, 1952). There now is very little nesting habitat for any of the waterbirds in Enchanted Lake or Salt Lake. Long gone, also, are the "duck ponds" at Waikiki.

The crux of the problem is that once a natural marsh is destroyed, either by draining or by filling, it is destroyed forever. There is little doubt now that the U.S. Fish and Wildlife Service should have included Punahoolapa marsh when the James Campbell National Wildlife Refuge was established. Therefore, as much as possible of Punahoolapa marsh should be preserved.

In a letter to Group 70, the U.S. Fish & Wildlife Service recommended that the following steps be taken to preserve and improve the marsh habitat for the endangered Hawaiian waterbirds:

1. That a moat be dug to surround completely the marsh area that will be delineated.

2. That additional open waterways be created makai of the existing open water areas to open up more feeding and loafing habitat for the waterbirds.

3. That islands be built in the new open water areas in order to provide safe nesting habitat for the Hawaiian duck and the stilt.

4. That a fence be constructed around the moat in order to keep dogs out of the marsh.

5. That the marsh be screened with landscaping. This could be implemented by installing a band of vegetation between the fence and the moat, or by installing a combination of vegetation and fence.

If these conditions are achieved, it is my opinion that "clearing vegetation within the marsh, construction of a golf course, and residential structures near the perimenter (of the buffer zone) of the marsh" would have no adverse effects on any of the endangered Hawaiian waterbirds. In fact, clearing of some of the vegetation within the marsh would be an asset to the birds because much of the marsh (e.g., Bruner's areas B and C) is so clogged with bulrushes and other aquatic vegetation now as to be virtually useless for the waterbirds. It was the determination of the U.S. Fish and Wildlife Service and myself, that the proposed "fill" areas (approximately 12 acres) would have no detrimental effects on the waterbirds.

IMPACTS OF REMOVING THE WASTE STABILIZATION POND

Although this pond provides some feeding and resting habitat for coots and herons, primarily, I firmly believe that it is of minor importance to these birds. Bruner (1978:4) wrote that "the Kuilima sewage pond is of particular importance to the (non-resident (migratory)) waterbirds. This open water area is used primarily for feeding and loafing." However, in his Table 2, Bruner lists only seven species of waterbirds. Of the seven, five of these species he recorded as being "rare" or "uncommon" to the site. Another, the Golden Plover, was seen primarily on the golf course and "at the old Kahuku air strip." He also noted a "considerabale movement of Northern Shovelers and Pintails between this pond and other ponds (i.e., Punahoolapa, Punamano) in the area."

I believe that it is reasonable to conclude that loss of the waste stabilization pond would have a negligible effect on either the endemic or the migratory waterbirds.

SUMMARY AND CONCLUSIONS

1. Punahoolapa marsh is a part of a natural wetland habitat that includes Punamano and Kii ponds.

2. If the changes and improvements recommended by the U.S. Fish and Wildlife Service and itemized on page 15 of this report are made, Punahoolapa marsh would become a signficant wetland habitat for increasing the numbers of all of the endangered Hawaiian waterbirds on Oahu, providing that optimal water levels are maintained.

3. If a moat, chain-link fence, and the other improvements are made for the marsh, the proposed golf course, residential units, and elimination of the waste stabilization pond should have no adverse effects on any of the endangered waterbirds.

4. At last 20 species of introduced birds have been found on the Kuilima properties. None are endangered, and many have proven to be serious pests, especially to agricultural crops, and the Barn Owl is known to prey on native birds. There have been no important changes in the avifauna of the area since Bruner's 1978 studies, although there have been considerable increases in the populations of some of the alien seed-eating birds, notably the Black-headed Mannikin and the Red-eared Waxbill.

5. All of the mammals, land reptiles, and amphibians in the project area are introduced or alien animals. Many of thee are predators on birds or are destructive to agricultural crops and other products. None of these animals are of any significance to the proposed development plans.

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APPENDIX G

REPORT ON DRAINAGE IMPACTS ON THE PUNAHOOLAPA MARSH

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June 11, 1985

Group 70, Inc.
924 Bethel Street
Honolulu, Hawaii 96813

Attention: Ms. Sheryl B. Seaman

Gentlemen:

Revised
Final Letter Report
Drainage Impacts on Punahoolapa Marsh
Proposed Kuilima Resort Expansion
Kahuku, Oahu, Hawaii

Per our revised proposal of August 15, 1984, and our subsequent contract, we submit this final letter report of our evaluation of drainage impacts on Punahoolapa Marsh which could result from the proposed Kuilima Resort expansion at Kahuku, Oahu. This report is based upon:

1. Our review of existing descriptive literature of the marsh and a one-day field reconnaissance to obtain a general description of the flora and fauna of the area.

2. A literature review and evaluation of reported pollutant washoff rates published by the U.S. Environmental Protection Agency (EPA) and our selection of the washoff rates most applicable to the proposed development, the drainage study conducted by EDP Hawaii, Inc., and our review of the National Weather Service rainfall event records.

The report uses a simplified methodology appropriate for determining if potential pollutants could affect the marsh. More refined techniques exist but were not used at this level of effort. The techniques utilized are conservative in that they maximize the estimate of potential pollutants, possibly creating a "worst case" scenario. The following sections describe our baseline assumptions on the marsh, rainfall and drainage conditions, and the pollutant washoff rates. Furthermore, they present the integration of these assumptions into pollutant loading of the marsh and its anticipated impacts.

PUNAHOOLAPA MARSH

For our study, we examined and defined the marsh as it presently exists. For our pollutant washoff and loading calculations, we utilized the modified configuration that you have agreed upon with the U.S. Fish and Wildlife Service (FWS).

Punahoolapa Marsh is a 106.8-acre wetland. Geologically, the marsh lies in a large solution depression on the low-lying Kahuku plain. The surface of the marsh, which lies between Elevation 2 and 5 feet, is very level and is underlain by a peat and organic clayey silt up to 20 feet thick. Several small ponds occupy sinkholes within the area.

The only other geographic feature of note in the marsh is an old railroad right-of-way causeway several feet high which bisects the marsh on an east-west line. This causeway is currently overgrown with shrubby vegetation and is nearly impassable. During the time of the survey, much of the marsh was covered by several inches of water, but in most places this was not visible because of the dense vegetation covering the area. The water is fresh to slightly brackish.

The marsh was visited on the 16th of September 1984. Much of the perimeter of the marsh was examined, and a reconnaissance was made across the northern part. All species encountered were recorded, and rough estimates of their abundance were made. Only one voucher specimen was collected, that of Fimbristylis sieboldii, which was deposited at the Bishop Museum Herbarium.

To augment the field work, a review of the literature was made, and maps and photos examined. A partial checklist of the species occurring in the marsh is found in Table 1.

At the time of the survey, four main types of vegetation could be distinguished in and around the marsh -- marshland, mudflats, marginal swamp forest, and marginal scrub-thickets.

A. Marshland

At the time of the survey, the major portion of the marsh was covered with a dense, nearly impassable marsh vegetation dominated by five species -- Scirpus californicus (great bulrush), Scirpus lacustris (great bulrush), Cladium leptostachyum (native sawgrass or 'uki), Pluchea indica (Indian pluchea), and Brachiaria mutica (California grass). Of these, only Cladium is native (Stemmermann, 1981) although some authors consider Scirpus lacustris to be native as well. These five species are not homogeneously distributed, but form a mosaic most likely determined by differences in substrate, depth of water, distance from the edge of the marsh, disturbance, and historical factors. All of these species were judged to occupy at least 10 percent of the area, with Pluchea the least abundant one. Another species noted in this association was Schinus terebinthifolius; the few trees seen looked like hammocks rather than trees because of a dense tangle of California grass that covered them.

In many places, dead plant material, particularly from California grass, forms a dense layer underneath the living plants. The density of the vegetation is a major factor contributing to the paucity of species in this association.

B. Mudflats

This type of vegetation is mostly restricted to the part of the marsh south of the causeway, and comprises most of the remainder of the mudflats which are not covered by the marshland. It is heterogeneous, consisting of low-growing herbaceous species interspersed with shrubs. The shrubby species are Pluchea indica (Indian pluchea), Pluchea x fosbergii (hybrid pluchea), and Pluchea odorata, the same ones which form the marginal scrub-thickets.

The areas of herbaceous vegetation are dominated by Sesuvium portulacastrum and Bacopa monnieria (water hyssop), an indigenous species in the snapdragon family, with smaller amounts of Eleocharis geniculata (spike rush), Scirpus spp., Mariscus javanicus (also known as Cyperus javanicus), Pycreus polystachyos (also commonly known as Cyperus polystachyos) and Fimbristylis sieboldii. The latter species, which forms dense clumps, has not been recorded previously in Hawaii. This sedge is native to Korea, Japan, the Ryukyus, Taiwan, and mainland China, but it is uncertain how or when the species arrived in Hawaii. It also was found in a small patch on the northwest corner of the marsh.

Adjacent to, and just across a dirt road from this patch of Fimbristylis is an open sandy area which is currently dominated by the succulent Sesuvium portulacastrum ('akulikuli). This is more of a littoral or brackish water plant species, and its presence there could indicate that either the sandy soil, or possibly the salinity of the water, deters the other more typical fresh-water marsh species from growing there.

The ponds within the marsh are mostly open water, but a few of them are covered with a thin, green layer of the tiny Lemna minor, and introduced duckweed.

C. Marginal Swamp Forest

Along the edges of the marsh, and in some places extending into the marsh itself, are small areas of forest composed of Casuarina equisetifolia (ironwood) and Hibiscus tiliaceus (beach hibiscus or hau). Ironwood is normally a littoral or dryland species, and in some places around the marsh, particularly along the north side, it forms a non-wetland forest with an open understory having a dense ground layer of its pineneedle-like "leaves." Its presence in the wetlands may indicate recent changes in elevation or water level within some parts of the marsh. The beach hibiscus, on the other hand, is a wetland or marginal wetland tree that forms dense, nearly impenetrable thickets in several places on the southern part of the marsh.

D. Marginal Scrub-thickets

Along the edge of the swamp there are dense thickets formed by several species of shrubs or small trees — Christmas berry, Koa haole, and the three Pluchea species. These thickets are very dense, particularly when California grass grows in them. The shrubs are not very hydrophytic, particularly the koa haole, and their presence usually indicates the margins of the wetlands. This vegetation also dominates the causeway which crosses the marsh.

No critical plant species were found in the marsh, although the Fimbristylis sieboldii has never been recorded in Hawaii.

Previous studies (Elliott and Hall, 1979) noted the presence of the Hawaiian Duck, Hawaiian Stilt, Hawaiian Coot, and Hawaiian Gallinule, all of them endemic, and the indigenous Black-crowned Night Heron. During the present field work, however, none of these were observed, although the latter species was seen sitting in the trees just to the west of the marsh. This may be due to the present drought-related decrease of standing water and/or the dense weedy vegetation that has closed up any open areas which are suitable to the feeding and nesting habits of those birds.

Several other species of birds were observed during the present field work, such as Common Mynahs and Mourning Doves, but no native birds other than the wetland species mentioned above were seen, nor would any other native birds be expected to occur in this highly disturbed area.

DRAINAGE CONDITIONS AND RAINFALL

The drainage area evaluated in our study is depicted in Figure 1. For our purposes we have assumed that 430 acres (0.672 square miles) of predominantly undeveloped land drain entirely into Punahoulapa Marsh. This contributes to the "worst case" scenario as some of this area would not drain into the marsh, but would drain into the drainage swale and off site.

With site development, some minor modification to the marsh boundaries will take place, and portions of the presently undeveloped drainage area would be transformed into stables, a club house, roadways, golf course, and resort residential use of densities from 12 to 16 units per acre. The area of the marsh will be reduced by 7 acres (0.011 square miles). Figure 2 depicts the proposed land use, and Table 2 presents the area in each land use category.

The percentage of rainfall that drains from each land use type varies. Roadways have high factors (coefficients) of drainage, whereas golf courses have low factors (coefficients). We used runoff coefficients provided in the EDP Hawaii, Inc. drainage study for this study.

We selected the average monthly rainfall as the event most likely to have an affect on an ecosystem as complex as Punahoulapa Marsh. Monthly rainfall data collected by the U. S. National Weather Service at a Kahuku rain gage from 1891 through 1983 was examined. The driest month was selected to represent the minimum event, and the wettest month was selected to represent the maximum event. These were a May (0.1 inches) and a February (36.8 inches) during the period of record. For the average event, we averaged the rainfall for all months recorded (3.3 inches).

The anticipated drainage by proposed land use type within the study area was calculated for the minimum, average, and maximum rainfall events and is presented in Table 3. For comparison, Table 3 also presents drainage from the project area under existing conditions. The minimum flows are 3 percent of the average flow, and the maximum flows are 1,115 percent of the average flow.

POLLUTANT WASHOFF RATES

As discrete point sources of pollutants (such as wastewater treatment plant discharges) were treated and the pollutants reduced, EPA focused attention on identifying and controlling the more diverse, nonpoint sources of pollution. Such sources as nutrients from distribution of fertilizer, lead-containing particles from automobile exhaust, or solids eroded from adjacent lands influence the water quality of receiving waters. Because these potential pollutants are carried by rainwater drainage, they are said to "washoff" from adjacent land into the affected area. Washoff rates are therefore the amount of each potential pollutant carried by each type of drainage event. These rates are expressed in pounds of pollutant per square mile per day. The sum of pollutant washoff over time is called pollutant loading. These are expressed as pounds per month.

EPA has studied extensively the washoff rates of various potential pollutants from different land use types. For this study, we reviewed EPA published washoff rates for the potential pollutants of concern, and based upon our evaluation of the proposed surrounding land uses, we selected washoff rates appropriate for the present land use and the proposed development. The range of washoff rates reported in the EPA studies and the rates selected for each contaminant of concern are presented in Table 4.

POTENTIAL POLLUTANT LOADING OF PUNAHOOLAPA MARSH

Based upon the acres in various land uses, and the selected washoff rates for potential pollutants, we calculated the average monthly pollutant loading of Punahoolapa Marsh. Loadings for both present and proposed land use were estimated. These estimated loadings are presented in Table 5. The calculations indicate an increase for all pollutants of concern over the existing estimated loadings. A graphical representation of the potential pollutants as compared to present loadings is presented in Figure 3.

To determine loadings under the minimum and maximum monthly rainfall, we adjusted the pollutant loadings based upon the ratio of the minimum and

minimum rainfall events to the average event. Therefore, minimum pollutant loadings would be 3 percent of the average and maximum pollutant loading would be 1,115 percent of the average.

These calculated loadings are the estimated amounts of pollutants that could wash into the marsh. Depending upon the configuration, flora and fauna, and flushing rate of the marsh, various percentages of each type of contaminent would remain in the marsh. The remainder would flow through the marsh and be discharged.

IMPACTS ON PUNAHOOLAPA MARSH

The proposed clearing of the marsh for avifauna habitat, with specific recommendations provided as proposed by the U.S. Fish and Wildlife Service, would be a significant alteration and modification of the existing wetland ecosystem. The open water/vegetation ratio and the hydraulic characteristics of the marsh would be altered. In addition, wetland flora and fauna are anticipated to be changed. This, in fact, is the purpose of the proposed clearing--with the intent to create a wetland habitat more favorable to selected waterbirds.

This study did not evalute the impact of the proposed clearing and alteration of the marsh, and offers no opinion on the modifications.

The total suspended solids loading to the marsh are estimated to increase by 32 percent. This loading estimate does not consider subsequent washout from the marsh of the solids, and should be considered an "exposure" rather than an increase to the solid material that will remain within the marsh. The impacts of potential increased solids loading on the existing Punahoolapa Marsh due to proposed modifications in existing land use are anticipated to be relatively minor when compared to the planned clearing and other modifications of the marsh which will more drastically alter the existing ecosystem. Thus, the impacts of increased pollutant loading should be used only as an indication of pollutants the new ecosystem would be exposed to, rather than an indication of the impacts the pollutants would have on the existing environment.

The nitrogen loading of the marsh would increase from 117 to 222 pounds per month. Most of this increase is due to the increased input from the planned golf course. This increase in nutrients will stimulate growth of both the algal species in the pond and the emergent vegetation along the perimeters of the pond.

The total suspended solids will increase from an estimated 23,185 pounds to an estimated 30,584 pounds per month. This is a less dramatic increase and should not be a significant impact on the marsh.

The calculated loading of lead indicates an increase from the present 12 pounds per month to 15 pounds per month. This impact is deemed minor. This is attributed to the increased vehicular traffic within the development. The calculations assumed that leaded gasoline would continue in use. Present indications are that the U.S. Environmental Protection Agency will phase out leaded gasoline and that this increase will not occur.

Dames & Moore

There will be an increase in polychlorinated hydrocarbons (HCX) due to increase use of herbicides, pesticides, etc. on the adjacent golf course. This increase is a substantial percentage over existing levels. However, the total loading remains small. The increase could be further minimized through the re-assessment of needs for pesticides, herbicides, and the like. Present pesticide applications at the existing golf course are outlined on Table 6.

Increased drainage to the marsh will also occur as a result of the development. The average flow may increase from the presently estimated 10.15 million gallons per average month to 17.53 million gallons per average month. This increased flow will be a significant factor in how much of the estimated pollutant loadings are retained in the marsh. As flow increases, fewer suspended solids settle out of the runoff, and the time that hydrocarbons are in contact with the flora or fauna is likewise reduced. Increased flow through the marsh will result in many of the algal species, that might otherwise benefit from the increased nitrogen, being washed out of the ecosystem. This will result in a less diverse aquatic environment than might otherwise exist.

- o0o -

Yours very truly,

DAMES & MOORE

S. K. Djou
Partner

SKD/JJK:oo(2071A/226A:13993-001-11)
(Two copies submitted)

Attachments:

References

Figure 1 - Punahoolapa Marsh Drainage Area Affected by the Proposed Development
Figure 2 - Proposed Land Use with Development
Figure 3 - Comparison of Present and Proposed Potential Pollutant Loadings at Punahoolapa Marsh

Table 1 - Partial Checklist of the Flora of Punahoolapa Marsh
Table 2 - Acres of Proposed Land Use Type
Table 3 - Drainage into Punahoolapa Marsh by Proposed and Present Land Use
Table 4 - Potential Pollutant Washoff Rates
Table 5 - Estimated Present and Proposed Potential Pollutant Loading into Punahoolapa Marsh
Table 6 - Pesticide Applications at Existing Golf Course

cc: Kennedy/Jenks Engineers
Attention: Don F. Graf

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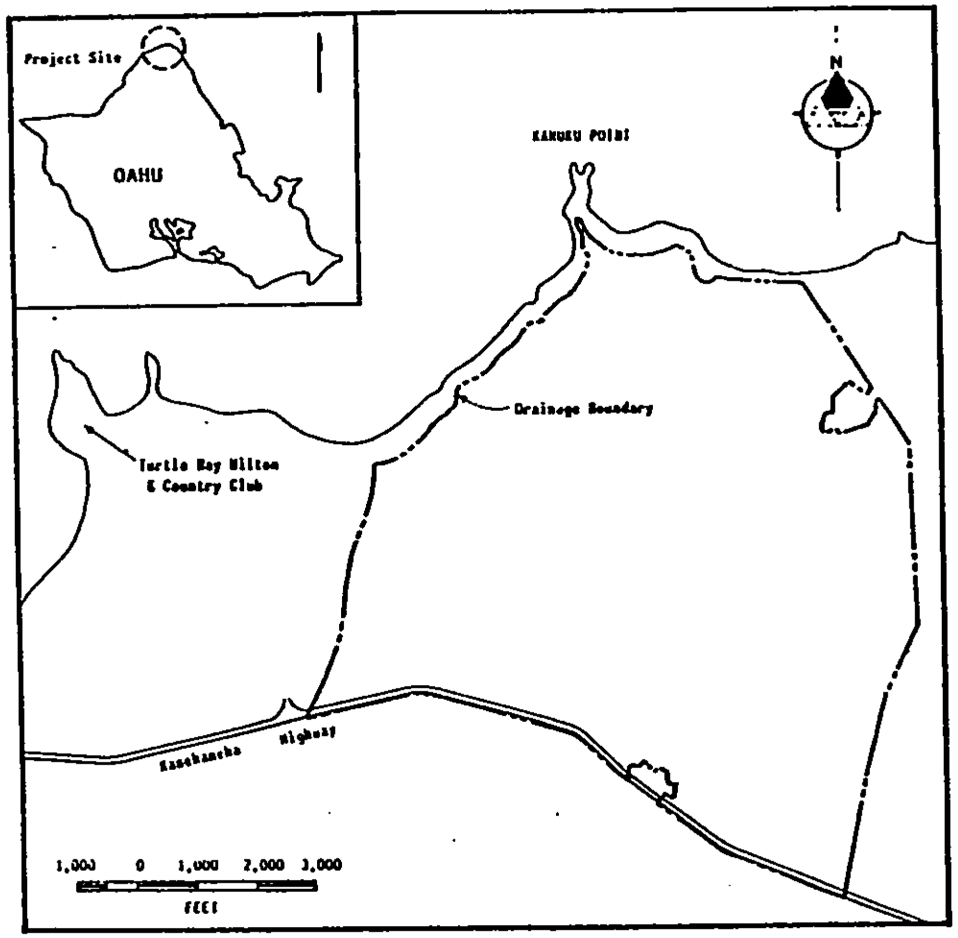
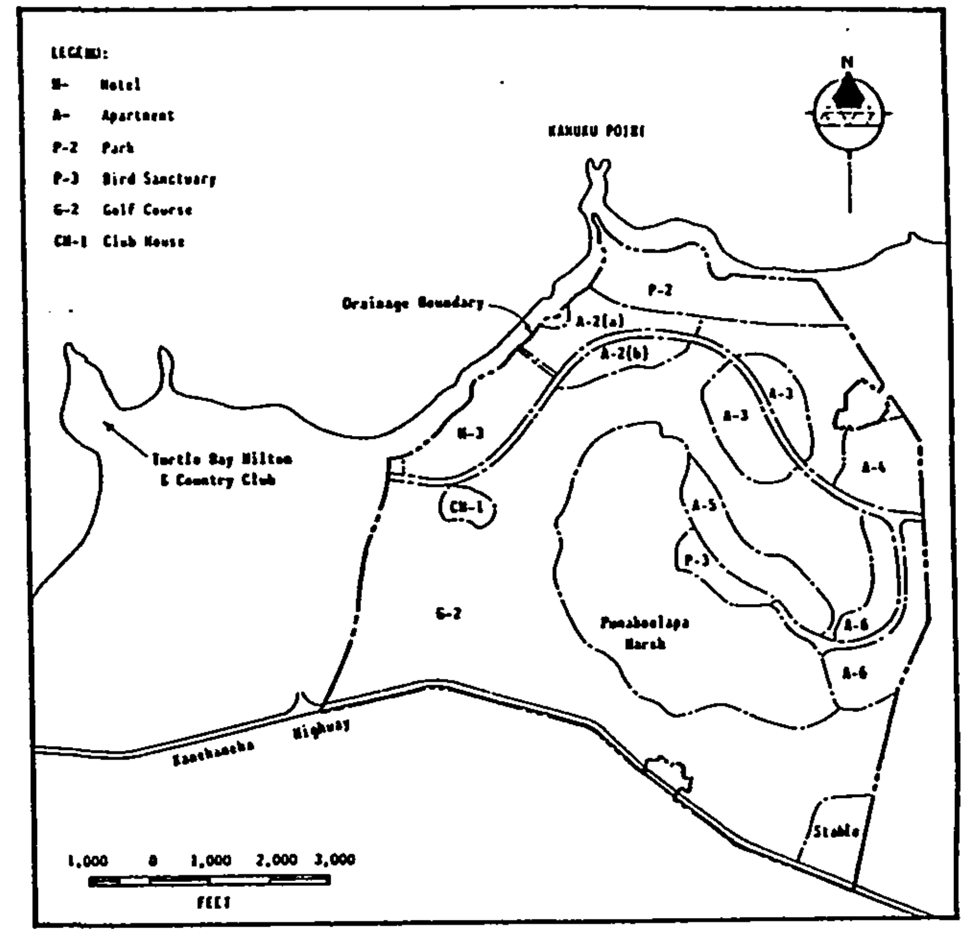


REFERENCE:
Group 70, Inc.
Kuilima Resort - Existing Plan, Master Plan
Dated 6 August 1984

PUNAHOOLAPA MARSH DRAINAGE AREA
AFFECTED BY THE PROPOSED DEVELOPMENT

DAMES & MOORE

FIGURE 1



REFERENCE:
Group 70, Inc.
Kuilima Resort - Existing Plan, Master Plan
Dated 6 August 1984

PROPOSED LAND USE WITH DEVELOPMENT

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FIGURE 2

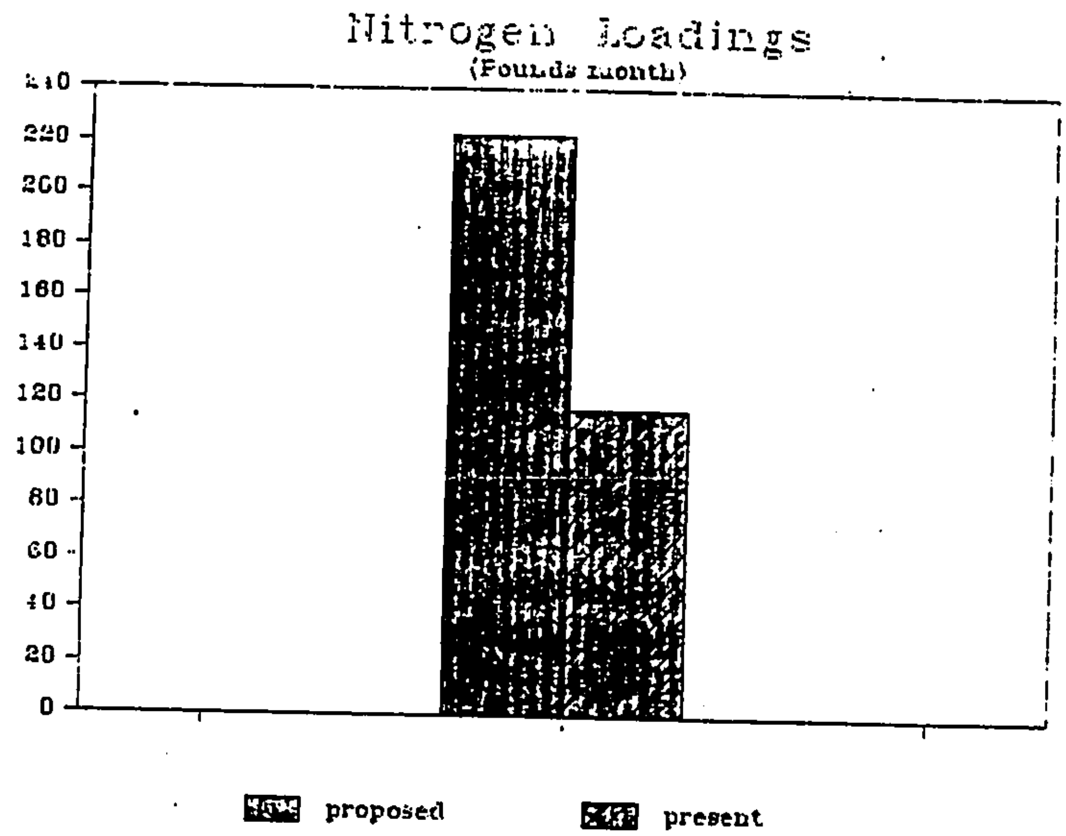

FIGURE 3A

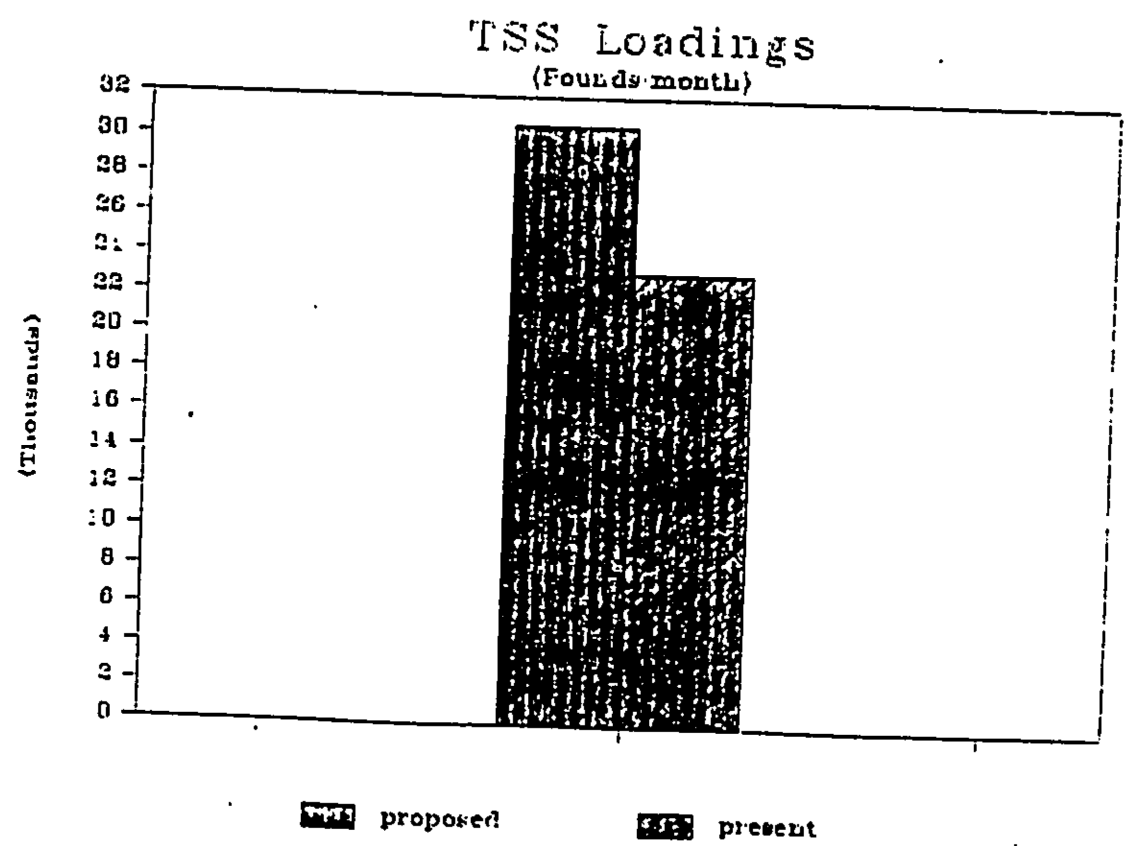

FIGURE 3B

Lead (Pb) Loadings

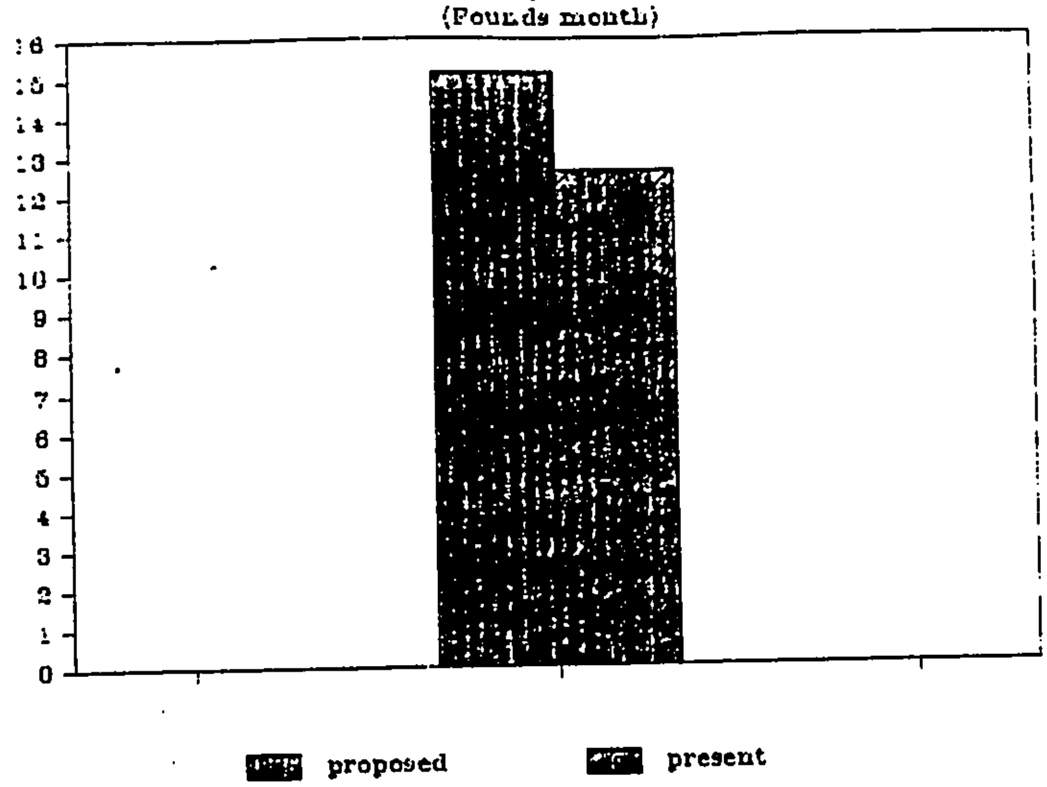

FIGURE 3C

Hydrocarbon (HCX) Loadings

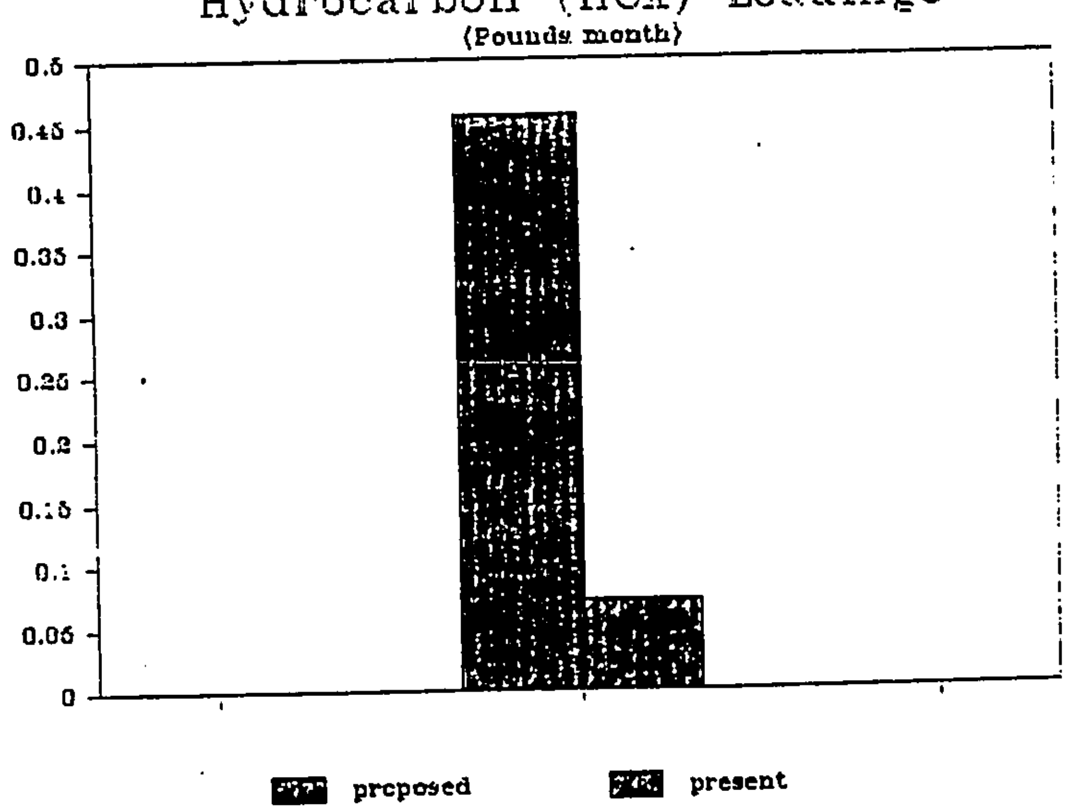

FIGURE 3D

TABLE 1

Partial Checklist of the Flora of Punahoolapa Marsh*

Species	Common Name	Status**
Bacopa monnieria (L.) Wettst.	Water hyssop	I
Brachiaria mutica (Forsk.) Stapf	California grass	X
Casuarina equisetifolia L.	Ironwood	X
Cladium leptostachyum Nees & Meyen	Native Sawgrass, 'uki	E
Cynodon dactylon (L.) Pers.	Bermuda grass	X
Eleocharis geniculata (L.) R. & S.	Spike rush	X
Fimbristylis sieboldii Miq.	----	X
Hibiscus tiliaceus L.	Beach hibiscus, hau	A
Ipomoea pes-caprae (L.) R. Br.	Beach morning-glory	I
Lemna minor L.	Duckweed	X
Leucaena leucocephala (Lam.) deWit	Koa haole	X
Mariscus javanicus (Houtt.) Merr. & Metc.	'Ahu'awa	I
Syzygium cumini (L.) Skeels	Java plum	X
Phymatosorus scolopendria (Burm.) P. Serm.	Maile-scented fern	X
Pluchea x fosbergii Coop. & Gal.	Hybrid pluchea	X
Pluchea indica (L.) Less.	Indian pluchea	X
Pluchea odorata (L.) Cass.	Pluchea	X
Pycreus polystachyos (Rottb.) Beauv.	----	I?
Schinus terebinthifolius Raddi	Christmas berry	X
Scirpus californicus (Meyer) Steud.	Great bulrush	X
Scirpus lacustris L. spp. validus (Vahl) Koyama	Great bulrush	X
Sesuvium portulacastrum (L.) L.	Sea purslane, 'akulikuli	I

*This list was compiled from observations, the checklist from Elliott and Hall, and personal communication with Erin Hall. A more detailed reconnaissance would have resulted in a more complete checklist.

** A = Aboriginal introduction
E = Endemic
I = Indigenous
X = Exotic (introduced)

TABLE 2

Acres of Proposed Land Use Type

Proposed Parcel	Land Use Designation	Acres
*H-3	House, 16 units/acre	22
*A-2(a)	House, 15 units/acre	14
*A-2(b)	House, 15 units/acre	7.2
*A-3	House, 15 units/acre	21
*A-4	House, 12 units/acre	15
*A-5	House, 12 units/acre	17
*A-6	House, 12 units/acre	25
°P-2	Park	37
°P-3	Bird Sanctuary	6
CH-1	Club House	5
Stable	Agriculture	10
Marsh	Preserve	100
G-2	Golf Course	194
Roadway (within development)		17
Highway (adjacent to development)		4.8

* These categories treated as identical land uses.
° These categories treated as identical land uses.

Reference:
Group 70, Inc.
Kuilima Resort - Existing Plan, Master Plan
Dated 6 August 1984

TABLE 3

Drainage into Punahoolapa Marsh
by Proposed and Present Land Use

Proposed Land Use Type	Acres	Square Miles	Run Coeff.	Flow (gallons per month) Minimum	Average	Maximum
Hotel (12-16 units/acre)	121.20	0.189	0.80	263,217	8,686,166	96,863,908
Park & Bird Sanctuary	43.00	0.067	0.20	21,346	770,431	8,591,477
Club House	5.00	0.008	0.80	10,859	358,340	3,996,036
Stable	10.00	0.016	0.27	7,330	241,880	2,697,324
Golf Course*	229.00	0.358	0.27	167,850	5,539,043	61,768,742
Roadway	17.00	0.027	0.99	45,688	1,507,716	16,813,321
Highway	4.80	0.007	0.99	12,900	425,708	4,747,291
Total	430.00	0.672		531,190	17,529,284	195,478,081

Present Land Use Type	Acres	Square Miles	Run Coeff.	Flow (gallons per month) Minimum	Average	Maximum
Golf Course	35.00	0.055	0.27	25,654	846,579	9,440,635
Runway Pavement	44.50	0.070	0.70	84,563	2,790,574	31,119,635
Highway	4.80	0.007	0.99	12,900	425,708	4,747,291
Agriculture	76.00	0.119	0.20	41,263	1,361,693	15,184,936
Pond	5.90	0.009	0.00	0	0	0
Open Space	263.80	0.412	0.20	143,227	4,726,507	52,707,712
Total	430.00	0.672		307,607	10,151,061	113,199,703

*Includes 35 acres of existing golf course.

References:
U.S.E.P.A., 1977. Evaluation of Combined Sewer Outflows and Urban Stormwater Discharge.
U.S.E.P.A., 1976. Areawide Assessment Procedure Manual, Volume I.
Group 70, Inc., Kuilima Resort - Existing Plan, Master Plan, Dated 6 August 1984

TABLE 4

Potential Pollutant Washoff Rates

Land Use Designation	Pollutant	Reported Range (lbs/square mile/day)	Selected Value
Hotel 12-16 units/acre	N	3.3 - 28.0	8
	TSS	306-7,526	3400
Park and Bird Sanctuary	N	1.3-16.0	2
	TSS	71-620	400
Club House	N	3.3-28.0	8
	TSS	306-7,526	3400
Stable	N	1.9-58.0	58
	TSS	449-6,594	2500
Golf Course	N	3.9-13.3	13.3
	TSS	19-1,320	670
	(b)HCX	N/A	4.25×10^{-2}
Highway(a)	N	N/A	5.58×10^{-3}
	TSS	N/A	35.7
	Pb	N/A	0.419
Roadway(a)	N	N/A	1.14×10^{-3}
	TSS	N/A	7.32
	Pb	N/A	8.58×10^{-2}
Runway Pavement	N	3.3-28.0	8
	TSS	306-7,526	3400
Agriculture	N	1.9-58.0	15
	TSS	449-6,594	2500
Open Space	N	1.3-16.0	2
	TSS	71-620	400

(a) Based upon Axle-Miles and traffic estimates. Selected values in lbs/day

(b) Calculated based upon present applications to existing golf courses

N = Nitrogen
TSS = Total Suspended Solids
Pb = Lead
HCX = Chlorinated Hydrocarbons from pesticides, herbicides, etc. by total weight (Active ingredient is 5-10% of total weight)

References:
U.S.E.P.A., 1977. Evaluation of Combined Sewer Outflows and Urban Stormwater Discharge.
U.S.E.P.A., 1976. Areawide Assessment Procedure Manual, Volume I.
Group 70, Inc., Kuilima Resort - Existing Plan, Master Plan, Dated 6 August 1984

TABLE 5

ESTIMATED PRESENT AND PROPOSED POTENTIAL POLLUTANT LOADING INTO PUNAHOOLAPA MARSH

		Pollutant Washoff Rate (lbs/sq. mi/day)				Loading of Pollutants in Pounds/month			
Proposed Land Use Type	Square Miles	N	TSS	Pb	HCX	N	TSS	Pb	HCX
Hotel	0.109	8	3400			45.36	17270		
Park & Bird Sanctuary	0.067	2	400			4.02	804		
Club House	0.008	8	3400			1.92	816		
Stable	0.016	50	2500			27.84	1200		
Golf Course	0.358	13.3	670		0.0425	142.842	7195.8		0.45645
Roadway$	0.027	0.00814	7.32	0.0058		0.0342	219.6	2.574	
Highway$	0.007	0.00558	35.7	0.419		0.1674	1871	12.57	
Total	0.472					222.1836	30584.4	15.144	0.45645

		Pollutant Washoff Rate (lbs/sq. mi/day)				Loading of Pollutants in Pounds/month			
Present Land Use Type	Square Miles	N	TSS	Pb	HCX	N	TSS	Pb	HCX
Golf Course	0.055	13.3	670		0.0425	21.945	1105.5		0.070125
Runway Pavement	0.070	8	3400			16.8	7140		
Highway$	0.007	0.00558	35.7	0.419		0.1674	1871	12.57	
Agriculture	0.119	15	2500			53.55	8925		
Pond	0.009								
Open Space	0.412	2	400			24.72	4944		
Total	0.672					117.1824	23185.5	12.57	0.070125

$ Washoff Rates represented in lbs/day

REFERENCE:
U.S.E.P.A., 1977. Evaluation of Combined Sewer Outflows and Urban Stormwater Discharge.

U.S.E.P.A., 1976. Areawide Assessment Procedure Manual, Volume I.

GROUP 70, Inc. Kuilima Resort - Existing Plan, Master Plan, Dated 6 August 1984.

TABLE 6

PESTICIDE APPLICATIONS AT EXISTING GOLF COURSE

	Application Rate
Herbicides:	
Banvel	1/2 pound per acre per day
Bueno Co	44 ounces per acre per day
Caliber 90	1.0 pound per acre per day
Lexon Vs	1/3 pound per acre per day
Fungicides:	
Dithene	11 pounds per acre approximately every 2 weeks
Chipco	5 pounds per acre approximately every 2 weeks
Insecticides:	
Dursban	1 quart per acre approximately every three to four months

Reference:
Turtle Bay Hilton Manager of Golf Course Maintenance, September 1984. Personal Communication.

APPENDIX H

SUBSURFACE ARCHAEOLOGICAL RECONNAISSANCE SURVEY REPORT

PAUL H. ROSENDAHL, Ph.D., Inc.
Consulting Archaeologist

Report 137-100784

SUBSURFACE ARCHAEOLOGICAL RECONNAISSANCE SURVEY
KUILIMA RESORT EXPANSION PROJECT

Lands of Opana, Kawela, Hanakaoe, Oio,
Ulupehupehu, Punalau and Kahuku
Koolauloa, Island of Oahu
(TMK:5-6-03 [Por.]; 5-7-01, -03 [Por.], -06)

by

Joyce E. Bath, M.A.
Archaeologist

with

Margaret L. K. Rosendahl, S.O.P.A.
Archaeologist

and

Paul H. Rosendahl, Ph.D.
Principal Archaeologist

Prepared for

Group 70
924 Bethel Street
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and

Kuilima Development Corporation
1001 Bishop Street
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November 1984

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SUMMARY

A subsurface archaeological reconnaissance survey was conducted in September 1984 for Group 70 and Kuilima Development Corporation by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in connection with the proposed expansion of the Kuilima Resort. The area surveyed includes portions of the lands of Opana, Kawela, Hanakaoe, Oio, Ulupehupehu, Punalau, and Kahuku in the District of Koolauloa, Island of Oahu.

Thirteen survey areas varying in size and location were selected for subsurface testing. A total of 135 test units, 124 auger tests and 11 faced-section tests of subsurface exposures, were excavated. Sixty man-days were expended on testing.

Two previously designated sites (50-Oa-F4-14 and -15) were tested. Seven additional sites (T-1 thru T-7) were identified, and of these, five (T-1, -2, -4, -6, -7) were tested. Based on documentary research, recovered portable remains, and radiocarbon age determinations, cultural sites were found to range in age from early prehistoric (possibly as early as c. 165 B.C.-A.D. 210) to modern. Recorded site types include indigenous subsurface occupation deposits and burials, possible agricultural soils, historic stone walls, a modern military structure, and a recent corral. Subsurface deposits in Punahoolapa Marsh previously identified as possible prehistoric agricultural soils (Site F4-15) were found to pre-date human occupation of the Hawaiian Islands.

Sites 50-Oa-F4-14 and T-1 possess high scientific research potential, and require immediate physical protection (fencing of site perimeters). Intensive survey and testing is recommended for these sites and Site T-6, limited testing for Site T-7, and limited testing and monitoring for F4-15 and its vicinity. Sites T-3 and T-5 require no further archaeological work, but they possess low to moderate interpretive value and could be incorporated into project area landscaping. Limited testing and/or archaeological monitoring is recommended for portions of Survey Areas 8, 11, and 13 that may have subsurface prehistoric agricultural soils. Archaeological clearance with no further archaeological work is recommended for Sites T-2 and T-4, and for remaining portions of all survey areas.

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INTRODUCTION

This report presents the final results of subsurface archaeological reconnaissance conducted by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in connection with the proposed expansion of the Kuilima Resort planned by Group 70 for the Kuilima Development Corporation. The project area surveyed includes portions of the lands of Opana, Kawela, Hanakaoe, Oio, Ulupehupehu, Punalau and Kahuku, in the District of Koolauloa, Island of Oahu (Figure 1).

SCOPE OF WORK

The basic objective of the subsurface reconnaissance survey was to identify—to discover and locate on available maps—sites or features of possible archaeological significance. A reconnaissance survey is simply a pedestrian, or walk-through, survey—extensive rather than intensive in scope—conducted to determine the presence or absence of archaeological resources within a specified project area. Reconnaissance survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. A reconnaissance survey permits a preliminary evaluation of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for such further archaeological work as might be necessary or appropriate. Such further work could include intensive survey—detailed recording of sites and features, and controlled test excavations; and possibly subsequent mitigation—salvage or research excavations, interpretive planning, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The principal tasks that comprised integral elements of the subsurface reconnaissance survey project, as specified in the contracted scope of work (PHRI Proposal No.137-071884), were the following five major items.

Archaeological Background Research

Archaeological background research was directed at a familiarization with all prior relevant archaeological research done within and immediately adjacent to the project area. This task consisted primarily of a critical review of available archaeological reports and records. As part of the background research, a one-day preliminary on-site field inspection of the project area was made in order to (a) locate and identify previously recorded archaeological sites, and (b) plan field strategy for the subsurface reconnaissance testing to be conducted during the field work portion of the project.

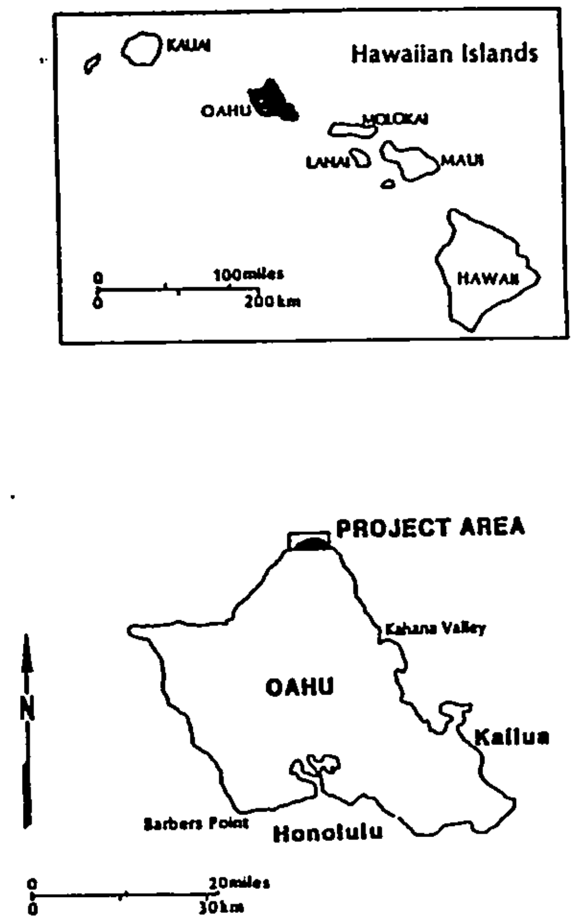

Figure 1

Project Location Map

Preliminary Historical Documentary Research

Preliminary historical documentary research was carried out by a qualified professional historical researcher, Ms. Carol L. Silva. The specific purposes of this preliminary work were two-fold: (a) to locate and summarize readily available relevant documentary resources (books, maps, journals, and other materials) relating to the project area, and (b) to assess the potential for subsequent more detailed historical research that would be appropriate to any subsequent intensive archaeological work.

Archaeological Reconnaissance Survey Field Work

The specific field tasks of the subsurface reconnaissance project, as originally specified in the contracted scope of work, included the following:

a. Inspection of all existing subsurface exposures for presence of buried cultural deposits or features (especially burial features with skeletal remains);

b. Subsurface testing of proposed drainage and stream alignments/realignments passing through both the Kuilima Resort property and the adjacent shoreline area (State Conservation District);

c. Subsurface testing in vicinity of Site F3-1, Kapi Fishpond, for presence of buried cultural deposits (Dye 1977:2);

d. Subsurface testing of previously identified "possible site" to determine if exposed grey deposit is cultural in nature (Dye 1977:3);

e. Subsurface testing of Site F4-15 to determine if the exposed black layer represents evidence of prehistoric wetland agriculture (Dye 1977:6);

f. Subsurface testing of Site F4-14 to clarify the nature, age, and horizontal extent of previously identified buried cultural deposits (Dye 1977:3-5); and

g. General subsurface reconnaissance testing to sample remaining areas within the expansion project area.

In a meeting held prior to the commencement of field work between Mr. Vincent Shigekuni and Ms. Sheryl Seaman of Group 70, and Ms. Joyce Bath--Field Director for PHRI, the list of specific field tasks contained within the scope of work was amended. Item c--subsurface testing in the vicinity of Site F3-1, Kapi Fishpond--was eliminated from consideration, as the actual

boundary of the project area terminates to the east of the fishpond location. At the same time, additional testing was requested in several areas bordering on Punahoolapa Marsh.

Data Analysis and Reports

Analysis of data recovered during the field work commenced upon completion of the field work. Both a Preliminary and a Final Report were prepared for submission. The Preliminary Report (Bath 1984) submitted upon completion of field was a progress report which summarized (a) relevant project back-ground, (b) field work accomplished and findings, (c) prelimi-nary conclusions and evaluations of findings, and (d) tentative recommendations for further work found to be necessary or appro-priate. The Final Report--as presented here--includes (a) the full description of project findings, (b) interpretation and evaluation of these findings, and (c) specific recommendations for further work found to be necessary or appropriate.

Coordination and Consultation

As part of the reconnaissance survey project work overall, close and frequent contact was maintained with the Hawaii State Historic Preservation Office (SHPO). Staff Archaeologist Earl Neller was involved throughout the course of the project. Prior to field work, he was consulted specifically concerning (a) his previous work both within and adjacent to the project area, and (b) the proposed scope of work for the subsurface reconnaissance survey project. Subsequently, the project scope of work was for-mally reviewed and approved by the State Historic Preservation Office (Letter of November 14, 1984 from Ralston Nagata, State Parks Administrator, Division of State Parks, Department of Land and Natural Resources, to Francis Oda, AIA, Group 70). During field work, SHPO Staff Archaeologist Neller was kept informed of progress and findings, and upon completion of field work, field findings and preliminary conclusions--including tentative evalu-ations and recommendations, were discussed in detail with him (November 20, 1984).

PROJECT AREA DESCRIPTION

The project area is bound by the Pacific Ocean on the north and by Kamehameha Highway on the south (Figure 2). The western boundary lies about at the mid-point of Kawela Bay. The eastern boundary follows Marconi road as far north as the abandoned rail-road bed of the Oahu Railroad and Land Company, then turns di-rectly north for an additional 500 meters. The final leg of the eastern boundary then swings to the northeast for 610 meters,

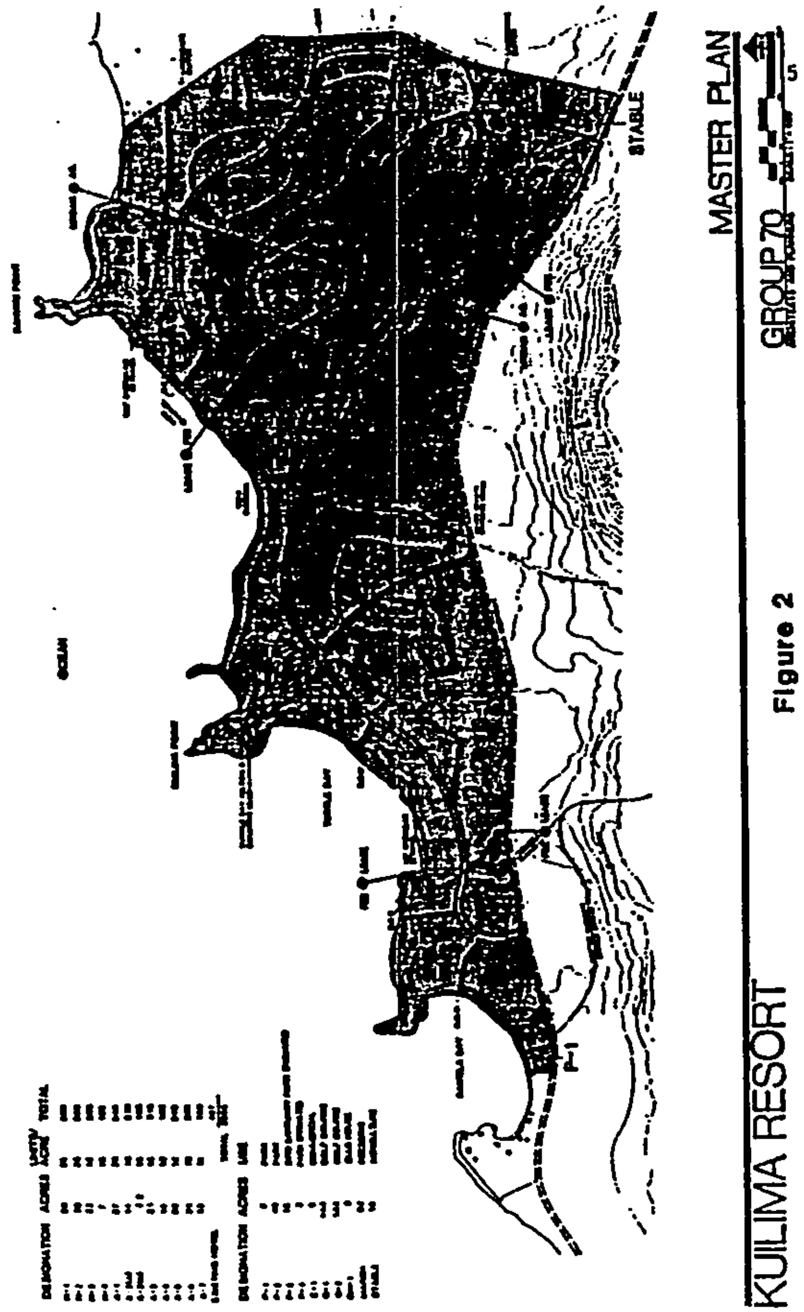

Figure 2
Project Area Map

intersecting the coastal fringe to the east of Kahuku Point. The project area consists of approximately 808 acres.

Environmental zones included in the project are coastal beaches from Kawela Bay to the east of Kahuku point, inland coastal agricultural lands, and the Punahoolapa Marsh and marsh margins. Bedrock throughout the area is a Pleistocene coral reef, a remnant of a once higher ocean stand (Kraft, pers. comm.; Foote et al. 1972: Map Sheet 46). In addition to littoral beach sands, the soils overlying the coral limestone bedrock include the Jaucas Series sands, which have associated pockets of Mokuleia loam and Mokuleia clay loam. Directly inland of the Jaucas sands are Kaloko clays, Waialua silty clays, and Lahaina silty clays. Surrounding the Punahoolapa Marsh, and presumably under it, are Pearl Harbor clays, which are noted as suitable for cultivation of taro and bananas (Foote et al. 1972:113). The distribution and representative profiles recorded by the Soil Conservation Service of all these soils are provided in Appendix A. The underlying Pleistocene reef bedrock in this area provides good evidence for the existence of a stable coastline since well before any possibility of human settlement in Hawaii.

Rainfall averages 30-40 inches per year along the coast and increases to 40-50 inches yearly for the inland area (Armstrong 1976:56). The vegetation is characterized as a zone of lantana--koa-haole shrub (Lantana camara L.--Leucaena glauca [L]. Benth.) (Armstrong 1976:64). Components are primarily koa-haole, Christmas-berry (Schinus terebinthifolius Raddi), and ironwood (Casuarina equisetifolia L.), with some scattered lantana. The vegetation does vary across the project area. The exposed beach area supports naupaka (Scaevola sericea Vahl), and immediately inland are stands of ironwood which are considerably more dense along the eastern coastal stretches, and which exist as scattered trees along the western coastline. This area, the Kawela Bay coastal section, currently has numerous residences with various ornamental plantings.

The arable lands extending over the inland area are primarily under cultivation with truck farming crops (corn, watermelon, squash, and beans). An area east of the Punahoolapa Marsh is open with low grasses and lantana, and is currently being used to graze cattle. The marsh itself is under a thick cover of dense reeds and grass, with thick stands of koa-haole, Christmas-berry, and grass along the periphery. Another small swamp area was identified along the east boundary (Survey Area 13). The area has a cover of hau (Hibiscus tiliaceus L.), with false kamani (Terminalia catappa L.) around the edges.

PREVIOUS ARCHAEOLOGICAL WORK

The earliest systematic site recording in the Kahuku area was done by McAllister (1933) in 1930. Of possible importance to this project is McAllister's Site 262, described as:

> Kukio pond, a natural basin filled with brackish water, located about 300 feet from the sea, Kahuku Point.
>
> The pond was formerly much larger and contained many kinds of fish. It is said to have been surrounded by a large Hawaiian settlement. Mrs. John Kaleo is probably the only survivor and her former friends and relatives have been buried in shallow graves in the sand between the pond and the sea. She remembers the time when trees, now found only on the mountains, covered the Kahuku plain, now a rather desolate, windswept area... (McAllister 1933:153).

Handy and Handy (1972:462) also mention that there was evidence of taro terraces around Kukio Pond.

Several contract archaeological projects have been conducted in recent years in the general Kahuku area (Barrera 1979, 1981, 1984; Clark 1978; Davis 1981, 1982; Nakamura 1981; Rogers-Jourdane 1982; Schilt 1979; Sinoto 1981). Three of these projects involved reconnaissance surveys on properties adjacent to the project area. Sinoto (1981) and Rogers-Jourdane (1982) covered areas immediately to the east of the project boundary, while Davis (1981) covered a large area inland of the Kuilima Resort property. Nakamura (1981) wrote an historical account of the Kahuku area. Two versions of this report were noted: the longer accompanies the Davis 1981 report, while a shorter version accompanies the Sinoto 1981 report.

Only one contract archaeological project has taken place within the boundaries of the Kuilima Resort project area. In 1977, a surface reconnaissance survey was conducted by the Anthropology Department of the Bishop Museum (Dye 1977). At that time, two sites were designated, 50-Oa-F4-14 and F4-15*.

Site F4-14 was described as two subsurface occupation layers found at Kahuku Point. The upper layer appeared to be transitional from prehistoric to historic, while the lower was judged

*Bishop Museum site designation system: 50 = State of Hawaii, Oa = Island of Oahu, F = District of Koolauloa, 4 = land of Hanakaoe; the last digits are the individual site number.

to be prehistoric on the basis of its stratigraphic position and the absence of historic artifacts. In his report, Dye (1977:9) recommended Site F4-14 be included on the State and National Registers of Historic Places. No subsequent action appears to have been taken by anyone. The second site, F4-15, was interpreted as a possible wetland agricultural site because of the presence of a peat layer overlying a layer of Pearl Harbor clay. An exposure in what was described as a backhoe cut next to the historic railroad bed was faced to obtain this soil profile. A third site was noted as a "possible site" but not recorded. This site is located in a beach berm somewhat to the west of Kahuku Point, and the evidence cited was the presence of subsurface grey layers visible on the ocean side of the eroding berm.

In May 1984, an incident which also affects the project area took place. The Hawaii State Historic Preservation Office was notified that human bones were being uncovered at Kahuku Point as a result of disturbance caused by sand vehicles operated by a concession at the Turtle Bay Hilton Hotel. SHPO Staff Archaeologist Earl Neller visited the site, and also examined the skeletal remains that had been disinterred by the Honolulu Police and the Medical Examiner's Office (Neller 1984). Two complete skeletons and part of a third had been recovered (Neller 1984). Following this disinterment, the sand vehicle concession operator, in an attempt to avoid the location where the bones were found, used a bulldozer to create an oval track within which sand vehicle activity is supposed to be limited. In so doing, the bulldozer appears to have destroyed a substantial portion of the archaeological cultural layers with which the skeletal remains had been associated.

BACKGROUND RESEARCH

Archaeological

All reports of previous archaeological projects in the Kahuku area were checked to ascertain which were relevant to the present project. Copies were obtained of those which contained either directly relevant information or useful background information.

A pre-field inspection was conducted on August 18, 1984, by Principal Investigator Dr. Paul H. Rosendahl and Field Director Joyce Bath for the purpose of pinpointing ground locations of the specific items covered in the scope of work and to assess possible access problems. A few days later, another visit to the project area was made by Ms. Bath and Dr. J. C. Kraft, a visiting geologist (University of Delaware) whose specialty involves the study of shoreline change, and who has done previous research in Hawaii. The purpose of this second visit was to ground-check the project area in terms of identifying geologic parent material and assess the probability of shoreline changes over time. Dr. Kraft confirmed that the underlying land form is a Pleistocene reef, a remnant of a higher ocean stand, and thus the Kahuku shoreline has been fairly stable throughout the period of human occupation in the Hawaiian islands.

A series of aerial photographs (taken in 1927, 1951, and 1968) was obtained to help assess changes in the landscape over the past 50 years which would affect the archaeological record. Several of these proved particularly useful, and are included here. Figure 3 is a 1927 aerial photograph of Kawela Bay. Figure 4, also a 1927 aerial, shows Kahuku Point and Punahoolapa Marsh. By 1943, the Kahuku Air Base had been constructed, and Figure 5 is an aerial photo taken in 1951, showing the base and surrounding territory.

A copy of a Kahuku Ranch map made by Loebenstein in 1890 was obtained from the Hawaii State Survey Office, and a Monsarrat 1876 map of Kahuku was examined at the same office. These were useful for locating old boundary walls, <u>kuleana</u>, and the old Richardson Ranch House.

Blueprints of the World War II Kahuku Air Base were borrowed and reproduced. The original set contains ten sheets. Copies of three sheets are included here, as they bear directly on the survey area. Figure 6 is Sheet No. 2, showing the military structures at Kahuku Point. The area just inland of Kahuku Point is covered by Sheet No. 3, reproduced here as Figure 7, and the adjoining area to the east, Sheet No. 5, as Figure 8.

Group 70 provided working aerial photos (1"=400' scale) taken in 1982, and comparable blueline copies of the Kuilima Resort Map showing the Existing Plan and Master Plan (dated 6 August 84). The aerial photos were used in the field to plot test unit locations, which were later transferred onto the Kuilima Resort Map. Figure 9--Survey Area and Test Location Map (at end)--shows all test unit locations, survey areas limits, and the approximate extent of the identified archaeological sites plotted earlier on the Kuilima Resort Map (1"=400' scale).

Historical Documentary

Preliminary historical documentary research was carried out by a qualified professional historical researcher, Ms. Carol L. Silva. The report on her research is attached here as Appendix C. In addition to addressing the two main tasks comprising the stated scope of work for the preliminary historical documentary research, Ms. Silva pursued in greater detail the original land claim documents for a number of the <u>kuleana</u> formerly present within the project area.

Figure 3.

1927 AERIAL PHOTOGRAPH OF KAWELA BAY AREA (OXF 89)

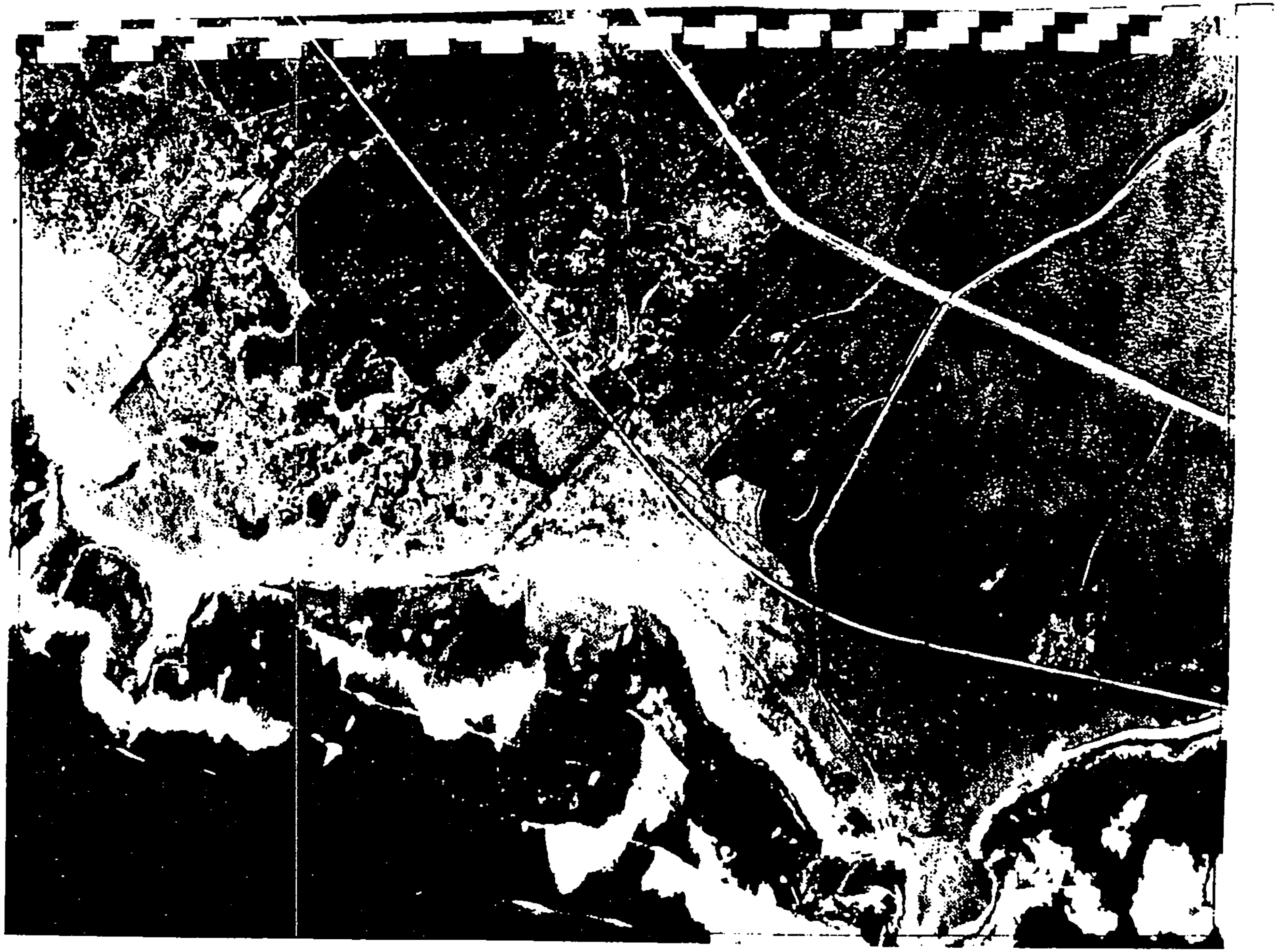

Figure 4.
1927 AERIAL PHOTOGRAPH OF KAHUKU POINT AREA (OT 10)

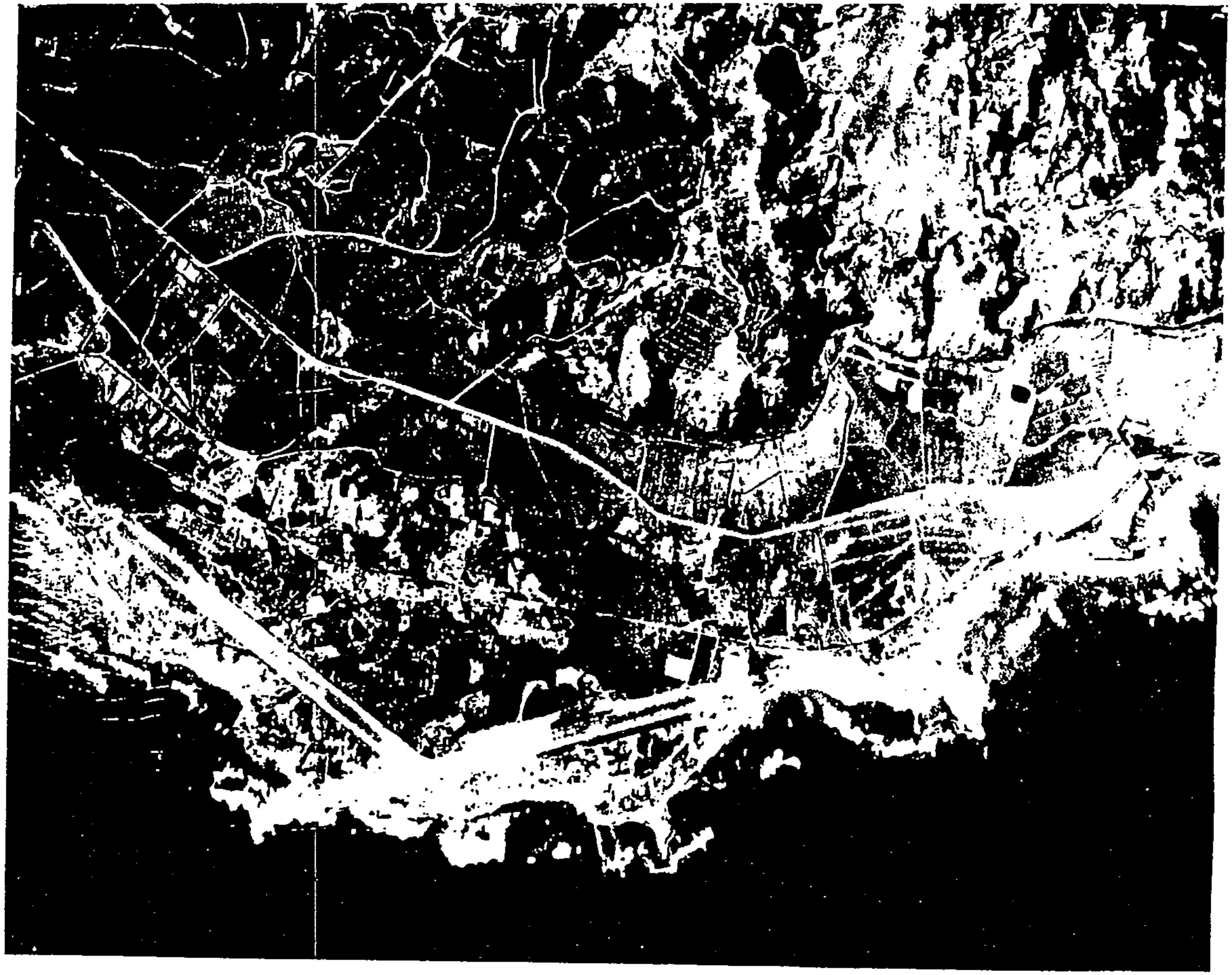

Figure 5.
1951 AERIAL PHOTOGRAPH OF KAHUKU POINT AREA (DACE 1-35)

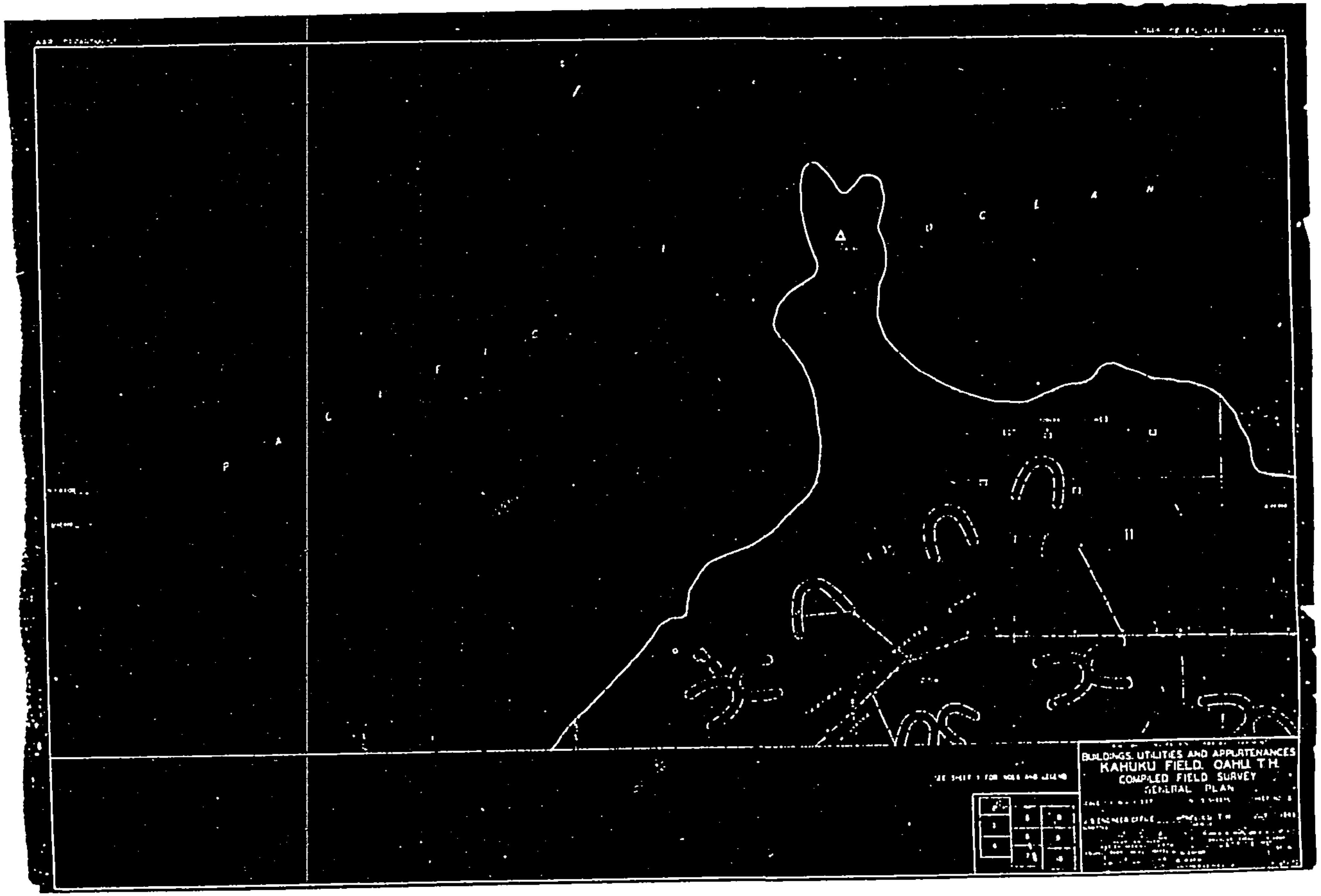

Figure 6.
KAHUKU AIR BASE PLAN, SHEET NO. 2

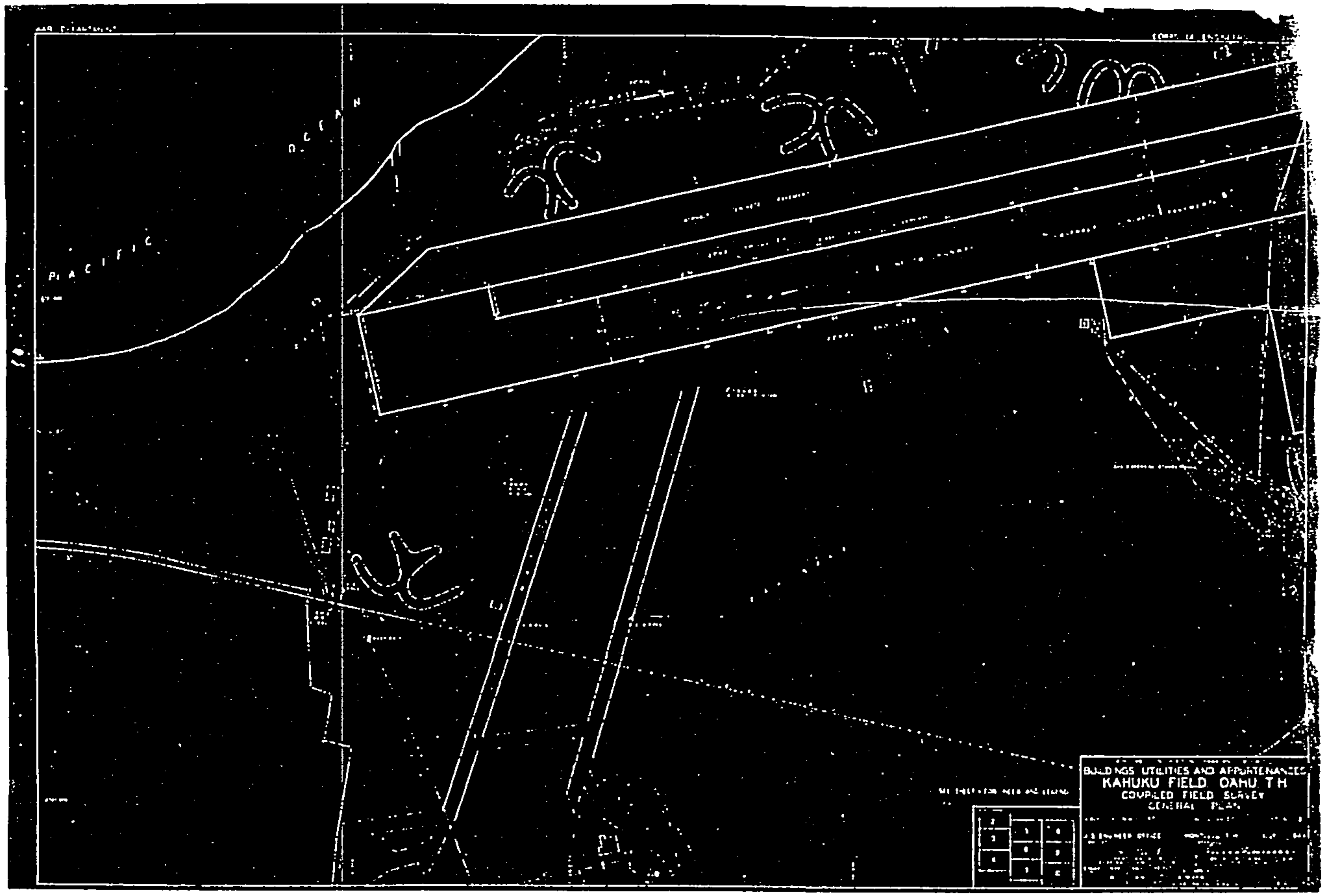

Figure 7.
KAHUKU AIR BASE PLAN, SHEET NO. 3

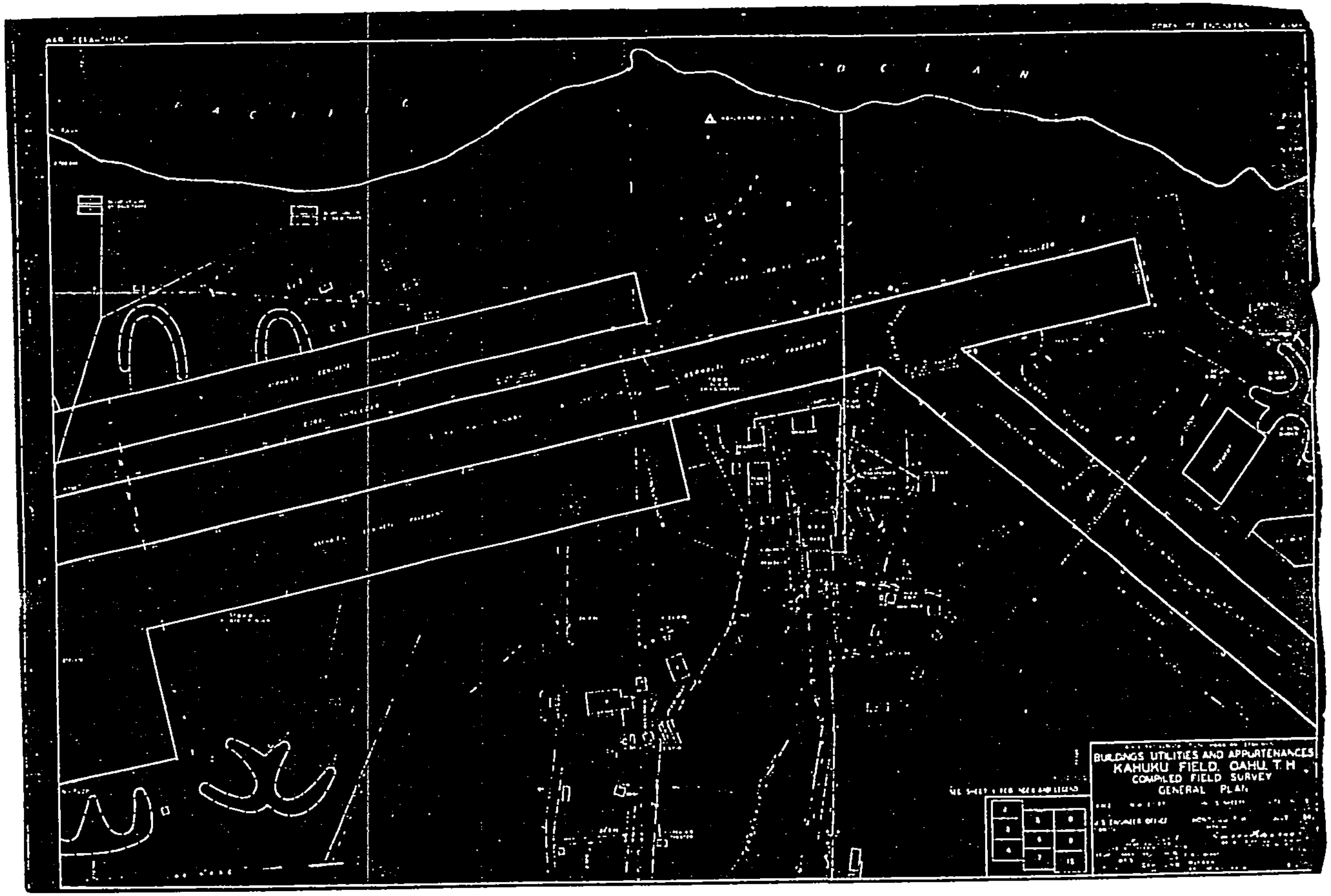

Figure 8.
KAHUKU AIR BASE PLAN, SHEET NO. 5

STUDY METHODS AND PROCEDURES

Field Work

Subsurface reconnaissance survey field work was carried out by a five-man crew during the period of September 5-20, 1984, under the supervision of Field Director Joyce Bath. Crew members included Field Archaeologists Alan Walker, Richard Gilman, Wanda Hoke, and Roy Pua-Kaipo. Sixty man-days were expended on the reconnaissance field work. Principal Investigator Dr. Paul H. Rosendahl conducted an on-site inspection while field work was in progress on September 14, 1984.

The five-man crew was divided into two teams equipped with soil augers (maximum diameter 2.5 in) and standard excavation equipment. In order to facilitate recording, one team was assigned a block of test unit (TU) numbers (1-100) and the other assigned a second block (101-199). Numbers 62 through 100 and 175 through 199 were not used, and therefore do not appear in the sequential record of tests. Each team recorded and plotted test unit locations on aerial photographs and these locations were transferred to a comparable blueline map of the Kuilima Resort (1"=400' scale). A total of 135 test units were excavated, 11 of which involved facing off one meter-wide sections of existing subsurface exposures. The remaining 124 test units were auger tests. Seven new sites were assigned temporary (T-) designations, and several more military remains were noted. A 35 mm photographic record, including both black-and-white and color, was kept of all tested areas (PHRI Rolls No. 327-330).

The subsurface reconnaissance sampling strategy adopted was formulated on the basis of the following factors:

1. Specific scope of work tasks derived from (a) recommendations of the previous Bishop Museum survey (Dye 1977), (b) State Historic Preservation Office consultations, and (c) the on-site field inspection made by Dr. Rosendahl and Ms. Bath just before the commencement of field work;

2. A subsequent request by Mr. Shigekuni and Ms. Seaman of Group 70 to test specific areas on the periphery of Punahoolapa Marsh;

3. The known distribution of soil types within the project area (see Appendix A);

4. Observations made during the on-site field inspection prior to beginning the reconnaissance survey field work;

5. Careful examination of relevant aerial photographs (see Figures 3, 4, 5) and the Kahuku Air Base plan maps (see Figures 6, 7, 8);

6. The known locations of former kuleana holdings within the project area; and

7. Proposed resort expansion development plans, as indicated on the Kuilima Resort Master Plan (see Figure 2).

Specific field task items on the scope of work were given priority in scheduling, and when those were well on the way to completion, general testing (Item g) was carried out. The actual placement of specific test units reflected the various sampling strategy factors listed above. During general testing, particular attention was given to areas which are scheduled for hotel and residential construction, and to those where water hazards within the proposed golf course expansion are planned. Areas which were heavily overgrown and would have required a substantial expenditure in clearing time were given low priority in order to maximize the available testing time.

Laboratory Work

All recovered materials, including portable artifacts, soil samples, and bulked firepit deposits, were returned to the PHRI laboratory in Hilo. In general, the extensive nature of the subsurface reconnaissance testing and the limited volume of material recovered from auger tests resulted in a paucity of collected samples. Additionally, all soil sample descriptions were done in the field, using standard procedures and terminology as set forth in the Soil Survey Manual (Soil Survey Staff 1962) and Birkeland (1979).

Selected samples from the sites tested during the survey were sorted for midden. Recovered midden was identified but not quantified. Artifacts were examined and identified as to apparent period (indigenous/prehistoric or historic) and functional category, where possible. Three samples (PHRI No. RC-156,-157 and -158) were sorted for charcoal recovery. Two soil samples were also selected for radiocarbon analysis (PHRI No. RC-154 and -155). All five were submitted to Beta Analytic, Inc. for radiocarbon age determination analysis (including determination of C-13/C-12 stable isotope ratios). Two samples of clay (Samples No. 12 and 34) and two samples of peat (Samples No. 17 and 35) from test units in the vicinity of Punahoolapa Marsh were submitted to Dr. Jerome V. Ward at the University of Oklahoma-School of Geology & Geophysics for possible pollen study. Upon examination, Samples No. 34 and 35 were selected and analyzed for pollen and spore content by Dr. Ward. His report is included here as Appendix B.

FIELD WORK FINDINGS

Results of the subsurface reconnaissance testing are summarized in Tables 1 and 2, and are described below by survey areas within the project boundaries. A summary of testing results is presented in Table 1. In Table 2, individual test units (TU) are identified within areas according to test type (auger or faced-section) and content (cultural deposit, sterile deposit, or suspected agricultural soil).

Two previously recorded sites (F4-14, -15) were tested. Seven additional new sites (T-1 thru T-7) were identified, and of these, five were tested (T-1, -2, -4, -6, -7). The locations of all survey areas, test units, and designated sites are shown on Figure 9 (at end).

SURVEY AREA 1 - Kawela Bay (5.5 ha/13.6 ac)

A total of 20 auger tests (TU 9,10, 44-49, 109-112, 156-163) were made at Kawela Bay. These were situated principally adjacent to the existing access road which parallels the beach, and varied from within approximately ten meters of the crest of the beach berm to c. 45 meters inland of the shoreline. A cultural deposit was encountered in all but three (TU 47, 160, and 163) of the 20 test units.

Designated as Site T-6, this cultural deposit is found primarily in the upper stratum of the stratigraphic profile. Thickness varies from 12 to 56 cm. In a few of the tests, modern aeolian sand or mixed deposits overlie the cultural A horizon. In others, the thinness of the deposit and position at the surface suggests some truncation has occurred.

A representative profile of the auger tests is:

Horizon	Depth	Description
A	0-30 cm	Dark yellowish brown (10YR 4/4d) to black (10YR 2/1d) fine silty calcareous sand; single grain; loose, nonsticky, nonplastic; roots common, fine; abrupt smooth boundary.
C	30-150	Yellow (10YR 8/6m) to very pale brown (10YR 7/4m) calcareous sand; single grain; loose, nonsticky, nonplastic; few roots; coral fragments common.

This profile is in accordance with the Jaucas sand profile reported by the Soil Conservation Service (see Appendix A).

Table 1.

SUMMARY OF TESTING RESULTS

Survey Area	No. Tests AT*	No. Tests FT*	Total Tests	Designated Sites	Type	Comments
1	20	-	20	T-6	Occupation/burial	Prehistoric
2	16	-	16	None	-	-
3	5	-	5	None	-	-
4	10	-	10	None	-	-
5	9	7	16	T-7	Occupation	Historic or recent
6	11	1	12	F4-14	Occupation	Possibly prehistoric to historic
7	8	1	9	T-1	Occupation/burial	Prehistoric
8	23	-	23	T-2	Stacked coral wall	Historic
				T-3‡	Animal pen	Recent
				Not designated	-	Poss. agricultural
9	5	2	7	F4-15	Agricultural soils	Possibly prehistoric
				T-5‡	Stacked coral wall	Historic
10	4	-	4	None	-	-
11	2	-	2	Not designated	-	Poss. agricultural
12	5	-	5	Not designated	-	Poss. agricultural
13	6	-	6	T-4	Concrete military structure	Recent
				Not designated	-	Poss. agricultural
Totals	124	11	135	9		

*AT = Auger Test, FT = Faced-section Test

‡Sites T-3 and T-5 were described, but not tested.

Table 2.

SUMMARY OF TEST UNITS AND CONTENT

Survey Area	Cultural Deposit Present AT*	Cultural Deposit Present FT*	Poss. Agricultural Soils Present‡	No Cultural Deposit AT*	No Cultural Deposit FT*
1	9,10,44-46 48,49,109-112,156-159,161,162 (Site T-6)	-	-	47,160,163	-
2	-	-	-	1-8,101-108	-
3	-	-	-	50-52,164, 165	-
4	-	-		39-43, 151-155	-
5	-	11-14 (Site T-7)		15,16,116-122	113-115
6	36-38,56, 57,146-148,171 (Site F4-14)	149 (Site F4-14)		150,170	-
7	28,133-135, 143,144 (Site T-1)	34 (Site T-1)		35,145	-

*AT = Auger Test, FT = Faced-section Test
‡Includes both auger tests and faced-section tests.

Table 2. (Cont.)

Survey Area	Cultural Deposit Present AT*	Cultural Deposit Present FT*	Poss. Agricultural Soils Present‡	No Cultural Deposit AT*	No Cultural Deposit FT*
8	-	-	20,21,61,126,127	17-19,22-27, 123-125,128-132,174(TU 25 placed adjacent to Site T-2)	-
9	-	-	31,32,53,140,141, 166,167 (Site F4-15)	-	-
10	-	-	-	54,55,168,169	-
11	-	-	33,142	-	-
12	-	-	59,60,173	58,172	-
13	-	-	29,136,137 (TU 136 placed adjacent to Site T-4)	30,138,139	-

*AT = Auger Test, FT = Faced-section Test
‡Includes both auger tests and faced-section tests.

They list a dark A horizon, with color varying from 10YR 2/1 to 4/1 as a variant. It seems fairly clear that this variant quite likely represents a cultural A horizon. The Soil Conservation Service stratigraphic profile (Appendix A) lists three C horizons, rather than just one, and the two deeper C horizons were also encountered in a few of the tests. Their occurrence would be dependent on the depth of the deposit, bearing in mind that coral bedrock substrate is in essence a karst topography, and thus test depths differ. Differences in moisture were also common at approximately two meters depth, suggesting that freshwater springs in the area are differentially affecting bedrock weathering.

The point of a bone composite fishhook was encountered in TU 111 at 18 cm below surface. It was embedded in a 10 cm thick layer of coral fragments, possibly an old floor surface or pavement. TU 112, made into a capped underground solution chamber, yielded several artifacts and a fragment of human bone. According to a local resident, a human skeleton had been found in the vicinity of TU 112 during a cesspool excavation several years ago. Charcoal in sufficient quantity for radiocarbon analysis was recovered from TU 158 and submitted for dating (PHRI No. RC-158).

The full subsurface limits of Site T-6 were not determined. It is quite probable that the buried deposit that constitutes the site continues around to the west side of Kawela Bay, outside of the project area limits. Inland of the coastal fringe, the land has been plowed for agricultural purposes since at least 1927, as can be seen from the 1927 aerial photo of Kawela Bay (Figure 3). Because the cultural deposit consists of the upper portion of the stratigraphic profile, the probability is high that the deposit has been disturbed by plowing in these fields. The eastern boundary of the site is established, as the cultural deposit does not extend into Survey Areas 2 and 3. The primary site area remaining is along the beach front that has been used for residential purposes, and it is quite likely that extensive portions of the site are still intact.

SURVEY AREA 2 - Kawela Stream Alignment (2.7 ha/6.6 ac)

Sixteen auger tests (TU 1-8, 101-108) were made in this area. No subsurface cultural remains or suspected living surfaces were encountered. Some of the B horizon clay deposits contained either charcoal or other organic flecking, suggesting possible agricultural activity in the past. Three distinctly different stratigraphic profiles were recorded within Survey Area 2. In the northern portion of the area, a typical beach sand profile was encountered. Inland of the beach, the middle portion of Survey Area 2 has clearly been a wide drainage for

a long time. Alluvial deposits are deep and present for some distance on the western side of the present drainage channel. A representative profile (based on TU 2-5, 101-105) of this middle portion is:

Horizon	Depth	Description
A	0-80 cm	Very dark brown (10YR 2/2d) to dark brown (7.5YR 3/4) sandy loam; moderate, fine, angular blocky structure; friable, sticky, plastic; some clay films on ped faces; fine vesicular roots common.
B_{11}	80-140	Dark brown (7.5YR 3/4d) to dark reddish brown (5YR 3/4m) silty clay; moderate, very fine, angular blocky structure; friable, sticky, very plastic; clay films on ped faces present.
B_{12}	140-175	Dark brown (10YR 3/3m) to dark reddish brown (5YR 3/4m) sandy clay; water-saturated; very sticky, very plastic.

The absence of a calcareous sand C horizon suggests that in the past enough water came through this area to scour out the channel. As the drainage shifted over time, either naturally or because of human interference, scoured areas became filled with alluvial soils transported by stream action. The development of the B horizons suggest that the alluvial soils have been in place for a long time.

The third stratigraphic profile was found in an existing agricultural field in the southern part of Survey Area 2. A representative profile based on TU 6-8 and 106-108 is:

Horizon	Depth	Description
A_p	0-35 cm	Dark brown (7.5YR 3/4) to dark reddish brown (5YR 3/3d) clay loam (plow zone); weak, fine, crumb structure; slightly sticky, slightly plastic; few roots.
C_1	35-80	Yellowish red (5YR 5/8d) calcareous sand; single grain; massive, nonsticky, nonplastic; few to no roots.
C_2	80-90	Very pale brown (10YR 7/4) calcareous sand; coarse; single grain; loose, nonsticky, nonplastic; no roots.

SURVEY AREA 3 - Turtle Bay Beach (0.84 ha/2.0 ac)

Five auger tests (TU 50-52, 164, 165) were excavated between the crest of the beach berm and the edge of the existing golf course. Four of the tests (TU 50-52, 164) showed a water-laid, non-cultural beach sand deposit. A representative profile is:

Horizon	Depth	Description
A	0-80 cm	Dark brown (7.5YR 3/2) to brown (10YR 4/3) very fine calcareous sand; single grain; loose, nonsticky, nonplastic; fine vesicular roots common; boundary clear, smooth.
C_1	80-120	Very pale brown (10YR 7/4) to pinkish white (7.5YR 8/2) calcareous sand; single grain; loose, nonsticky, nonplastic; very few roots.
C_2	120-210	Very pale brown (10YR 8/4) to pink (7.5YR 8/4) very fine to fine calcareous sand; single grain; loose, nonsticky, non-plastic; very few roots.

TU 165 differed in that a 25 cm thick dark A horizon was encountered at 50 cm below surface. Buried A horizons can be either natural or cultural in origin. No cultural material was recovered in the test, but one auger test is statistically not significant. The presence of a buried A horizon in only one auger test suggests a remnant pocket of an older deposit in that particular spot, implying that the beach berm has been reworked by storm wave action in the possibly recent past.

SURVEY AREA 4 - Kuilima Point, East Side (5.57 ha/13.8 ac)

This area is a very broad, level beach berm between the shoreline and the existing golf course. A total of ten auger tests (TU 39-43, 151-155) were placed at intervals along the length of the berm. Lensing of darker sands was noted at various depths; otherwise a representative profile would be very similar to that for Survey Area 3, and is not repeated here. Testing depths ranged from 50 to 265 cm below surface, and modern materials (shoe leather, modern glass and cement fragments) were recovered throughout the deposit. The berm appears to be very recent in its present form.

SURVEY AREA 5 - Coastal Stream Alignment (1.4 ha/3.5 ac)

Sixteen tests (TU 11-16, 113-122) were made in this area. TU 11-14 were faced-section tests along the ocean side of the beach berm, as was TU 113 on the inland side of the berm. TU 11-14 showed a deep cultural deposit of two layers which was designated Site T-7. This area was originally identified as a "possible site" during the 1977 Bishop Museum surface reconnaissance survey (Dye 1977:3).

Four sand layers were distinguished in TU 11-14 (Figure 10). Layer I, an aeolian deposit of recent origin, is discontinuous. Layer II, discolored by decaying humus debris, is a cultural layer; a firepit ash deposit was encountered in TU 12. In TU 13, a very dark pit feature, possibly an imu, appears in profile in the Layer III greyish black cultural matrix. The underlying Layer IV is sterile beach sand, and excavation was terminated at approximately one meter below the uppermost boundary of Layers III and IV.

TU 113, on the inland side of the berm, was lower in the deposit. No cultural layers were found; however, a buried O horizon, identifiable as ironwood cones and needles, was encountered beneath the sterile Layer IV deposit found below the the cultural layers present on the seaward side of the berm (Figure 10). The cultural deposit, therefore, appears to postdate the 19th century historic period introduction of ironwood into Hawaii (Neal 1965:289). The beach berm itself does not appear to be a naturally deposited feature (Kraft, pers. comm.), and may possibly date to bulldozer activity associated with the construction of Kahuku Air Base during World War II. If so, the cultural deposit of Site T-7 could postdate not only the introduction of ironwood trees into Hawaii, but also establishment of the military installation.

TU 114 and TU 115 were faced-section tests along the relict stream drainage inland of and below the beach berm. In both tests, two separated layers (Layers VI and VIII) of a reddish-brown (almost orange) sand were exposed. The color indicates leaching of iron oxides into the calcareous matrix, suggesting two episodes in which soils containing oxides were in contact with the underlying calcareous sands. This probably relates to times when the drainage was operative, and alluvium was being transported along the channel.

TU 116-122 and 15-16 were auger tests placed inland of the drainage channel. No cultural materials were found in any of the tests, and the profiles were typically fine light brown (10YR 5/3) calcareous beach sand at the surface, becoming progressively lighter and coarser with depth. Coral bedrock was not reached in this area, and the tests were terminated in very white (10YR 8/3) beach sand. The deepest test in the area was taken down to 250 cm below the surface.

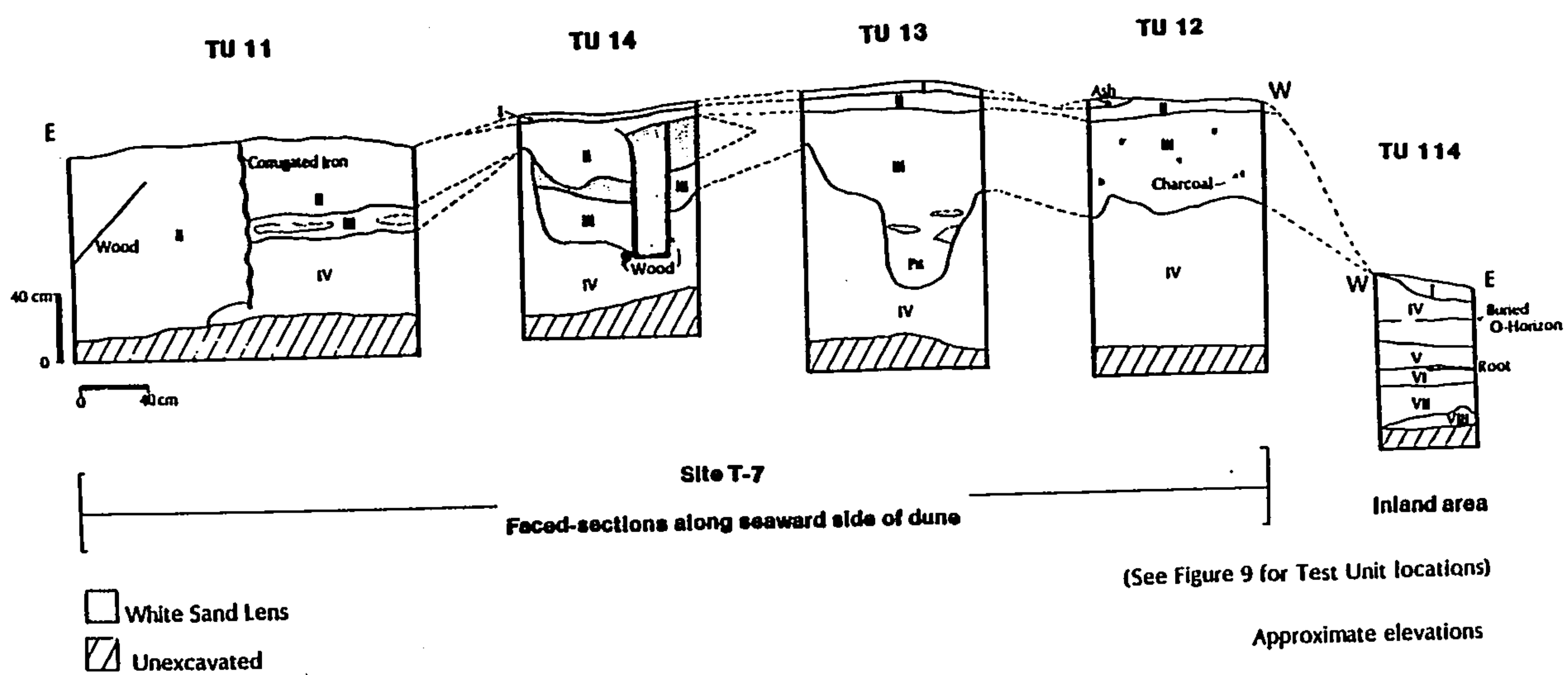

Figure 10

Profiles of TU 11, TU 12, TU 13, and TU 14 (Site T-7) and TU 114 (Inland Area), Survey Area 5

SURVEY AREA 6 - Site 50-Oa-F4-14 (2.8 ha/6.9 ac)

This area is the locus of Site F4-14, on the west side and including portions of Kahuku Point. The site was originally identified by the Bishop Museum (Dye 1977). Eleven auger tests (TU 36-38, 56, 57, 146-148, 150, 170, 171) and one faced-section (TU 149) were excavated in the area. Of these, all except TU 170 and 150 revealed a minimum of two and a maximum of three cultural layers. TU 170 was situated out on a high dune on Kahuku Point. The cultural layers are probably deeply buried beneath the dune, as they were present in TU 56, which was situated further out on the point but at a lower elevation. TU 150 was the last of the tests in a line proceeding to the west along the beach. When only non-cultural deposits were found, testing in that direction was terminated. From Kahuku Point, the site extends approximately 215 meters to the west, and at least 60 meters inland (Figure 9, at end)).

Representative of Site F4-14 is the stratigraphy of the faced-section test, TU 149, which showed three cultural layers (Figure 11):

Layer	Depth	Description
I	0-6 cm	Aeolian deposit, sterile sand.
II	6-25	Black (10YR 2/1) fine calcareous sand with dark charcoal; loose, nonsticky, nonplastic; cultural layer.
III	35-47	Light brown grey (10YR 7/2) calcareous sand with charcoal flecking; loose, nonsticky, nonplastic; cultural layer.
IV	47-60	Black (10YR 2/1) fine to crumb calcareous sand with charcoal and ash; loose, nonsticky, nonplastic; cultural layer.
V	60-80	Brownish yellow (10YR 6/6) sand with small amounts of midden; loose, nonsticky, nonplastic.
VI	80+	Pale brown (10YR 7/4) sterile coarse beach sand.

Layers III and IV appear to correspond to Bishop Museum's Layers III and IV, which were tentatively interpreted as historic and prehistoric respectively, on the basis of recovered portable remains (Dye 1977:7). Modern aluminum pop-top tabs

Figure 11. NORTH FACE OF TU 149, SITE F4-14.
View to north. (PHRI Neg.328-36A)

from soda or beer cans were more recently recovered from Layer IV, but these may well be intrusive, as no other modern or historic materials were obtained from the layer. Midden was recovered from Layer IV, and a very small amount of midden was found in Layer V, which was otherwise sterile. Charcoal recovered from Layer IV was submitted for radiocarbon analysis (PHRI No. RC-157).

SURVEY AREA 7 - Kahuku Point, East Side (3.38 ha/8.3 ac)

Nine test units (TU 28, 34, 35, 133-135, 143-145) were dug in Survey Area 7. TU 34 was a faced-section on the north side of a dune. TU 135 involved skimming and sifting approximately one by three meters of loose sand directly adjacent to the sand vehicle track. The remaining units were auger tests.

Two subsurface cultural layers were found. The extent of the deposit was designated Site T-1. In some tests, the layers are separated by a sterile sand layer, while in others the layers are contiguous, with a very abrupt boundary. These layers extend approximately 240 meters E-W by 140 N-S (Figure 9). The upper layer (I) is a light grey deposit (10YR 5/3 to 6/2) with which the skeletal remains disinterred earlier by the Honolulu Police and Medical Examiner's Office were associated (Neller 1984). The grey sands of the upper layer (I) can be easily distinguished in areas where sand vehicle activity is ongoing (Figure 12). TU 135 exposed additional skeletal remains from a disturbed portion of this layer. The lower cultural layer (II) contains abundant charcoal. TU 34 revealed a firepit in Layer II which intruded into Layer III.

The stratigraphy revealed in TU 34 (Figure 13) is:

Layer	Depth	Description
I	0-20 cm	Light brownish-grey (10YR 6/2) very fine calcareous sand; single grain; abrupt smooth boundary; contains sparse charcoal and human skeletal material.
II	20-50	Very dark grey (10YR 3/1) to black, very fine calcareous sand; single grain; abrupt smooth boundary; contains abundant charcoal.
III	50-70	Very pale brown (10YR 8/4), very fine calcareous sand; culturally sterile.

Figure 12. GENERAL VIEW OF SITE T-1.

Note exposures of light grey cultural layer (I). View to east. (PHRI Neg. 328-22)

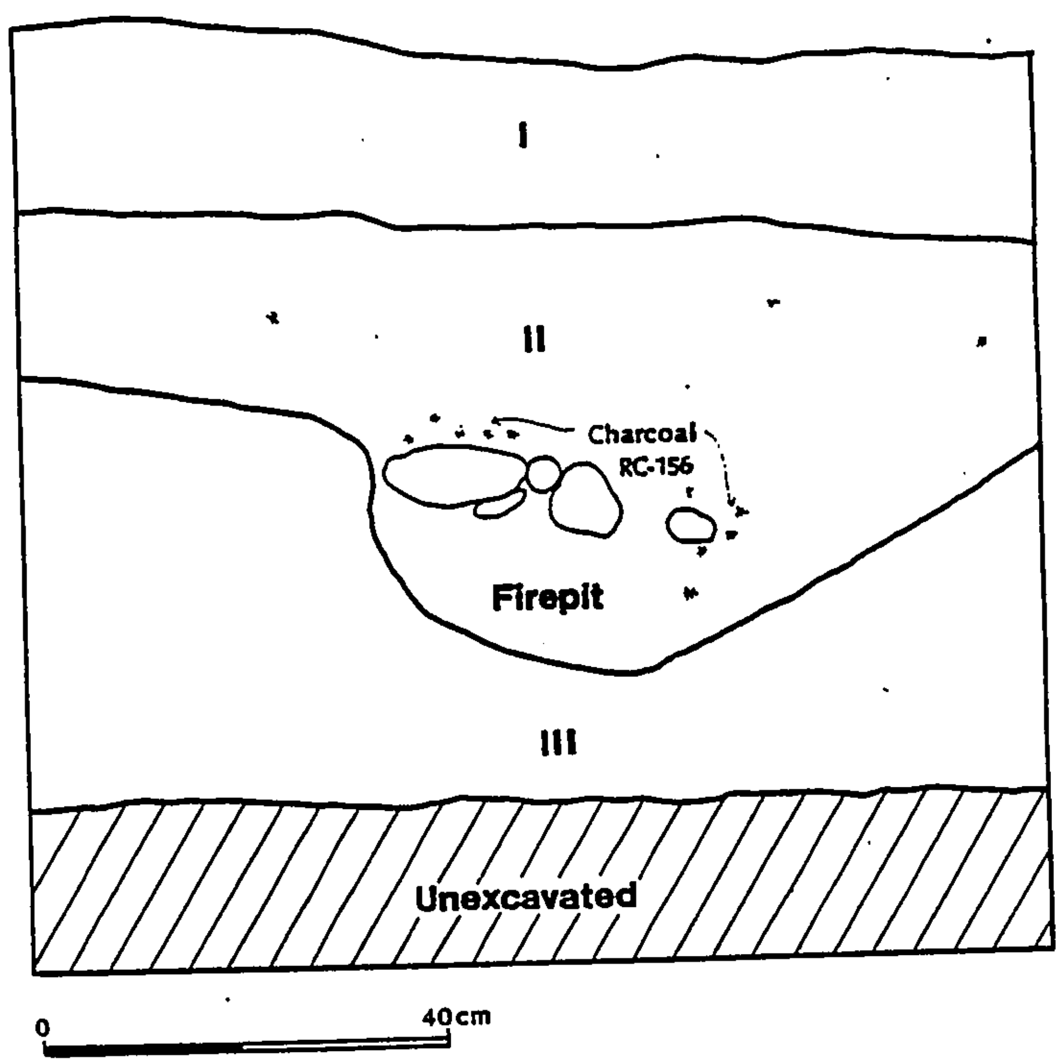

Figure 13

Site T-1
TU 34 Northeast Face

SURVEY AREA 8 - Proposed Water Hazard (7.9 ha/19.5 ac)

The proposed water hazard would connect Punahoolapa Marsh with an existing drainage canal which bisects the present golf course. A total of 23 test units (TU 17-27, 61, 123-132, 174) were excavated within the survey area (Figure 9). No evidence of prehistoric occupation was found, but tests conducted in the vicinity of the marsh (TU 61) and near the proposed club house site (TU 20, 21, 126, 127) revealed the same deposit of Pearl Harbor clays with an underlying peat layer.

TU 24-27 and 128-132 were made between the existing golf course and the marsh edge at the southeast end of Survey Area 8. Here the soil is sandy clay loam of varying depth over coral bedrock. Bedrock outcrops are common. At the end of the transect at the marsh edge, stretches of open water and coral limestone banks were noted.

A representative profile of the soils in the southeast part of Survey Area 8 is:

Horizon	Depth	Description
0	0-3 cm	Very dark brown (10YR 2/2) humus; weak fine crumb structure; nonsticky, nonplastic; very abrupt smooth boundary.
A	3-50	Dark brown (7.5YR 3/4) clay loam; moderately strong fine angular to subangular blocky structure; sticky, plastic; very abrupt smooth boundary.
B	50-100	Dark brown (7.5YR 4/2) sandy clay; water-saturated; sticky, plastic; very abrupt smooth boundary.
C	100+	Grey (10YR 6/1) gritty decomposing coral bedrock.

The area is designated on the soils map as Lahaina silty clay (Foote et al. 1972) (see Figure 15 in Appendix A). The soil profile description is within comparable range (see Appendix A), but the slope designation of 7-15% does not correspond with field observations. However, the vegetation is dense in this area.

The other test units (TU 17-19, 22, 23, 123-125, 174), which failed to reveal any cultural materials, ranged in depth from 40 to 210 cm below surface and varied in composition from mainly sand to almost impenetrable clays.

Site T-2, where TU 25 was made, is an L-shaped stacked coral wall. The SE leg is 30 meters long; the NE leg was not followed beyond 40 meters from the wall corner. It appears to go on out into the present marsh. The wall is faced on both sides, is about 1.0 m wide and 1.1 m high, and has a fairly level top surface. This wall is visible on the 1927 aerial photograph of the marsh (see Figure 5), and is possibly indicated on Loebenstein's 1890 map of Kahuku Ranch. No definite subsurface cultural layer was encountered in TU 25, which was situated near the inside corner of the wall, but organic matter was noted in Layer III (beneath 75 cm below surface). Surface remains included broken glass, leather, a wooden post, a glass bottle, and a single piece of Cypraea shell.

T-3, the other site recorded near the wall, was an enclosure of wooden posts (cut from logs), walled with corrugated iron. The nails used appeared modern rather than earlier historic. Some cow bones were noted adjacent to the enclosure.

During the military occupation at Kahuku, a road connected the runway with this area (see Figure 7). The installation at the end of the road, which corresponds to this area, is not identifed on the military plan map, as only buildings and utilities not directly related to combat purposes are identified. Thus this particular installation was probably combat-related in nature. The configuration of the access and parking areas suggests that the installation was the ammunition storage area.

SURVEY AREA 9 - Site 50-Oa-F4-15 (0.32 ha/0.8 ac)

Seven test units (TU 31, 32, 53, 140, 141, 166, 167) were excavated along the old Oahu Railroad and Land Company right-of-way, between the marsh edge and the location of the original 1977 Bishop Museum test at the eastern end of Survey Area 9. Two of the units (TU 31, 53) were faced-sections, while five (TU 32, 140, 141, 166, 167) were auger tests. Six of the units (TU 31, 32, 140, 141, 166, 167) revealed the following representative stratigraphy:

Horizon	Depth	Description
A	0-80 cm	Yellowish brown (10YR 5/6) loam; weak very fine angular blocky structure; slightly sticky and slightly plastic.
B_{21}	80-110	Very dark greyish brown (10YR 3/2) silty loam; water-saturated; slightly sticky, plastic.

B_{22}	110-160	Dark yellowish brown (10YR 3/4) to very dark grey (10YR 3/1) clay; water-saturated; sticky, plastic; organic flecking.
1b	160-210	Black (10YR 2/1) peat; water-saturated; sticky, plastic; organic to organic inclusions.
2b	210-360	Very dark brown (10YR 2/2) sandy silt; water-saturated; slightly sticky, slightly plastic.

This stratigraphy is in accordance with the column for Pearl Harbor clay (Foote et al. 1972) (see Appendix A). It does not correspond with the stratigraphy originally recorded by the Bishop Museum (Dye 1977:6).

A faced-section unit (TU 53) was placed in the vicinity of the original Bishop Museum test location. Both displayed a stratigraphy that had a black peat layer over a very dark grey clay layer (Figure 19). This stratigraphy has these layers reversed when compared to the Pearl Harbor clay description. This discrepancy was clarified by a careful examination of the vicinity. The exposure where the Museum profile had been recorded was the result of an earlier backhoe cut made through a soil mound formed by deposition of material excavated from a nearby sink hole, thus inverting the stratigraphy.

The location of the 1977 Museum test had been designated Site 50-Oa-F4-15, based on the presence of the black soil layer that was believed might "...represent the remains of prehistoric [wetland] agriculture" (Dye 1977:6). Though the justification for a site number at this particular location is no longer supported after the additional field work testing, the site number will be retained to identify the Pearl Harbor clay profiles that are present in Survey Area 9.

Another stacked coral wall, Site T-5, was recorded in Survey Area 9. This wall averages 0.85 m in height and width. Wall length was not determined, as the wall and the surrounding area are heavily overgrown with hau. The wall orientation at the point of intersection with the railroad right-of-way is almost due N-S. The railroad bed orientation at this point is NNE-SSW. Visible on Monsarrat's 1876 map of Kahuku Ranch, the wall predates the railroad, which was completed in 1892.

SURVEY AREA 10 - Proposed Water Hazard (1.5 ha/3.7 ac)

This area is presently covered with lantana and used as a cow pasture. Four auger tests (TU 54, 55, 168, 169) were spaced

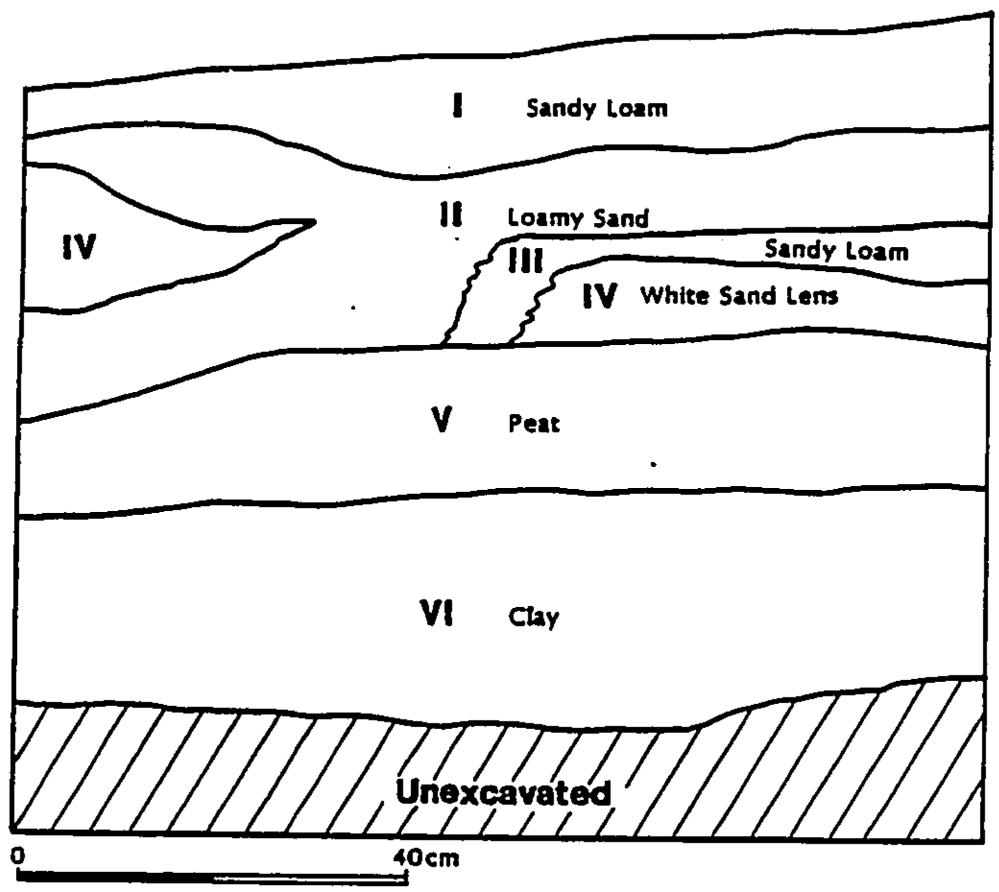

Figure 14

Site 50-Oa-F4-15

TU 53 East Face

around the pasture. No subsurface cultural layers or materials were encountered. There are, however, numerous cement foundations (each c. 12 by 15 feet), which apparently had been used for small barracks during the WW II military occupation at Kahuku. The stratigraphic profile here consists of a very thin (10 to 15 cm) A horizon of loamy sand overlying coral bedrock.

SURVEY AREA 11 - Proposed Water Hazard (0.5 ha/1.2 ac)

This area is presently an agricultural field. A drainage runs through the field and terminates in a freshwater marshy area which appears to be the southeastern extent of Punahoolapa Marsh. Two auger tests (TU 33, 142) were made in the field. The soils recovered from beneath the present agricultural topsoil are similar to the Pearl Harbor clay (with underlying peat) identified in Survey Area 9. Soil samples of the clay (Sample No. 34) and peat (Sample No. 35) subsequently underwent pollen analysis, the results of which are presented in Appendix B. Bulked soil samples from the same clay and peat layers were also submitted for radiocarbon analysis (PHRI No. RC-154 and 155).

SURVEY AREA 12 - Punahoolapa Marsh, NE Area (1.9 ha/4.7 ac)

Five auger tests (TU 58-60, 172, 173) were placed in this area on the northeast border of Punahoolapa Marsh. Tests in the eastern portion of the area indicate a thin A horizon overlying coral bedrock, as was encountered in Survey Area 10. Those in the western portion (TU 59, 60, 173), nearer to the marsh edge, have the same stratigraphic soil profile found in Survey Areas 8, 9, and 11. A drainage ditch cut along the edge of the agricultural field bordering Survey Area 12 on the east revealed a buried asphalt surface, identifiable by reference to Sheets No. 3 and 5 of the Kahuku Air Base maps as a large asphalt runway apron on the south side of the southern runway (see Figures 7 and 8). This pad provided access to hangar areas. A concrete structure was noted, but not recorded, east of Survey Area 12.

SURVEY AREA 13 - Sakamoto Farm (3.7 ha/9.1 ac)

Six very widely-spaced test units (TU 29, 30, 136-139) were made in Survey Area 13. Historic research (see Appendix C) indicates that there were a number of kuleana in this general area, but no surface or subsurface evidence of any such historic occupation was identified in the appropriately located auger tests (TU 30, 138, 139).

The findings indicate that test units TU 29, 136, and 137 are located on the edge of the Pearl Harbor clay deposits. However, the underlying peat layer found in Survey Areas 8, 9, 11, and 12 was not found here. In the northern part of Survey Area 13 there is only a thin layer of soil overlying coral bedrock (TU 30, 138, 139). TU 30 was excavated close to a small natural sinkhole pond, which obviously had a source of circulating fresh water.

One small concrete structure, Site T-4, was identified adjacent to TU 136. Site T-4 is a roofless, poured concrete octagonal structure, 2.25 m in diameter and 1.22 m high. About 45 cm below the top of the structure is a small rectangular aperture, 45 cm wide by 77 cm high. Wall thickness is 50 cm. A second large concrete structure was noted near TU 30, but it was not recorded. Both were assumed to be military in origin.

PRELIMINARY HISTORICAL DOCUMENTARY RESEARCH FINDINGS

Preliminary historical documentary research was carried out by Ms. Carol L. Silva, and her report has been included here as Appendix C. Her report contains references from mythological literature, a brief historical sketch of the general Kahuku area, specific historical references to the project area, information regarding land records for the period prior to A.D. 1900, a note on relevant cartographic sources, and recommendations for additional historical research that would appear to be useful for understanding the significance of the archaeological and historical sites present within the Kuilima Resort project area.

Restricted in scope and scale, the preliminary documentary historical research was originally intended to focus on the more readily available published and archival resources in order to present a short summary of the history of the project area, and to assess the potential for subsequent more detailed historical documentary research. Much of the preliminary historical documentary research for the general Kahuku area was subsequently discovered, in the process of doing the archaeological background research, to have been done already as part of various contract archaeology projects conducted in the general Kahuku area over the last four years (see Nakamura 1981, Davis 1981: 7-10, Sinoto 1981:4-16).

In the course of her research, Ms. Silva examined more than fifty sources for materials relevant to the project area. In general, little information specific to the project area was found, with the exception of numerous kuleana land claim and award documents. These land awards allowed the common people to acquire fee simple title to traditionally occupied parcels; however, "...before receiving awards for their lands from the Land

Commission under [the] Act of 1850, the native tenants were re-quired to prove that they actually cultivated those lands for a living" (Chinen 1966:30). The first cursory examination of the land records indicated the presence of few kuleana, and the more obvious ommissions. The full extent of the available documen-tary materials came to be realized only as the initial research effort progressed back to the original archival documents.

Documentary materials for forty-six kuleana claims and awards situated within the project area have been located and examined. More than 200 man-hours were expended to sort through various old tax maps, clarify the discrepancies found on the tax maps, locate the original land claim and award documents, and translate them from Hawaiian into English. Translations and copies of selected documents are included here in Appendix C.

DATA ANALYSES

The recovery of charcoal, midden, and soil samples from subsurface deposits made it possible to do some preliminary analyses, an option which is not normally available in recon-naissance surveys. Charcoal was recovered in sufficient quan-tity for radiocarbon dating from Sites T-1, P4-14, and T-6. As it is now possible to date organic materials in soil matrices, soil samples from other proveniences were also submitted for radiocarbon analysis. These were samples of the peat and clay layers from Survey Area 11.

Samples of these same peat and clay layers were also sent for pollen analysis to Dr. Jerome Ward, a palynologist at the University of Oklahoma. Pollen counts provide information as to vegetation associations correlated with soils, and therefore yield data which aid in reconstructing past environmental con-ditions. Pollen counts and radiocarbon dates from these soil layers woulld provide one reasonable basis for assessing the possible presence of prehistoric agriculture in the vicinity of Punahoolapa Marsh.

Recovered artifacts were processed and cataloged, and are summarized in Table 3. Human skeletal remains from Sites T-1 and T-6 were identified, and are listed by site in Table 4. Midden identifications were made for selected samples, and the results are given in Table 5.

PORTABLE ARTIFACTS

Artifacts recovered during the course of the project are summarized according to type and provenience in Table 3. Both surface and subsurface finds are included. Six artifacts were identified from Survey Area 1. A historic glass fragment and one rusty metal fragment were recovered from Layer I (0-12 cm below surface) of TU 157. Indigenous-type artifacts include the bone point of a composite fishhook from Layer I (18 cm below sur-face) of TU 111, and one polished basalt flake and two basalt flakes from Layer II (110 cm below surface) of TU 112 .

Survey Area 7, Site T-1, yielded four artifacts. A single flake of volcanic glass and a rifle shell casing were found in Layer I (10-20 cm below surface) of TU 135. Two artifacts, a shell casing and a carbon rod, were collected from the surface near TU 133. Other evidence noted on the beach are the remains of concrete anti-aircraft gun emplacements, fragments of Marston steel matting, and a lid from an anti-aircraft ammunition box.

Table 3.

PORTABLE ARTIFACTS RECOVERED

Type	Area 1 Site T-6	Area 7 Site T-1	Area 8 Site T-2 & General	Area 9 General
INDIGENOUS MATERIALS				
Composite fishhook point (bone)	1	-	-	-
Polished basalt flake	1	-	-	-
Flaked stone				
Basalt	2	-	-	-
Volcanic glass	-	1	-	-
Total Indigenous	4	1	-	-
HISTORIC MATERIALS				
Bottle glass fragment	1	-	1	-
Bottles	-	-	10	-
Carbon rod	-	1	-	-
Ceramic insulator	-	-	-	1
Nail (round head)	-	-	1	-
Shell casing	-	2	-	-
Metal fragments (rusted)	1+	-	-	-
Total Historic	2+	3	12	1
Total Artifacts	6+	4	12	1

Of the ten bottles collected in Survey Area 8, one was a beverage bottle, three were ink bottles (two with interior wells), three were pickle/preserve bottles, two prescription or pharmaceutical bottles, and the last unknown. All of the bottles were collected from the surface near TU 129 and TU 130. Most appear to date to pre-World War II and World War II. There are no indications that the area has been used since World War II. Another surface find was a nail at TU 131. The only subsurface artifact from TU 131 was a glass fragment recovered from Layer II (86 cm below surface). The final artifact is a ceramic insulator found on the surface near TU 140 in Survey Area 9.

HUMAN SKELETAL REMAINS

Recovered human skeletal remains are summarized in Table 4. The radius head fragment recovered from an underground solution chamber at Site T-6 was identified during testing. At least part, and possibly most, of the radius is still *in situ*. The use of solution chambers, which apparently were subsequently capped, as burial chambers may not be uncommon in Hawaii. One is reported from Barbers Point of Oahu (Davis, pers. comm.), which is also a coral limestone reef formation.

Table 4.

IDENTIFIED HUMAN SKELETAL REMAINS

Provenience	Identification
T-6	Radius - head fragment
T-1	Radius - left (complete except for proximal end) Cranial fragments - including maxilla Rib fragment Phalange tip - hand or foot (uncertain) Fibula - left 4th metatarsal - probably left Vertebrate fragment
Survey Area 12	Incisor

Bones identified at Site T-1 were not *in situ*. They had been disturbed by sand vehicle activity and subsequently by bulldozing. The excavation of the two skeletons carried out earlier by the Honolulu Police obviously would have disturbed the site deposit also. The distribution of the bones strongly suggests, however, that undisturbed subsurface deposits may still be present in the dune immediately to the west of the TU 135 location. Neller (1984) described the skeletal remains that were previously disinterred by the Honolulu Police and removed to the Medical Examiner's Office.

All skeletal remains recently examined at Site T-1 are listed in Table 4. The cranial fragments displayed occlusal surfaces of the maxilla teeth that are only slightly worn and no dental caries. Cranial sutures are still rugged. These traits suggest that the individual was probably a young adult. Bones which would aid in sexing were not recovered. The absence of any associated coffin remains, or grave goods suggests prehistoric interment.

The incisor found in Survey Area 12 was a surface find. The tooth is broken, and the break may be post-mortem. No caries are present. The outstanding characteristic of this incisor is its relatively large size.

MIDDEN REMAINS

Identifications of recovered midden remains are presented in Table 5. Ecofactual remains from the four coastal sites (T-1, T-6, T-7, and F4-14) were examined. The limited nature of the testing did not yield samples for detailed comparative analysis, and therefore only the presence or absence of identified species is indicated.

Shell midden remains indicate exploitation of both gastropods and bivalves, primarily the shallow water dwellers. Fish bone is present, but not specifically identified, and thus no implications can be derived as to whether inshore or deep water species were being taken. The Bishop Museum midden list (Dye 1977:5) includes fish bone from F4-14 identified as *Scarus* sp. (parrot fish), which is a lagoon or reef dweller. Turtle bone was also recovered, but turtles have a wide range of habitats and cannot be considered as evidence of deep water exploitation. So far, the evidence points to the use of inshore shallow water habitats for marine resources.

Pieces of both carbonized and non-carbonized *kukui* nut shell (*Aleurites moluccana*) have been identified as present in all sites listed on Table 5. Nonmarine gastropods (land snails) were also present at the four sites examined.

RADIOCARBON ANALYSIS

Three charcoal samples and two soil samples were submitted to Beta Analytic, Inc. for radiocarbon age determinations. The results of the analyses are presented in Table 6.

PHRI No. RC-154 and -155 were recovered from subsurface peat and clay deposits respectively at Survey Area 11. Both were given special handling for bulk low carbon samples. This treatment included multiple extractions and extended counting.

PHRI No. RC-156 was a bulked firepit from Layer II of TU 34 at Site T-1. The contents of the bulk sample were sorted in the PHRI laboratory for fragments of charcoal. PHRI No. RC-157 was taken from the lowest cultural layer (Layer IV) of an exposed face in TU 149, Site F4-14. This was a bulked sample from the layer matrix. PHRI No. RC-157 was also given special handling

Table 5.

QUALITATIVE SUMMARY OF MIDDEN REMAINS

Category	Area 1 T-6	Area 5 T-7	Area 6 F4-14 II	III	IV	Area 7 T-1 II	III
GASTROPODA							
Cellana sp.	-	-	-	+	-	-	-
Turbo sandwicensis	+	-	-	-	-	-	-
Neritidae	+	-	-	-	-	-	-
Nerita picea	+	+	+	+	+	-	+
Littorinidae	-	-	-	+	-	-	+
Planaxis labiosa	-	-	-	-	-	-	+
Strombidae	+	-	-	+	-	-	-
Hipponicidae	+	-	+	+	+	-	+
Cypraeidae	-	-	+	-	+	+	-
C. caputserpentis	+	-	+	+	-	-	-
Conidae	-	-	+	-	-	-	-
Opercula	+	-	-	+	-	-	+
Unidentified	-	-	+	+	-	-	+
BIVALVIA							
Brachidontes cerebristriatus	+	+	+	+	+	-	-
Isognomon californicum	+	-	-	-	-	-	-
Gouldei cookei	-	-	-	+	-	-	+
Periglypta reticulata	-	-	-	+	-	-	+
NONMARINE GASTROPODS	+	+	-	+	+-	-	+
ECHINOIDEA	+	+	-	-	-	-	+
E. calamaris	-	+	+	+	+	-	+
CRUSTACEA	+	+	-	-	-	-	+
VERTEBRATES							
Bird	-	-	-	-	+	-	+
Fish	-	+	+	+	+	-	+
Mammal	-	+	-	+	+	-	+
Unidentified	+	+	-	+	-	-	-
VEGETABLE MATERIAL							
Charcoal	+	+	+	+	+	-	+
Aleurites moluccana							
Carbonized	+	+	-	-	+	-	-
Non-carbonized	+	-	-	+	+	-	-
Unidentified seed	-	-	-	-	+	-	-

Key: + = Present
 - = Absent (not identified)

Table 6.

RADIOCARBON AGE DETERMINATIONS

PHRI No. RC-	Lab No. Beta-	Provenience	C-14 Age Years B.P.±1 S.D.	C-13 Adjusted C-14 Age Years B.P.	Calibrated* Date Range (95% Confidence)
154	10534	Survey Area 11; TU 142; Layer IV; 84-94 cm below surface	3090±130	2990±130	1575-845 B.C.
155	10535	Survey Area 11; TU 33; Layer III; 120-215 cm below surface	4840±130	4750±130	3865-3165 B.C.
156	10536	Site T-1; TU 34; Layer II; 46-62 cm below surface	130±60	110±60	A.D. 1655-1950
157	10537	Site F4-14; TU 149; Layer IV; 54-59 cm below surface	2070±50	1990±50	165 B.C.- A.D. 210
158	10663	Site T-6; TU 158; Layer II; 12-68 cm below surface	Less than 150	180±60	A.D. 1630-1950

*Calibrated date ranges according to Klein et al. (1982).

which included multiple extractions and extended counting. PHRI No. RC-158 was recovered from Layer II in an auger test (TU 158) at Site T-6. The sample was screened, sorted in the field, and was wrapped in aluminum foil. All sample analyses included the counting of C-14 radioactivity and determination of C-13/C-12 stable isotope ratios.

Survey Area 11

Dating of the previously suspected agricultural soils that were similar to soils described for Site F4-15 presented a situation whereby the upper clay layer (Layer III) had a date range older than the underlying peat layer (Layer IV). The results suggest that the older clay sediments (PHRI No. RC-155, calibrated date range of 3865-3165 B.C.) were naturally transported into their present location, where they covered a younger peat layer (PHRI No. RC-154, calibrated date range of 1575-845 B.C.) The Soil Conservation Service (USDA-SCS 1972:112) notes that these Pearl Harbor clays are developed in alluvium overlying organic matter (peat), and not in residuum. Thus the dating is consistent with the development of the soil profile. However, the very old date derived from the organics present in the clay cannot be related to any prehistoric agriculture on the Kahuku Plain. The date must be considered as dating the organics deposited in the soil prior to transport. The age determinations of the two layers do suggest that an environmental change of some magnitude occurred in the past, possibly near the upper end of the date range derived from the peat sample, around 800 B.C. This change might well have resulted in transport of alluvium from the uplands down to the coastal plain.

Site T-1

PHRI No. RC-156, dating a Layer II firepit at Site T-1 on Kahuku Point, resulted in a wide date range. The calibrated range is A.D. 1655-1950. No artifactual remains, indigenous or historic, were recovered from this layer. The only possible corroborative evidence at this time are the skeletal remains which suggest prehistoric interment.

Site Oa-F4-14

PHRI No. RC-157 from Site F4-14 was obtained from a faced-section (TU 149) of a dune. The dense charcoal and ash deposit suggested a firepit rakeout area. The date derived from this sample, which corrects to a calibrated range of 165 B.C.- A.D. 210, is the earliest yet obtained for a culturally deposited layer in Hawaii. Prior to this project, the earliest generally accepted Hawaiian settlement dates were c. A.D. 400 from Bellows

Beach on Oahu and the South Point area on Hawaii Island (Tuggle 1979:189). The potential significance of Site F4-14, in terms of scientific research value for Hawaiian archaeology, cannot be overstated.

The similarity of stratigraphy noted in F4-14 on the west side of Kahuku Point and T-1 on the east side of Kahuku Point also raises a very important question. If the observed similarity of the stratigraphic layers actually represents equivalence, then there is a wide disparity in age which needs clarification. If, however, the layers are not equivalent, then the dates indicate the possibily of long-term occupational span at Kahuku Point.

Site T-6

The Kawela Bay Site (T-6) sample (PHRI No. RC-158) yielded a calibrated date range of A.D. 1630-1950. The historical documentary records suggest extensive use of the area in the past. The Land Commission records of 1847 and 1848 (see Appendix C) indicate that many of the Hawaiians represented in land claims examined had their house lots at Kawela Bay. Rights of occupancy for some of these lots were testified to as dating back to Kamehameha I,and by implication even earlier. Only indigenous artifacts were recovered from the soil matrix which provided the dating sample.

POLLEN ANALYSIS

Four soil samples were submitted to Dr. Jerome Ward at the University of Oklahoma-School of Geology & Geophysics for pollen analysis. Samples No. 34 and 35 were selected and analyzed for pollen and spore content. Both samples were taken from TU 142 in Survey Area 11, the previously suspected agricultural area. Sample No. 34 was a clay sample taken from Layer III (52-84 cm below surface), while Sample No. 35 was a peat sample from Layer IV (84-94 cm below surface). The results of this preliminary study are presented here in Appendix B. In general, findings document an early period of low water (but perhaps high water table and abundant rainfall), and a later period of higher water. Ward goes on to say that "...certain dry loving plants present would indicate some amount of seasonality (and/or disturbance)...", and concludes that there was "...nothing in the samples that would be likened to cultivated plant pollen" (Letter of October 30, 1984 to Paul H. Rosendahl).

CONCLUSION

DISCUSSION

Subsurface reconnaissance survey of the Kuilima Resort project area identified archaeological remains of both prehistoric and historic-period occupation. The range of archaeological features found within the project area includes prehistoric subsurface cultural deposits and burials, historic walls, possible agricultural soils, and recent military and other structures. The overall physical condition of the archaeological remains is fair. In general, the potentially most significant remains, the prehistoric subsurface cultural deposits and associated burials, are located along the coast. The inland portion of the project area has been extensively modified during the recent historic past, as documented by the 1951 aerial photo (Figure 5) of the Kahuku area and the Kahuku Air Base General Plan (Figures 6, 7, and 8), and as confirmed by recent field work findings. One area that appears to have escaped substantial human modification is the Punahoolapa Marsh, located in the eastern portion of the project area. Sites in the general vicinity of the marsh include possible agricultural soils, historic walls, and recent military and other structures.

Survey Area 1

This area is essentially conterminous with Site T-6. On the basis of documentary evidence, this site is indicated to have a chronological sequence from at least Kamehameha I times through the 19th century. Auger tests suggest that it is a single component occupation site. Burials are clearly present, but how they relate to the occupation is not clear on the basis of reconnaissance testing. The recovery of indigenous artifacts lends some strength to the historically documented pre-contact phase at Kawela Bay. Thus the site is possibly a transitional one, which could provide valuable evidence bearing on both pre- and post-contact adaptations and the processes of change.

Survey Area 2

The proposed realignment of Kawela stream crosses agricultural land on the south and deep alluvial deposits towards the north. Testing did not provide any evidence of subsurface cultural layers on the southern agricultural portion of the realignment. Organic flecking was noted in the alluvial clays of the northern portion, but no cultural occupation layers were documented by testing. Organic flecking is thought more likely to represent evidence of past agricultural activities or natural processes, rather than occupation.

Survey Areas 3 and 4

Both of these areas are recently formed and/or modified beach berms. Only one auger test in Area 3 provided evidence of a buried surface, and there was no indication that the surface was anthropogenic in origin. The Pleistocene coral reef bedrock is lower in the bays than on the points, and storm action has clearly modified the deposits.

Survey Area 5

In this area, Site T-7 was found along the ocean side of the high beach berm, or dune. On the evidence so far gathered, the cultural deposits in the berm are either early historic or recent. The co-occurrence of wood and corrugated iron roofing materials with firepits and imu suggests that the site may be recent. The beach location implies that the site may be related to present-day shoreline fishing activities.

The remainder of Area 5, inland of the beach berm, yielded no evidence of cultural remains. From ground inspection, subsurface auger testing, and study of the Kahuku Air Base maps, it is clear that this area was heavily modified by WW II runway construction. The construction activity apparently was extensive enough that any evidence of prior prehistoric or historic occupation which may have been present has been obliterated.

Survey Area 6

This area is the locus of Site 50-Oa-F4-14. Subsurface testing demonstrated that three cultural layers to be present here. The cultural nature of the layers is evidenced by the recovery of midden remains (Table 5, this report; Dye 1977:5), and the previously excavated firepits and artifacts (Dye 1977: 5). The radiocarbon date obtained on the stratigraphically lowest of these cultural layers has a date range of 165 B.C.-A.D. 210. This is the earliest radiocarbon date yet obtained from a definite cultural deposit in Hawaii.

The site tentatively represents a stratified deposit with a very early component. The condition of the site is fragile. The area is subjected not only to the natural erosional forces, but is currently being adversely affected by sand vehicles.

Survey Area 7

On the east side of Kahuku Point, this area is the locus of Site T-1. Two layers are evident. The upper is a grey layer, associated with burials, and the lower is characterized by a

heavy charcoal deposit and firepits. The site area is being exposed by sand vehicle activity. This activity has also churned up the burial deposits, and damage is on-going. Two different sand vehicle concessions are affecting the site. One is the concession operating out of the Turtle Bay Hilton Hotel. This operator has confined activity to an oval track on the beach, but the oval overlaps the archaeological site. The other independent concession is based on Campbell Estate property east of the site, but customers are free to explore without guides. Many find their way to this site, and they are not confined to the oval track.

The radiocarbon age determination for a firepit from the lower layer of the site yielded a calibrated date range of A.D. 1655 to 1950. The actual occupation could fall anywhere within this range. The fact that the burials which overlie the dated layer produced no post-contact remains would strongly suggests that the dated layer is prehistoric, and probably dates toward the earlier portion of the corrected date range.

Site T-1 is quite likely an eastward portion of Site 50-Oa-F4-14 in Survey Area 6, as the two cultural layers found at T-1 are very similar to Layers III and IV on the other side of Kahuku Point. At present, the two areas are separated by a large dune which was constructed by the military as a protective embankment around an airplane parking area (Figures 5 and 6). It is also possible that the skeletons relate to the "graveyard" reported by McAllister in his description of Site 262 (1933:153, Figure 19). While Kukio Pond has not been identified, if McAllister's location of this pond is correct, the pond would have been filled in during the construction of Kahuku Air Base. It is very possible, however, that McAllister never actually saw the site, and his placement of it could be very inaccurate. On the 1927 aerial photo, a dark spot possibly indicating Kukio Pond is visible just inland of Kahuku Point.

Survey Area 8

This survey area covers several different depositional regimes. Testing along the eastern edge of the existing drainage indicates deep alluvial soils overlaid by golf course topsoil. No cultural layers were encountered, and deposits show evidence of prior mixing and modification. For these reasons, testing was not extended along the existing channelized drainage.

Tests conducted in the portion of the area proposed for club house construction yielded the same soils suggested as being agricultural soils at Site F4-15 in Survey Area 9. Testing on the existing golf course produced no cultural layers, and indicates that extensive modification of the soil has taken place during golf course construction.

The test units placed in the heavily overgrown area between the edge of the golf course and the marsh produced no evidence of prehistoric cultural layers. However, Site T-2, a stacked coral wall, was recorded in this sector of Survey Area 8. This wall is historic, and very probably dates back to the establishment of the original Kahuku Ranch, c. A.D. 1850. Site T-3, recorded in the same area, is a recent animal pen.

Survey Area 9

The reconnaissance survey conducted by Bishop Museum in 1977 identified a black peat layer (exposed in a backhoe cut) which was interpreted as suggesting the existence of prehistoric cultivation (Dye 1977:6). This location was designated Site 50-Oa-F4-15 at that time. During the present project, six test units were dug along the old Oahu Railroad and Land Company right-of-way, between the marsh edge and the location of the original Bishop Museum test at the eastern end of Survey Area 9. All tests revealed stratigraphy corresponding to Pearl Harbor clay (Foote et al. 1972)--a layer of dark yellowish brown to very dark grey clay over a black peat layer. These findings did not correspond with those of the earlier Museum excavation--a black layer over the dark clay (Dye 1977:6). The obvious discrepancy concerning this very organic black peat layer, which was originally postulated as possibly wetland agricultural in nature, needed to be explained. Therefore the immediate focus was on the relationship of these two layers, the black peat and very dark grey clay.

A faced-section test (TU 53) was placed in the vicinity of the original Bishop Museum test location. Both displayed a stratigraphy that had a black peat layer over a very dark grey clay layer. This stratigraphy has these layers reversed when compared with the Pearl Harbor clay description. A careful examination of the immediate area clarified the discrepancy. The backhoe cut had been made through a soil mound which had been formed by the deposition of materials excavated from a nearby sink hole, thus inverting the natural stratigraphy. The site number has been retained for the area, as the Pearl Harbor clay profiles present suggest a potential for taro cultivation (Foote et al. 1972:12). This same soil profile was identified in Survey Areas 8, 11, 12 and 13.

The detailed analysis of these two layers is discussed below in the section about Survey Area 11. Samples sufficient for radiocarbon dating, and comparable sample material for pollen analysis, were collected from Survey Area 11. In general, the auger tests in Survey Area 9 did not provide sample materials sufficient for analysis. Also the depth of samples--over three meters below surface in some areas, and the need to sample as much of the overall project area as possible, necessitated the use of auger testing to accomplish this task.

A stacked coral wall, Site T-5, was also located in this area. This wall documents the historic period use of the area.

Survey Area 10

This area has a very thin recent soil mantle over coral bedrock. No cultural remains other than military cement pads were present.

Survey Area 11

Only two auger tests were made in this area, but analysis of the recovered sample material provides insight into the depositional nature of the Pearl Harbor clays identified in Survey Areas 8, 9, 11, 12 and 13. The analysis focused on the lower black peat layer and the overlying dark grey clay because of the earlier suggestion that the rich organic black peat layer was a cultivated matrix. The other overlying soil layers present were not subjected to detailed examination.

Results of both the pollen analysis and radiocarbon analysis present corroborative evidence that the clay layer (III) and the underlying black peat layer (IV) were not cultivated. No cultivated plant pollens were identified, and both layers pre-date considerably initial human settlement of the Hawaiian Islands.

The dating results presented an interesting chronological inversion. The upper clay layer (III) had a date range older than the lower peat layer (IV), suggesting that the older clay sediments (PHRI No. RC-155, calibrated date range of 3865-3165 B.C.) had been naturally transported into the present location, where they covered a younger peat layer (PHRI No. RC-154, calibrated date range of 1575-845 B.C.). The Soil Conservation Service (Foote et al. 1972:112) notes that these Pearl Harbor clays are developed in alluvium overlying organic matter (peat), and not in residuum. Thus the dating is consistent with the development of the soil profile.

These findings suggest the possibility of substantial landscape changes. Similar landscape changes have been identified in Kahana Valley, on the northeast coast of Oahu. Recent research by Price-Beggerly (pers. comm.) has yielded a dated stratigraphic sequence of local environmental change in the valley. The major stratigraphic units are, from oldest to youngest:

Layer	Description
1	Marine ocean sands, 3 meters+ deposit.
2	A mixed deposit of marine sands, *Tellina* and *Theodoxus neglectus* shell, and basalt rock pebbles, basaltic

terrigenous sands and silts. Dated to 2340±100 years B.P., which corrects (Klein et al. 1982) to 770-180 B.C.

3 Silts and basaltic terrigenous material. This layer is dated at 1690±80 years B.P., which corrects (Klein et al. 1982) to A.D. 60-575.

The dates derive from charcoal recovered from Layers II and III, and Price-Beggerly (pers. comm.) has suggested that the change in the nature of the deposits (and their included charcoal) might possibly have resulted from the burning off of the vegetation cover and subsequent erosion of upland Kahana Valley slopes. Such events could have been natural and/or possibly cultural in origin.

The clay and peat layers encountered in the marsh deposits in Survey Areas 9 and 11 (in and adjacent to Punahoolapa Marsh) might possibly reflect similar sequences of local environmental change in the Kahuku area. Additional indications suggesting such changes are provided by the results of the radiocarbon and pollen analyses.

Survey Area 12

The eastern section of Survey Area 12 has no cultural remains other than recent military. The soil is a thin, culturally sterile A horizon overlying coral bedrock. In the western portion of the area, nearer the marsh margin, Pearl Harbor clays were encountered.

Survey Area 13

Military modification of the landscape during the construction of Kahuku Air Base appears to have effectively destroyed the previous land surfaces. While the historic record documents several kuleana in this vicinity (see Appendix C), no prehistoric or historic cultural deposits were located in the auger tests located on the northern portion of the survey area.

The auger test dug in the southern half of the survey area revealed the Pearl Harbor clays without the underlying peat layer. One small concrete structure, Site T-4, was recorded. A similar structure was also noted in the area. Both structures were presumed to be military in origin.

EVALUATIONS AND RECOMMENDATIONS

The significance of archaeological remains can be defined in terms of potential scientific research, interpretive, and/or cultural values. Research value refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past life-ways, and cultural processes at the local, regional, and interregional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation. Cultural value, within the framework for significance evaluation used here, refers to the potential of archaeological resources for the preservation and promotion of cultural and ethnic identity and values.

To attempt definitive evaluation of the significance of archaeological resources on the basis of a preliminary assessment such as a reconnaissance survey is generally premature. Occasionally it is possible at even a preliminary level of study, such as that of a reconnaissance survey, to evaluate the significance of specific sites or features when their scientific research, interpretive, and/or cultural value is obvious; however, in most instances it is necessary first to conduct intensive survey, often including test excavations, to determine and substantiate the significance of specific archaeological remains.

Upon completion of the reconnaissance survey field work, preliminary conclusions, including tentative evaluations and recommendations, were formulated. Preliminary recommendations were made for dealing with the archaeological resources identified within the project area. Tentative significance evaluations and preliminary recommendations for appropriate further archaeological work, including intensive survey, on specific identified sites and within individual survey areas are outlined in Table 7. In general, the need for further archaeological work at specific sites is obvious.

Located along the coastal stretches of Kahuku Point, Sites 50-Oa-F4-14 and T-1 both require immediate attention. They contain subsurface cultural deposits and burials that are presently being disturbed and destroyed by sand vehicles. Fencing off the site areas is recommended as a temporary action to prevent further damage to the sites. These sites contain stratified, subsurface cultural deposits which may yield information on early settlement of the Hawaiian Islands. One dated sample from Layer V of Site F4-14 (PHRI No. RC-157) has a calibrated date range of 165 B.C.-A.D. 210, the earliest single date from a definite cultural deposit in Hawaii. Intensive survey and testing of both sites is strongly recommended in order to determine fully and document their nature and significance.

Table 7.

EVALUATIONS AND RECOMMENDATIONS FOR SURVEY AREAS AND SITES IDENTIFIED WITHIN THE KUILIMA RESORT PROJECT AREA

Survey Area	Site No.	Physical Condition	Significance* Degree & Nature	Recommended Treatment
1	T-6	Fair-Good	Mod.-Hi. Res.	Intensive survey and testing
2	-	-	-	Archaeological clearance
3	-	-	-	Archaeological clearance
4	-	-	-	Archaeological clearance
5	T-7	Poor-Fair	Low-Mod. Res.	Limited testing; archaeological clearance for remainder of area
6	F4-14	Fair	Hi. Res.	Immediate protection; intensive survey and testing
7	T-1	Fair	Hi. Res.	Immediate protection; intensive survey and testing
8	T-2	Fair	Low Res./Mod.Int.	Incorporate into landscaping
8	T-3	Fair	-	No further work (recent)
8	Agri. soils	Fair	Low-Mod. Res.	Limited testing and/or archaeological monitoring; archaeological clearance for remainder of area

*Significance Evaluation--
Degree: Hi. = High
Mod.= Moderate
Low = Low

Nature: Res. = Scientific Research
Int. = Interpretive

Table 7. (Cont.)

Survey Area	Site No.	Physical Condition	Significance* Degree & Nature	Recommended Treatment
9	T-5	Fair	Low Res./Mod.Int.	Incorporate into landscaping
9	F4-15	Fair	Low-Mod. Res.	Limited testing; archaeological monitoring
10	-	-	-	Archaeological clearance
11	Agri. soils	Fair	Low-Mod. Res.	Limited testing and/or archaeological monitoring; archaeological clearance for remainder of area
12	Agri. soils	Fair	Low-Mod. Res.	Limited testing and/or archaeological monitoring; archaeological clearance for remainder of area
13	T-4	Fair	-	No further work (recent)
13	Agri. soils	Fair	Low-Mod. Res.	Limited testing and/or archaeological monitoring; archaeological clearance for remainder of area

*Significance Evaluation--
Degree: Hi. = High
Mod.= Moderate
Low = Low

Nature: Res. = Scientific Research
Int. = Interpretive

Site T-6, located along the coastal section of Kawela Bay and extending to the east, should also receive intensive survey and testing. A subsurface cultural deposit yielded both indig- enous and historic artifacts, and has a calibrated date range of A.D. 1630-1950. Burials have also been identified within the limits of this site. The site area includes numerous kuleana (see Appendix C) which attest to the intensive early historic occupation of the area.

Site T-7, an area defined as a subsurface cultural deposit, requires limited testing to substantiate the preliminary find- ings that it represents recent activity associated with inten- sive land modification of the area. This activity most likely occurred during the military occupation of the Kahuku Air Base.

Site 50-Oa-F4-15 was designated by Bishop Museum in 1977 (Dye 1977) because the observed soil stratigraphy was thought possibly indicative of prehistoric wetland agriculture. The original discrepancy with the inverted soil stratigraphy (black peat over greyish-brown clay) noted in the 1977 test and the recently conducted subsurface reconnaissance has been clarified. Subsequent attention then focused on understanding the nature and age of these soil layers. Adequate sample material was obtained from Survey Area 11, an area also containing the Pearl harbor clays, for radiocarbon dating and pollen analysis. Nei- ther the field work nor the subsequent data analyses produced any evidence of prehistoric agriculture. They do suggest the possibility of major landscape change, and provide indications of the flora present prior to human settlement of the Hawaiian Islands. Attention was not focused on the upper stratigraphic layers overlying the previously presumed agricultural soil. These upper layers may very well represent a subsequent pre- historic cultivation matrix. Additional testing and subsequent detailed analysis is recommended to clarify the nature and impli- cations of these deposits.

Test units revealing what were originally suspected as agri- cultural soils extend across the inland area and include Survey Areas 8, 9, 11, 12, and 13. The soils are classified as Pearl Harbor clays and are considered suitable for taro cultivation (Foote et al. 1972:112-113). It is still very likely that the Punahoolapa Marsh and surrounding area supported some wetland taro cultivation in the past, even though there are no field findings to substantiate directly this claim. Referring to the presence of old taro terraces in 1935, Handy and Handy stated that "...in the seaward swampland north and south of Kukio Pond there were such remains" (1972:462). This reference describes the area inland of Kahuku Point, an area that has been exten- sively modified, except for Punahoolapa Marsh and its immediate periphery. The historical documentary records, the suitability of soils for taro cultivation, and the subsistence requirements of the local prehistoric and early historic populations all tend

to support the contention that the areas surrounding the marsh were most likely cultivated in the past. Limited testing and archaeological monitoring during land modification activities in the marsh area are therefore recommended to clarify this issue of possible agriculture soils.

Sites T-2 and T-5 are stacked coral walls that require no further archaeological work, but which are recommended for incorporation into project area landscaping. They possess low to moderate interpretive value, as they are surface structures that have been identified on early historic maps as related to ranching activities. Sites T-3 and T-4 are both recent in origin, possess little or no archaeological significance, and require no further archaeological work.

In areas where testing has either not been done or has been very limited, construction work may uncover evidence of past occupations or activities, both artifactual and depositional. A case in point would be the area of the Richardson Ranch House (Kahuku Ranch). This historic complex was located on the west- ern edge of Punahoolapa Marsh, somewhat north of the old govern- ment road, according to Monsarrat's 1876 map. This area has not been tested, and therefore archaeological monitoring is recom- mended as appropriate in this and other untested areas.

One specific area that was explicitly excluded from the sub- surface testing is the beach exit of the existing drainage be- tween the eastern edge of Survey Area 4 and the western edge of Survey Area 5. A visual check of the beach confirmed that sand- moving activities related to recurrent drainage clearing have been ongoing, probably since the construction of the barrier wall and culvert connecting the drainage channel to the beach. So much modification of the previously natural landscape has taken place in this small area that the possibility of any archaeological deposits surviving was judged to be very remote.

The areas occupied by the existing hotel and associated hotel units, the condominium complex, and the golf course were not included within the coverage of the subsurface reconnais- sance project. The original construction of the resort, which reportedly did uncover archaeological remains, including human burials (Neller, pers. comm.), was assumed to have effectively destroyed all evidence of past occupations and activities.

Testing of existing agricultural fields was limited to por- tions of Survey Areas 2 and 11. In the case of the agricultural fields inland of Kawela Bay, where the archaeological deposit consists of the uppermost 50 centimeters of the soil profile, the deposit appears to have been plowed and mixed with imported topsoil. A visual check confirmed this assessment. Agricul- tural fields on the eastern side of the project area should be approached with some caution during construction, as testing was very limited and the postulated earlier agricultural soils are presumed to underlie at least portions of the present agricultural fields.

Tests in Survey Areas 2, 3, 4, 10, and the inland portion of 5 did not reveal any buried cultural deposits. Archaeological clearance with no further archaeological work is being recommended for these areas, with the qualification that there is always the possibility that previously unidentified subsurface features or deposits may be encountered during construction. In this event, work in the immediate area of such remains should be suspended and a professional archaeologist notified. Construction activity should not resume until the archaeologist has had an opportunity to inspect and evaluate the significance of any newly discovered remains.

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APPENDIX A:

DETAILED SOIL DESCRIPTIONS

Detailed descriptions of soils present within the project area (Figure 15) are reproduced here from the Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (Foote et al. 1972).

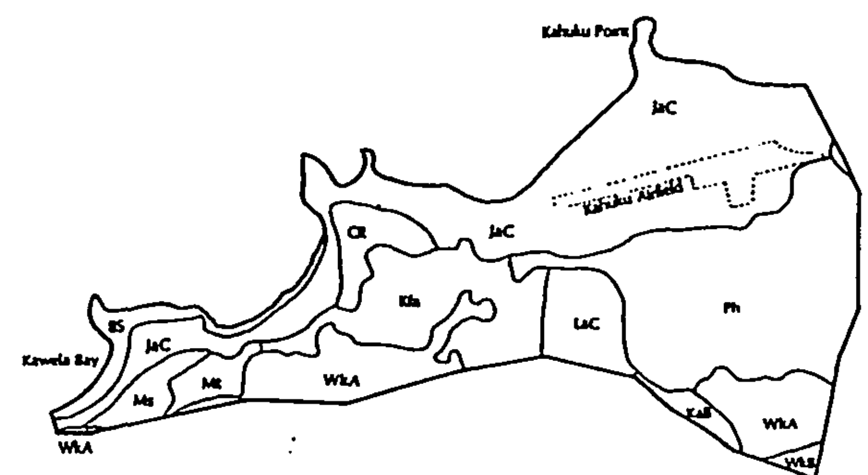

Figure 15.

SOILS DISTRIBUTION MAP*

Key:

BS	Beaches	Mt	Mokuleia clay loam
CR	Coral outcrop	Ms	Mokuleia loam
JaC	Jaucas sand (0-15% slopes)	Ph	Pearl Harbor clay
KaB	Kaena clay (2-6% slopes)	WkA	Waialua silty clay (0-3% slopes)
Kfa	Kaloko clay	WkB	Waialua silty clay (3-8% slopes)
LaC	Lahaina silty clay (7-15% slopes)		

*Taken from Foote et. al. (1972: Sheet 46).

BEACHES (BS)

Beaches (BS) occur as sandy, gravelly, or cobbly areas on all the islands in the survey area. They are washed and re-washed by ocean waves. The beaches consist mainly of light-colored sands derived from coral and seashells. A few of the beaches, however, are dark colored because their sands are from basalt and andesite.

Beaches have no value for farming. Where accessible and free of cobblestones and stones, they are highly suitable for recreational uses and resort development. (Capability classification VIIIw, nonirrigated)

CORAL OUTCROP (CR)

Coral outcrop (CR) consists of coral or cemented calcareous sand on the island of Oahu. The coral reefs formed in shallow ocean water during the time the ocean stand was at a higher level. Small areas of coral outcrop are exposed on the ocean shore, on the coastal plains, and at the foot of the uplands. Elevations range from sea level to approximately 100 feet. The annual rainfall amounts to 18 to 40 inches. Coral outcrop is geographically associated with Jaucas, Keaau, and Mokuleia soils.

Coral outcrop makes up about 80 to 90 percent of the acreage. The remaining 10 to 20 percent consists of a thin layer of friable, red soil material in cracks, crevices, and depressions within the coral outcrop. This soil material is similar to that of the Mamala series.

This land type is used for military installations, quarries, and urban development. Vegetation is sparse. It consists of kiawe, koa-haole, and fingergrass. (Capability classification VIIIs, nonirrigated)

JAUCAS SAND, 0 TO 15 PERCENT SLOPES (JaC)

The slope range of this soil is 0 to 15 percent, but in most places the slope does not exceed 7 percent. Included in mapping were narrow strips of Beaches and areas of Pulehu, Mokuleia, and Keaau soils.

In a representative profile the soil is single grain, pale brown to very pale brown, sandy, and more than 60 inches deep. In many places the surface layer is dark brown as a result of

accumulation of organic matter and alluvium. The soil is neutral to moderately alkaline throughout the profile.

Permeability is rapid, and runoff is very slow to slow. The hazard of water erosion is slight, but wind erosion is a severe hazard where vegetation has been removed. The available water capacity is 0.5 to 1.0 inch per foot of soil. In places roots penetrate to a depth of 5 feet or more. Workability is slightly difficult because the soil is loose and lacks stability for use of equipment.

Representative profile: Island of Molokai, lat.21°05'38"N. and long.157°13'03"W.

C1-- 0 to 13 inches, pale-brown (10YR 6/3) sand, light yellowish brown (10YR 6/4) when dry; single grain; loose, nonsticky and nonplastic; plentiful roots; violent effervescence with dilute hydrochloric acid; neutral; gradual, wavy boundary. 3 to 15 inches thick.

C2-- 13 to 22 inches, light yellowish-brown (10YR 6/4) sand, very pale brown (10YR 7/4) when dry; single grain; loose, nonsticky and nonplastic; few roots; violent effervescence with dilute hydrochloric acid; mildly alkaline; gradual, wavy boundary. 6 to 30 inches thick.

C3-- 22 to 60 inches, very pale brown (10YR 7/4) sand; single grain; loose, nonsticky and nonplastic; violent effervescence with dilute hydrochloric acid; neutral.

The texture of the surface layer is dominantly sand, but in a few places it is fine sand or loamy sand. In some places there is an A horizon, a few inches thick, that is darkened by organic matter and alluvium. The profile is 10YR in hue. It ranges from 6 to 7 in value, and, in chroma, from 2 to 4 when moist. Pebble-size fragments of coral and seashell are common in the profile.

This soil is used for pasture, sugarcane, truck crops, and urban development. (Capability classification IVs if irrigated, VIe if nonirrigated; sugarcane group 1; pasture group 1)

KAENA CLAY, 2 TO 6 PERCENT SLOPES (KaB)

This soil has a profile like that of Kaena stony clay, 6 to 12 percent slopes, except that there are few or no stones in the surface layer. Runoff is slow, and the erosion hazard is slight. This soil is used for sugarcane, truck crops, pasture, and urban development. (Capability classification IIIw if irrigated, IVw if nonirrigated; sugarcane group 4; pasture group 7; woodland group 4)

KALOKO CLAY (Kfa)

This soil is nearly level and occurs on coastal plains. Included in the areas mapped on Oahu were small areas that consist mainly of coral fragments or marly material; areas of clay, very poorly drained soils that are underlain by peat or muck; and small areas of dark reddish-brown, very deep, moderately well drained alluvial soils.

In a representative profile the surface layer is dark-brown clay about 12 inches thick. The subsoil, about 8 inches thick, is dark reddish-brown and weak-red clay. Below this is mottled, white to light-gray, platy silty clay about 13 inches thick. This is underlain by dark greenish-gray and dark-gray massive silty clay. The soil is mildly alkaline to neutral throughout the profile.

Permeability is moderately slow to slow. Runoff is slow to very slow, and the erosion hazard is no more than slight. The available water capacity is about 1.6 inches per foot of soil. Roots penetrate to a depth of about 40 inches or to the water table in undrained areas. Workability is somewhat difficult.

Representative profile: Island of Kauai, lat.22°01'6.5"N. and long.159°46'10.1"W.

Ap-- 0 to 12 inches, dark-brown (7.5YR 3/2) clay; common, fine, distinct, red mottles and yellowish-white specks; weak, fine, subangular blocky structure; very hard, firm, very sticky and very plastic; abundant roots; moderate reaction with hydrogen peroxide; violent reaction with hydrochloric acid; mildly alkaline; clear, smooth boundary. 8 to 15 inches thick.

B2-- 12 to 20 inches, dark reddish-brown (5YR 3/3) and weak-red (2.5YR 5/2) clay; many, fine, distinct mottles of brownish yellow (10YR 6/6), white (2.5Y 8/2), and reddish yellow (5YR 6/6); moderate, fine, angular and subangular blocky structure; very hard, firm, very sticky and very plastic; plentiful roots; many fine pores; thin, patchy coatings that look like illuviation cutans; slight reaction to hydrogen peroxide; violent reaction to hydrochloric acid; mildly alkaline; abrupt, smooth boundary. 7 to 11 inches thick.

IIC1g--20 to 29 inches, mottled white (2.5Y 8/1), reddish-brown (5YR 5/4), strong-brown (7.5YR 5/8), dark-brown (7.5YR 3/2), and gray (5Y 6/1) silty clay; rubbed color is light yellowish brown (2.5Y 6/3); weak, medium and thick plates; salt crystals between some plates; hard, firm, sticky and plastic; few roots; few fine and

medium pores; violent reaction to hydrochloric acid; mildly alkaline; abrupt, smooth boundary. 8 to 11 inches thick.

IIC2sag--29 to 33 inches, layers of light-gray (N 6/0), gray (N 5/0), dark-gray (5Y 4/1), pink (7.5YR 8/4), grayish-brown (2.5Y 5/2), and reddish-brown (5YR 4/4) silty clay; rubbed color is olive gray (5Y 5/2); moderate, medium and thick plates; hard, friable, sticky and plastic; few roots; few fine pores; salt crystals make up about 50 percent of volume; neutral; abrupt, smooth boundary. 12 to 15 inches thick.

IIIC3g--33 to 43 inches, thickest plates are dark greenish-gray (5BG 4/1) silty clay; other plates are dark-gray (N 4/0), gray (5Y 5/1), and light-gray (5Y 6/1) silty clay; rubbed color is dark greenish gray (5BG 4/1); moderate, thin and thick plates; hard, friable, sticky and plastic; few roots; common fine and medium pores; moderate effervescence with hydrochloric acid; neutral; abrupt, smooth boundary. 9 to 11 inches thick.

IIIC4sag--43 to 60 inches, dark greenish-gray (5BG 4/1), light greenish-gray (5GY 7/1), greenish-gray (5GY 6/1), and dark greenish-gray (5GY 4/1) silty clay; rubbed color is greenish gray (5BG 5/1); massive; friable, sticky; common salt crystals; moderate effervescence with hydrochloric acid; mildly alkaline.

The A horizon ranges from 5YR to 7.5YR in hue and from 1 to 2 in chroma. Mottles in the A horizon range from few to common. The B horizon ranges from 2.5YR to 10YR in hue and from 2 to 4 in chroma. The depth to the light-colored calcareous C horizon ranges from 12 to 20 inches. The depth to the water table varies, because all the soils are artificially drained. Unless the soils are drained, the water table generally is at a depth of 12 to 20 inches.

This soil is used for irrigated sugarcane and pasture. (Capability classification IIIw if irrigated, Vw if nonirrigated; sugarcane group 3; pasture group 7)

LAHAINA SILTY CLAY, 7 TO 15 PERCENT SLOPES (LaC)

On this soil, runoff is medium and the erosion hazard is moderate. Included in mapping were small, steep areas and areas where a few cobblestones and stones are on the surface.

Lahaina silty clay (LaC) provides a general description of the series. In a representative profile the surface layer is dark reddish-brown, silty clay about 15 inches thick. The subsoil, about 45 inches thick, is dusky-red and dark reddish brown subangular blocky silty clay and silty clay loam. The substratum is soft, weathered basic igneous rock. These soils are medium acid in the surface layer and slightly acid to medium acid in the subsoil.

Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot in the surface layer and about 1.4 inches per foot in the subsoil. In places roots penetrate to a depth of 5 feet or more.

This soil is used for sugarcane and pineapple. Small acreages are used for truck crops, pasture, and wildlife habitat. (Capability classification IIIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 3; pasture group 3; woodland group 1)

MOKULEIA CLAY LOAM (Mt)

This soil occurs as small areas on the coastal plains. It is nearly level. Included in mapping were small areas of Jaucas soils; small areas of very deep, well-drained soils in drainageways; and small areas of poorly drained clay soils underlain by reef limestone.

In a representative profile the surface layer is very dark grayish-brown clay loam about 16 inches thick. The next layer, 34 to more than 48 inches thick, is dark-brown and light-gray, single-grain sand and loamy sand. The surface layer is neutral in reaction, and the underlying material is moderately alkaline.

Permeability is moderate in the surface layer and rapid in the subsoil. Runoff is very slow, and the erosion hazard is no more than slight. The available water capacity is about 1.8 inches per foot in the surface layer and about 1.0 inch per foot in the subsoil. In places roots penetrate to a depth of 5 feet or more.

Representative profile: Island of Oahu, lat.21°34'49"N. and long.158°10'09"W.

Ap-- 0 to 16 inches, very dark grayish-brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) when dry; moderate, very fine and fine, granular and subangular blocky structure; hard, firm, sticky and plastic; plentiful fine roots; many, very fine and fine, interstitial pores; few, fine and very fine, tubular pores; common wormholes and worm casts; horizon consists of about 25 percent coral sand; slight effervescence with hydrogen peroxide; violent effervescence with hydrochloric acid; neutral; abrupt, wavy boundary. 10 to 16 inches thick.

IIC1--16 to 22 inches, dark-brown (10YR 4/3) loamy sand, brown (10YR 5/3) when dry; massive; soft, slightly hard, nonsticky and nonplastic; plentiful fine roots; porous; few pieces of reef limestone; horizon consists of about 80 percent coral sand; violent effervescence with hydrochloric acid; moderately alkaline; abrupt, smooth boundary. 6 to 20 inches thick.

IIC2--22 to 50 inches, light-gray (10YR 7/2), moist or dry, coral sand; single grain; loose when moist or dry, nonsticky and nonplastic; few fine roots; porous; few pieces of coral; violent effervescence with hydrochloric acid; moderately alkaline.

The depth to coral sand ranges from 12 to 30 inches. The A horizon ranges from 10YR to 5YR in hue and from 1 to 3 in value when moist and 3 to 5 when dry. It ranges from 1 to 3 in chroma when moist and 1 to 3 when dry. The IIC1 horizon ranges from 10YR to 7.5YR in hue, from 3 to 6 in value when moist and 4 to 7 when dry, and from 1 to 3 in chroma.

This soil is used for sugarcane, truck crops, and pasture. (Capability classification IIs if irrigated, VIs if nonirrigated; sugarcane group 1; pasture group 3)

MOKULEIA LOAM (Ms)

This soil has a profile like that of Mokuleia clay loam, except that the surface layer is loam and in most places is about 8 inches thick. It is nearly level.

This soil is used for sugarcane, truck crops, and pasture. (Capability classification IIs if irrigated, VIs if nonirrigated; sugarcane group 1; pasture group 3)

PEARL HARBOR CLAY (Ph)

This soil is on low coastal plains adjacent to the ocean. It is level or nearly level. Included in mapping were small areas of Kaloko and Keaau soils.

In a representative profile the surface layer is very dark gray, mottled clay about 12 inches thick. The subsoil, about 19 inches thick, is very dark gray and very dark grayish-brown, mottled clay that has angular and subangular blocky structure. The substratum is muck or peat. The soil is neutral in the surface layer and mildly to moderately alkaline in the subsoil.

Permeability is very slow. Runoff is very slow to ponded, and the erosion hazard is no more than slight. The available water capacity is about 1.4 inches per foot in the surface layer and subsoil. In places roots penetrate to a depth of 2 to 4 feet. Workability is very difficult.

Representative profile: Island of Oahu, lat.21°22'19"N. and long.158°01'47"W.

AP-- 0 to 12 inches, very dark gray (10YR 3/1) clay; many, fine, strong-brown (7.5YR 5/6), prominent mottles on peds and in pores; dark gray (10YR 4/1) when dry; strong, fine and medium, granular structure and fine, subangular blocky; very hard, firm, very sticky and very plastic; abundant very fine and fine roots; common, very fine and fine, tubular pores and few, medium, tubular pores; common wormholes and worm casts; moderate effervescence with hydrogen peroxide; neutral; clear, wavy boundary. 8 to 12 inches thick.

B21g--12 to 20 inches, very dark gray (10YR 3/1) clay; many strong-brown (7.5YR 5/6) mottles in all pores and a few on ped faces; strong, fine and medium, subangular blocky and angular blocky structure; very hard, firm, very sticky and very plastic; abundant very fine and fine roots; common, very fine and fine, tubular pores and few, medium, tubular pores; thin, intermittent, horizontal layers of ironstone; moderate effervescence with hydrogen peroxide; mildly alkaline; gradual, smooth boundary. 6 to 8 inches thick.

B22g--20 to 25 inches, very dark gray (10YR 3/1) clay; fine pores are lined with strong-brown (7.5YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; abundant very fine roots; many, very fine, tubular pores and common, fine, tubular pores; slight effervescence with hydrogen peroxide; few fine shells that effervesce with hydrochloric acid; moderately alkaline; gradual, smooth boundary. 3 to 7 inches thick.

B23g--25 to 31 inches, very dark grayish-brown (10YR 3/2) clay; many, fine, strong-brown (7.5YR 5/6) mottles in pores and on ped surfaces, grayish brown (10YR 5/2) when dry; moderate, fine and medium, subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; many, very fine, tubular pores;

few, fine and coarse, tubular pores; wormholes and worm casts; many small shells; strong effervescence with hydrogen peroxide; moderate effervescence with hydrochloric acid on soil mass; violent effervescence on shells; moderately alkaline; abrupt, smooth boundary. 3 to 6 inches thick.

1b-- 31 to 37 inches, very dark grayish-brown muck; few, fine, strong-brown (7.5YR 5/6) mottles; massive; very hard, friable, slightly sticky and slightly plastic; plentiful roots; common, fine, tubular pores; few shells; few, fine, black fragments of tuff; thin, discontinuous, vertical bands of ironstone; moderate effervescence with hydrogen peroxide; strong effervescence with hydrochloric acid; mildly alkaline; clear, smooth boundary. 4 to 6 inches thick.

2b-- 37 to 48 inches, very dark gray (10YR 3/1) muck, gray (10YR 6/1) when dry; massive; hard, friable, sticky and plastic; few roots; few, very fine, tubular pores; brackish water table at a depth of 40 inches; few rounded pebbles; mildly alkaline.

The depth to the buried muck or peat ranges from 20 to 33 inches. The brackish water table is at approximately the same depth. In places as much as 5 percent of the buried horizons is coral sand or shells. The solum ranges from 7.5YR to 10YR in hue and from 2 to 4 in value when moist. When dry, the A and B horizons range from 4 to 6 in value and from 0 to 1 in chroma.

This soil is used for sugarcane, taro, bananas, and pasture. (Capability classification IVw, irrigated or nonirrigated; pasture group 7; woodland group 4)

WAIALUA SILTY CLAY, 0 TO 3 PERCENT SLOPES (WkA)

This soil is on smooth coastal plains. Included in mapping were small areas of Honouliuli, Kaena, and Kawaihapai soils. Also included were small areas that are gravelly.

In a representative profile the surface layer is dark reddish-brown silty clay about 12 inches thick. The subsoil, about 26 inches thick, is dark reddish-brown and reddish-brown silty clay that has subangular blocky structure. The substratum is dark reddish-brown, mottled silty clay. The soil is neutral in the surface layer and slightly acid in the subsoil.

Permeability is moderate. Runoff is slow, and the erosion hazard is no more than slight. The available water capacity is about 1.8 inches per foot in the surface layer and 1.6 inches per foot in the subsoil. In places roots penetrate to a depth of 5 feet or more.

Representative profile: Island of Oahu, lat.21°34'03"N. and long.158°08'39" W.

AP-- 0 to 12 inches, dark reddish-brown (5YR 3/2) silty clay, dark reddish brown (5YR 3/3) when dry; moderate, medium and coarse, subangular blocky structure; very hard, firm, very sticky and very plastic; abundant very fine roots; common, very fine and fine, interstitial and tubular pores; thin layer of moderate, very fine, and fine granules on surface; common, fine, black concretions; strong effervescence with hydrogen peroxide; neutral; clear, wavy boundary. 5 to 15 inches thick.

B21--12 to 20 inches, dark reddish-brown (5YR 3/2) silty clay, dark reddish brown (5YR 3/3) when dry; moderate, fine and medium, subangular blocky structure; very hard, friable, very sticky and very plastic; abundant very fine and fine roots and few medium roots; common, fine and medium, tubular pores; few, fine, black concretions; strong effervescence with hydrogen peroxide; slightly acid; clear, wavy boundary. 6 to 8 inches thick.

B22--20 to 30 inches, reddish-brown (5YR 3/3) silty clay, dark reddish brown (5YR 4/3) when dry; weak, medium and coarse, subangular blocky structure; very hard, friable, very sticky and very plastic; abundant fine roots; many, fine, tubular pores; common thin clay films in pores; few black concretions; strong effervescence with hydrogen peroxide; slightly acid; clear, wavy boundary. 8 to 12 inches thick.

B23--30 to 38 inches, dark reddish-brown (5YR 3/3) silty clay; common, medium, distinct, dark-red (2.5YR 3/6) mottles; dark reddish brown (5YR 3/4) when dry; weak, medium and coarse, subangular blocky structure; very hard, friable, very sticky and very plastic; abundant fine roots; many, fine, tubular pores; thin, patchy clay films in pores and on ped faces; abundant, fine, black concretions; black stains 2 to 5 millimeters wide; strong effervescence with hydrogen peroxide; slightly acid; clear, smooth boundary. 6 to 10 inches thick.

C-- 38 to 55 inches, dark reddish-brown (5YR 3/3) silty clay; common, medium, distinct, dark-red (2.5YR 3/6) mottles; dark reddish brown (5YR 3/4) when dry; weak, coarse, subangular blocky structure; very hard, friable, very sticky and very plastic; few fine roots; common, fine, tubular pores; few, fine, black concretions; black stains 2 to 5 millimeters wide; slight effervescence with hydrogen peroxide; slightly acid.

In places fine black concretions occur throughout the solum. Reaction ranges from slightly acid to neutral. The amount of highly weathered cobblestones and pebbles in the profile ranges from 5 to 30 percent. The plasticity of the clay ranges from very sticky and very plastic at the lower elevations to sticky and plastic at the higher elevations. The solum ranges from 5YR to 10YR in hue. Silty clay and clay types are mapped. The A horizon ranges from 2 to 3 in value when moist and from 3 to 4 when dry. It ranges from 1 to 2 in chroma when moist and from 2 to 4 when dry. The B horizon ranges from weak to moderate in structure.

This soil is used for sugarcane, truck crops, and pasture. (Capability classification I if irrigated, IIIc if nonirrigated; sugarcane group 4; pasture group 3; woodland group 1)

WAIALUA SILTY CLAY, 3 TO 8 PERCENT SLOPES (WkB)

On this soil, runoff is slow and the erosion hazard is slight.

This soil is used for sugarcane, truck crops, and pasture. (Capability classification IIe if irrigated, IIIc if nonirrigated; sugarcane group 4; pasture group 3; woodland group 1)

APPENDIX B:

POLLEN ANALYSIS

by

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Four samples (Samples No. 12, 17, 34, 35) were submitted for pollen analysis. The latter two were selected. Both of these samples were from TU 142 of Survey Area 11. Sample No. 34 was collected from Layer III at 52-84 cm below surface. This clay sample and the peat sample (Sample No.35) removed from Layer IV at 84-94 cm below surface were analyzed in order to determine whether they had been used for prehistoric Hawaiian agriculture.

Palynomorphs were counted and then separated into two broad categories, autothonous and allothonous, reflecting in general their source of contribution to the sediment (Table 8). Autothonous refers to forms growing or produced within the area of deposition, and allothonous refers to pollen or spores produced at some distance and subsequently introduced into the sediment. These are relative terms, and so there will inevitably be some overlap; however, it does facilitate an interpretation of ecological change.

Both Sample No. 35, a peat, and Sample No. 34, a grey clay, had average to good pollen density and preservation. While fungal palynomorphs (spores and hyphae) were not very common (perhaps 10%, fungal spores were not counted), some fungal activity was noted as many of the pollen grains and spores showed signs of digestion from microorganisms.

Sample No. 35 had 18% sedge pollen and a few isolated remains of Pediastrum. The remaining 78% was comprised of 24% monolete fern spores, 23% Pritchardia, 11% undetermined tricolpate pollen, 7% undetermined tricolporate pollen, and 5% cheno-am pollen (Table 8). When the sediments of Sample No. 35 were being deposited, an area of shallow standing water nearby is postulated, based on the percentage of sedge pollen present. Various other shrubs, small trees, and larger forest trees then also contributed to the basin at some unknown distance. One source of difficulty in making more precise ecological determinations in Hawaiian bogs and wetlands is the tendency for forest

Table 8.

RELATIVE FREQUENCY OF POLLEN AND SPORES

Category	Sample No. 34 (n=485) Number	%	Sample No. 35 (n=332) Number	%
AUTOTHONOUS				
Floating algae				
Pediastrum	119	25	11	3
Selanastrum	15	4	-	-
Zygnematales	19	5	1	<1
Sedges				
Large pollen	-	-	59	18
Small pollen	7	2	2	<1
Algal or animal cysts				
Stalked	31	9	-	-
Unstalked	20	6	3	1
ALLOTHONOUS				
Undet. monocots (monosulcate)	13	4	10	3
Undet. tricolpates	48	13	36	11
Undet. tricolporates	14	4	22	7
Aralia	8	2	-	-
Scaevola	8	2	-	-
Euphorbia	11	3	3	1
Metrosideros	4	1	-	-
Pritchardia	75	20	78	23
Monolete fern spores	69	19	91	24
Rutaceae/Rubiaceae	4	1	1	<1
Umbelliferae	4	1	-	-
Urera	-	-	1	<1
Cheno-ams	16	4	18	5
Pelea	-	-	5	2
Coprosma	-	-	1	<1

trees and shrubs to grow up and onto the bog and therefore contribute pollen both as an allothonous and an autothonous component. While it may not be possible to exactly map out the plant community from the pollen rain, an indication of the moisture available may be made. Several indicators are present which suggest at least some locally dry (and perhaps disturbed) conditions. Urera today favors moderately dry gulches at low elevations, Umbelliferae are usually found in seasonally dry areas, and pollen known as cheno-ams is present during drier intervals. Plants such as Rutaceae/Rubiaceae, Pelea, and

Coprosma are from the wetter regions of the forest. Note however, that they are not as common as the cheno-am pollen. The pollen of *Pritchardia*, an endemic Pacific palm, is found in great abundance here, which is a bit puzzling. Selling included pollen of this genus in his sum of hygrophytic indicators but also noted that it may occur in either a wet or a dry forest (1948: 85-86). It is possible that this palm was prehistorically more common and more abundant at lower elevations; today they are confined chiefly to between 1000-3000 feet. Selling notes that their distribution is highly local; that is, they may be confined to one valley only (1947: 335-337). Also, many planted groves have now disappeared, perhaps due to insect damage. It would be difficult to interpret almost one-quarter *Pritchardia* pollen without invoking a localized grove or clump of trees within the drainage basin.

Sample No. 34, the clay with rich organic lenses, is presumably derived from overlying sediment at a time of higher standing water. The algal record attests to this. The most prevalent form was *Pediastrum* at 25% (calculated as a double-fixed sum), which prefers freshwater with some circulation (i.e., not stagnant and not swiftly running) (Table 8). Other algal (and perhaps animal) cysts and cells support this idea. Sedge pollen is much reduced from the underlying sample and is of a smaller size. The remaining allothonous pollen and spores include *Pritchardia* at 20%, monolete fern spores at 19%, cheno-ams at 4%, and various tree and shrub pollen with a tricolpate or tricolporate morphology. With few variations in percentages in the latter categories, Sample No. 34 presents a similar paleoclimatic picture with respect to the dry indicators present (cheno-ams, Umbelliferae), while the ecologic changes are slight--chiefly with a greater amount of standing water in the basin favoring floating algai and various cysts. *Pritchardia* retains a similar ecologic abundance here as in the lower sample suggesting its prevalence in the valley. There was nothing in either sample that could be likened to cultivated plant pollen.

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APPENDIX C:

PRELIMINARY HISTORICAL DOCUMENTARY RESEARCH

Lands of Opana, Kawela, Hanakaoe, Oio, Ulupehupehu,
Punalau and Kahuku Koolauloa, Island of Oahu

by

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Historical Researcher

It is the intent of this preliminary research effort to identify and examine immediately available sources for information relative to the project site.

A sampling of specific mythological, cultural and historical information has been assembled from the writings of native historians, from missionary and travellers' accounts, land records and cartographic sources.

It is hoped that the data collected herein will prove useful in the formation of a general impression and understanding of the total land area, as well as provide specific historical information of service to professional consultants.

MYTHOLOGY

Several traditions have survived regarding the origin of this district. The striking commonality that exists among these myths is that the district is characterized by a certain physical instability.

A proverb which captures this states:

> Kahuku 'Āina lewa. Kahuku, an unstable land.

An accompanying note to the above explains further:

> O'ahu, according to legend, was once two islands that grew together. Kahuku is the part that bridges the gap. (Pukui, 1983:144)

Levi Chamberlain related the following tale which he recorded on his 1828 tour of Oahu:

> The natives tell a marvellous story respecting the origin of this destrict /sic/, which they say floated in from the sea, and attached itself to the ancient shore of the island, that there was a subterranean communication between the sea & the ancient shore, by which a shark used to pass, & make depredations up on land. The basis of the tract, which is from 5 to 7 miles in length, & from 1 to 2 miles in breadth, appears to be of coral; and it was evidently redeemed from the sea, as a good deal of the land, in many places along the shore around the whole circuit of the island, evidently has been. (Chamberlain, 1957:35-6)

A third rather novel creation myth links the district with the sacred legendary princess, Laieikawai. Within this tradition are found the names of two small bodies of water that act as anchorages for the floating Kahuku land mass:

> Kahuku district, according to legend, was once a floating island blown about by the winds. As it banged against Oahu, it made noises which disturbed the old women guarding the Princess Laieikawai. The old women grappled the island with fishhooks and attached it securely to Oahu. Polou pool on the sea side of the Kahuku mill is one spot where the hook was fastened. The other end was fastened at Kukio pond, 300 feet inland at Kahuku Point. (Boswell, 1958:68) .

In the final creation tradition, the floating land mass was cited as a home of the <u>menehune</u>. This legend bears particular import in that it acknowledges two natural attributes of the area - the district's springs and its verdant uplands.

> Ka-hu-ku section of O'ahu was once a separate island... It was an islet whose people were the Mene-hune, or Dwarfs as

> they are called today. Many stories are told about the miraculous feats performed by the Little People of ancient Hawaii. It is known, also, that they always worked from just after sunset until just before dawn.
>
> Legend tells us that Kahuku was a floating island situated several miles out to sea. For a long time, the people of O'ahu had planned to make the island a part of their land, for they saw it come close to O'ahu's shores. The floating island of the Menehune did not have any fresh-water springs because there were no high mountains covered with verdure and trees to capture the rains. So, the Little Folk used to paddle their islet into the bays of O'ahu at night to haul water from the springs of the large island.
>
> One day, a resident of Kahuku suggested that all the people gather together to make strong hooks of whalebone and attach them to a stout rope made of sacred Olona fibres. This was done.
>
> The Menehune came to take water as usual, then the residents of O'ahu attached the large hooks to the floating isle while the Little Folk were off at the water-springs. When the water was loaded, the Menehune started to paddle off again, but they could not move their islet or free it from the ivory hooks and Olona ropes.
>
> Today, many people who travel Kahuku section of O'ahu and see the many islets seeming to float off shore, and hear the sea singing its songs, they say, 'Listen to the Menehune grumbling while they try to move their island that used to float!'
>
> The rumbling and grumbling is heard only at night, for that is the time for the Menehune to be working at Kahuku. (Paki, 1972:53)

Aside from creation myths, a colorful assortment of legends exist for the broad Kahuku area. These will be examined first as I believe they exemplify some of the characteristics that can also be attached to the less-written-about <u>ahupuaa</u> just north of Kahuku which fall within project boundaries. Once the bulk of pertinent Kahuku literature is exhausted - a close perusal of the relatively few legendary references to Opana, Kawela, Ulupehupehu, Oio, Punalau and Hanakaoe will be conducted.

The entire district of Kahuku was well-remembered for its fragrant groves of <u>hala</u>; the following proverb and translation memorializes them for all time:

Nani i ka hala ka ʻōiwi o Kahuku.
The body of Kahuku is beautified by hala trees.
(Pukui, 1983:248)

The above appears to be extracted from a chant composed by Halemano. In an attempt to win back the attention of his wife, Halemano recalls pleasant sentiments shared:

A kukui au a Kahewahewa,
Ku au nana i laila,
Haloiloi kuu waimaka e uwe,
Nani na hala ka oiwi o Kahuku,
I ka lawe a ka makani he mikioi. (Elbert, 1965:281)

As I reported to Kahewahewa,
I stood and gazed, then
Tears filled my eyes causing me to weep.
How beautiful are the hala, native trees of Kahuku,
As they are being fanned by the Mikioi wind. (ibid.:280)

Mention is made of the famed hala groves of Kahuku in the tragic tale of the prophet Kaopulupulu. Kaopulupulu and his son are summoned by chief Kahahana to appear before him in consequence of an act that Kaopulupulu dutifully performed. Although the prophet clearly foresees his death, he and his son set out for Kahahana's court.

...In the morning, ascending a hill, they turned and looked back over the sea-spray of Waialua to the swimming halas of Kahuku beyond. Love for the place of his birth so overcame Kaopulupulu for a time that his tears flowed for that he should see it no more. (Thrum, 1912:210)

A final reference to the hala of Kahuku can be found in the classical myth of Pele and Hiiaka. In travelling to Kauai to fetch Pele's loved one, Lohiau, Hiiaka encounters two rude creatures who refuse the goddess Hiiaka the slightest acknowledgement. Their discourtesy causes Hiiaka to compose chant lines employing a word-play on "hala".

They /Hiiaka and companions/ passed through the lands of Laie, Malae-kahana and Keana and at Kahipa they saw the crouching figures of Puna-he'e-lapa and Pahi-pahi-alua, who stole

away into the shelter of the pandanus groves without deigning to give them any salutation. At this show of disrespect, Hiiaka called out:

Komo i ka nahele ulu hinalo,
Nahele hala o Po'o-kaha-lulu;
Oia nahele hala makai o Kahuku.
Heaha la ho'i ka hala
I kapu ai o ka leo, e?
I Hookuli ai oe i ka uwalo, e?
E uwalo aku ana au;
Maloko mai oe, e!

We enter the fragrant groves,
Hala groves whose heads make a calm,
Wild growths by the sea of Kahuku,
But what, indeed, are your halas?
Shall their murmur forbid you speech?
Make you dumb to my salutation?
I make this kindly entreaty
To you who sit in the grove. (Emerson, 1915:97-8)

Emerson includes the following footnote relative to the hala word-play:

There seems to lurk a play in this word hala. It stood not only for the pandanus tree; it also meant a fault, a sin. (ibid.:97)

In another well-known classic - the tradition of the pig-god Kamapuaa - residents of Kahuku are called upon by their chief, Olopana, to capture the chicken-thief, Kamapuaa. Once he is bound and readied to be carried off, his grandmother's chanting stirs Kamapuaa into action and he decimates his many captors and gains freedom. (Elbert, 1965:200-1)

Another set of traditions deal with a stream which courses under the mountain range and connects Kahuku with Waipahu. The following proverb summarizes this characteristic feature:

Pukana wai o Kahuku.
The water outlet of Kahuku.
Refers to the outlet of an underground stream that once flowed from Kahuku to Waipahu, O'ahu. (Pukui, 1983:299)

An abstract of this legend appears in a descriptive account of the Kahuku area as visited by train in the early 1900's.

> As our train sped on toward Kahuku, we were told of the various water-holes of the district with certain of them furnishing catches of fish, but only on the nights of Kane. One called Punamano is famed for a shark-man's exploits, and another as having connection with Waipahu, in the Ewa district, which is said to have been verified in the following manner:
>
> A kapa-beating log of peculiar sound, unlike any other known on the island, which was placed in its waters at the close of a kapa-making season to keep it smooth and free from cracks that would impart an impression to the cloth in its manufacture, was missed, and, believing it to have been stolen, search was made all through the Koolau, Waialua and other districts till at last it was found in use at Waipahu. Recognizing it by its resonant tone, it was claimed by the searching owner, and right thereto by those in possession as vigorously maintained. To test the truth of ownership as claimed, the Ewa people accompanied the claimant back to Kahuku to visit the scene and witness a test of the underground stream theory. A bundle of ti leaves were gathered, which was wrapped together and consigned to the waters of Punahoolapa. In the course of a few days they were lost to sight, whereupon the party set out for Ewa, and after careful watching, as predicted, the bundle of ti leaves came forth on the bosom of the waters of the Waipahu stream. The kapa log was thereupon recognized as the rightful property of the Kahuku claimant. (Thrum, 1910:130-1)

Another version of the same tale, though somewhat more embellished, is presented by Pukui and Curtis in The Water of Kane. (Pukui and Curtis, 1976:162-7)

The legend, which closes this section of mythology relating to the general Kahuku area, appears antiquated in its content; it is set during the period of migration to Hawaii from Kahiki (foreign lands).

> The story I am about to tell you came to me as a marvellous, mysterious, miraculous myth of the long ago, when strange powers dwelt in both animals and men, and when cannibalism might have been carried on to be reported later under the guise of eating the flesh of beast or fish. In the long ago there were two "fish" crossing the trackless waters of the Pacific Ocean. Their home was in one of the far-away lands, known as Tahiti. These "fish" were great canoes filled with men. They decided that they would like to visit some of the lands about which they had heard in the legends relat-

> ed by their fathers. They knew that certain stars were always in certain places in the sky during a part of every year. By sailing according to these stars at night and the sun by day they felt confident that they could find the wonderful fire-land of Hawaii about which they had been taught in the stories of returned travellers. So the two "fish" - the two boats - after weary days and nights of storm and calm, of soft breeze and strong, continuous winds, found the northeast side of the island of Oahu with its rugged front of steep, precipitous rocks. The travellers landed first on a point of land extending far out into the sea, terminating in a small volcano. Here they made examination of the unfriendly coast and decided to journey entirely around the island, one fish, or boat, going toward the north and the other toward the south. They were apparently intending to pass around the island and find an appropriate location for a settlement. Possibly they planned to make a permanent home or hoped to meet some good community into which they might be absorbed. The point of land which marked the separation of the two companies is called Makapuu. The boat which sailed toward the north found no good resting-place until it came to the fishing-village of Hauula. The stories told by the old natives of the present time do not give any details of the meeting between the strangers and the people residing in the village. Evidently there was dissension and at last a battle. The whole story is summed up by the Hawaiian legend in the saying: "The fish from Tahiti was caught by the fishermen of Hauula. They killed it and cut it up into pieces for food." Thus the visitors found death instead of friendship, and cannibalism was thereby veiled by calling the victims "fish" and the victory a "catch."...
>
> The second fish from Tahiti had gone on southward in its journey around the island of Oahu. It passed the rough and desolate craters of Koko Head on the eastern end of the island. It swam by Diamond Head and the beautiful Waikiki Beach. Either the number of the inhabitants was so large that they were afraid to make any stay or else they preferred to make the complete circuit of the island before locating, for they evidently made only a very short stay wherever they landed, and then hurried on their journey. By the time they reached Kaena, the northwestern cape of Oahu, they were evidently anxious concerning their missing companions. Not a boat on the miles of water between Kaena and Kahuku, the most northerly point on the island. The legend says that the fish changed itself into a man and went inland to search the coast for its friend, but the search was unsuccessful. It was now a weary journey from point to point, watching the sea and exploring all the spots on the beach where it seemed as if there was any prospect of finding a trace of their expected friends. Where a break in the coral reef permitted their boat to approach the land they forced their way to shore. Then when the thorough search failed again, the boat was pushed out over the line of white inrolling breakers to the great sea until at last the Tahitians came to Kahuku.

Now they appeared no longer as "fish," but went to the village at Kahuku as men. They made themselves at home among the people and were invited to a great feast. They heard the story of a battle with a great fish at Hauula and the capture of the monster. They heard how it had been cut up and its fragments widely distributed among the villages on the northwest coast. Evidently provision had been made for several great feasts. The people of Kahuku, although several miles distant from Hauula, had received their portion. The friendly strangers must share this great gift with them. But the men from Tahiti with heavy hearts recognized the fragments as a part of their companion. They could not partake of the feast, but by kindliness and strategy they managed not only to decline the invitation, but also to secure some portions of the flesh to carry down to the sea. These were thrown into the water, and immediately came to life. They had the color of blood as a reminder of the death from which they had been reclaimed. Ever after they bore the name "Hilu-ula," or "the red Hilu."

Then the "fish" from Tahiti went on around to Hauula. They went up to the tabu land back of Hauula. They pulled up the tabu flags. Then they dammed up the waters of the valley above the village until there was sufficient for a mighty flood. The storms from the heavy clouds drove the people into their homes. Then the Tahitians opened the floodgates of their mountain reservoir and let the irresistible waters down upon the village. The houses and their inhabitants were swept into the sea and destroyed. Thus vengeance came upon the cannibals.

The Tahitians were "fish," therefore they went back into the ocean to swim around the islands. Sometimes they came near enough to the haunts of fishermen to be taken for food. They bear the name "hilu." But there are two varieties. The red hilu is cooked and eaten, but never eaten without having felt the power of fire. The trace of the cannibal feast is always over its flesh. Therefore it has to be removed by purification of the flames over which it is prepared for food. The blue hilu, the natives say, is salted and eaten uncooked. Thus the legend says the two fish came from Tahiti, and thus they became the origin of some of the beautiful fish whose colors flash like the rainbow through the clear waters of Hawaii. (Westervelt, 1973:139-145)

EARLY HISTORY OF THE KAHUKU DISTRICT

The native historian S. M. Kamakau bridges the time gap between the mythological and historical eras by relating the following long-held traditions of the ancients:

> There is only one famous hiding cave, ana huna, on Oahu. It is Pohukaina. The opening on Kalaeoka'o'io that faces toward Ka'a'awa is believed to be in the pali of Kanehoalani, between Kualoa and Ka'a'awa, and the second opening is at the spring Ka'ahu'ula-punawai. This is a burial cave for chiefs, and much wealth was hidden away there with the chiefs of old. On the Kona side of the island the cave had three openings, one at Hailikulamanu - near the lower side of the cave of Koleana in Moanalua - another in Kalihi, and another in Pu'iwa. There was an opening at Waipahu, in Ewa, and another at Kahuku in Ko'olauloa. The mountain peak of Konahuanui was the highest point of the ridgepole of this burial cave "house," which sloped down toward Kahuku. Many stories tell of people going into it with kukui-nut torches in Kona and coming out at Kahuku. Within this cave are pools of water, streams, creeks, and decorations by the hand of man (hana kinohinohi'ia), and in some places there is level land.
>
> According to the traditions of some people, Oahu was said to have once been a floating land, he 'aina lewa o Oahu. The Kahuku side was a wide open gap (puka hamama) and this was called Ka puka o Kahipa a me Nawaiuolewa, "The opening of Kahipa and Nawaiuolewa." The piece of land that closed it up was called Kahuku, and the hooks that made fast the piece of land and joined it to the island were called Kilou and Polou. (Kamakau, 1974:38-9)

Included under this heading "early history" is a brief discussion of ancient sacred relics uncovered in the Kahuku district.

In his series Arts and Crafts of Hawaii - Religion, Peter H. Buck numbers three carved images as having been found in Kahuku.

The first two are classified as temple images; they are described as follows:

> Two images of a similar type were found at Kahuku, Oahu. Both have the high head slab, one plain and the other with triangular and lozenge-shaped openings...Each has a pointed prop and each is more than 5 feet tall. The image with the slab openings was destroyed by fire, and the other is in a private collection. Fortunately, the Museum has field photographs, from one of which the figure was drawn. (Buck, 1964:495)

The last of the three is categorized as a worked stone god.

Regarding these, Buck notes:

> Worked stone representing the human form in part or in whole was termed a ki'i pohaku (stone image), and it was only after the necessary ritual that it became an akua pohaku (stone god). After the general acceptance of Christianity,

many keepers of the stone gods hid them, either from lingering sentiment or because they were afraid to destroy them by breaking them up. Thus they have been found in caves, in concealment cavities in stone piles, in taro swamps, and buried underground. Some were kept by families, particularly by fishermen, who saw no contradiction to Christianity in keeping a good luck talisman which increased the supply of fish....(ibid.:496)

...The last drawing (fig. 312,e), taken from a cast of a specimen in the Berlin Ethnographic Museum, is from Kahuku, Oahu. It differs from the Hawaii specimens in having raised elliptical eyes; a small, raised nose; a hollowed mouth with a raised upper lip; and a sharp chin. (ibid.:498)

A SAMPLING OF HISTORICAL ACCOUNTS - Post 1778

Two of the earliest voyager descriptions of the northwestern part of Oahu mention expanses of cultivated fields and well-inhabited communities. Cook's officers who assumed command of his ships after his death jotted the following impressions:

SUNDAY 28th. Winds E^t^erly, fresh breezes with open Cloudy Weather. Run round the N^o^ern Extreme of the Isle which terminates in a low Point rather projecting;[2] off it lay a ledge of rocks extending a full Mile into the Sea, many of them above the surface of the Water; the Country in this neighbourhood is exceedingly fine & fertile; here is a large Village, in the midst of it is run up a high Pyramid doubtlessly part of a Morai.[3] I stood into a Bay just to the W^t^ward of this point[4] the Eastern Shore of which was far the most beautifull /sic/ Country we have as yet seen among these Isles, here was a fine expanse of Low Land bounteously cloath'd with Verdure, on which were situate many large Villages and extensive plantations; at the Water side it terminated in a fine sloping, sandy Beach...(Clerke in Beaglehole, 1967:I:572)

[2]Kahuku Point, low, covered with sand dunes; its position, lat. 21°43' N, long. 157°59' W, gives us a check on Clerke's noon position a few lines above.

[3]An bracle tower,' lana nu'u mamao; cf. p. 270, n.3 above.

[4]Waimea Bay, not a very deep indentation in the coast. (ibid.)

WOA'HOO.[3] We saw this Island the beginning of last year, but only just as a high lump. We this Time saild along its NE & NW sides but saw nothing of the S^o^ern part. What we did see of this Island was by far the most beautiful country of any in the Groupe; particularly the Neck that Stretches to the N^o^ward: & its NW side. Nothing could exceed the verdure of

the hills, nor the Variety which the face of the Country display'd. It /s north-eastern/ parts[4] were cliffy, & rugg'd to the Sea side, but the Valleys look'd exceedingly pleasant, near the N point we were charmd with the narrow border full of Villages, & the Moderate hills that rose behind them;... (King in Beaglehole, 1967:I:610)

An excellent discussion of the historical agrarian aspects of the district is given in The Hawaiian Planter:

KAHUKU

This blunt northern tip of the island of Oahu, whose name means "The hillock," is now the seat of the Kahuku Plantation Company's offices, town, and mill, and for many years has been planted in sugar cane. Kahuku ahupua'a presents something of a paradox. McAllister (1933, p.153) remarked in his survey that it did not seem possible that this "rather desolate, wind-swept" plain could ever have supported much life, agricultural or human, before the era of industrial machinery and organization. Yet one of his informants "remembers the time when trees now found only in the mountains" covered it. And in Captain Cook's time it was reported that "nothing can exceed the verdure of the hills, the variety of wood and lawn, and the rich cultivated valleys which the whole face of the country /on this northern end/ displayed" (Cook, 1784, Vol. 3, p. 115). Thirteen years later Vancouver (1798, Vol. 3, p. 71) wrote of Kahuku and surrounding territory: "Our examination confirmed the remark of Capt. King excepting that in point of cultivation or fertility, the country did not appear in so flourishing a state, nor to be so numerously inhabited, as he represented it to have been at that time, occasioned most probably by the constant hostilities that had existed since that period." There is a similar discrepancy between the descriptions of other areas in the 1780's and 1950's /sic/ insofar as cultivation is concerned; but not in verdure. What catastrophe of the elements, slow or swift, has wrought the change in Kahuku?

In 1833 Hall (1839) observed at Kahuku that "much taro land now lies waste because the diminished population of the district does not require its cultivation." There seems no evidence of old terraces in the upland along either branch of Kahuku Stream, but in the seaward swampland north and south of Kukio Pond there are such remains. A 1935 informant, Kaleo, knew the names of 11 localities where terraces were formerly cultivated.

Rounding the northern tip past Kahuku onto the "sunset coast," the next sizable wet-taro area is the deep valley of Waimea. Before reaching Waimea the intervening stream beds, shown on the map as Hanako'ae, Pahipahiaula /sic/, and Kaunala, had not sufficent flatlands for taro cultivation under the old system. Two exceptions to noncultivation in this region were to be found. One was in 'Opana (The-squeezing) adjoining Hanako'ae /sic/, where there was formerly a small spring-

watered terrace area named Ka-wela (The-heat), which is also
the name of the bay below. The other was in Waiale'e, next
before Kaunala, where there were another small group of ter-
races anciently named Kane-ali'i. In 'Opana the legend is
told that the gods Kane and Kanaloa struck spring water from
a rock known as Wai-kane, to give life to this hitherto water-
less region around Kawela Bay." (Handy, Handy and Pukui,
1972:462-3)

Agricultural notes are also found within a delightful descrip-
tion of Pahipahialua (which adjoins the ahupuaa of Opana) and its
surrounding lands. This 1815 account is provided by a visitor nam-
ed John B. Whitman; the following excerpt is taken from his <u>An Ac-
count of the Sandwich Islands</u>:

A friend of mine having lived on Owhyhee for several
months had returned to Woahoo for the purpose of taking pos-
session of a large plantation which the high priest of the
Islands had given him. He requested me to accompany him,
and we commenced our journey early in the morning of Septem-
ber 6, 1815...
Passed through Whyamere /cs:Waimea/ and arrived at Py-
py-arure /cs:Pahipahialua/ which makes the point of the Is-
land. It is not so fertile as Whyarure /cs:Waialua/ the
low lands being rock and uncultivated. It was late in the
afternoon when we arrived at the estate belonging to my
friend and was introduced to the superintendant. He was a
good looking man whose grey hair and wrinkled visage bespoke
him not far from sixty years of age. Being informed of the
nature of our visit, his rapid orders produced a confusion
among the under tenants somewhat resembling the bustle at a
country inn on the arrival of unexpected hungry travellers.
An uproar in the hog pen announced the speedy dissolution of
two of the members. New mats were brought for us to set on.
The tarbooed fire was lighted from the old mans match rope,
another fire blazed at some distance. I perceived a farce
was playing which I could not rightly comprehend, but waited
with patience the conclusion of it. Fresh taro was brought
by different hands and laid near the two fires. Two gourd
shells filled with water were next brought and I determined
to solve the mystery. Taking hold of one of them I was salu-
ted with ayer no wye tarboo (that is tarbooed water), and the
other was immediately handed to me. It appeared we were to
have two suppers cooked. One tarbooed, the other nored /cs:
noa-made free of restriction/ and as we did not wish to be
idle, in the mean time, we sallied forth to take a cursory
view of the newly acquired estate.
It consisted of a small valley well stocked with taro
in fine order, several of the patches having been recently
planted. A strip of low rocky land extending to the sea and
a large extent of fishing ground which was said to be very

productive.
Returning to our host we found supper ready. The old
superintendant, our guides and my friend seated themselves
on a large mat and partook of a tarbooed supper consisting
of a hog and poey /cs:poi/. My friend it seems had been re-
gularly tarbooed by the Head Priest on Owhyhee which entitl-
ed him to the privilege of eating out of the same dish with
him, and with any of his tarbooed men. Not having had that
distinguished honor conferred upon me I of course was exclu-
ded from the sacred feast, but much to my satisfaction I
found a hog well cooked and served up separate. Not being
inclined to a supper "a le solitaire" I invited the boys to
partake with me and jocularly observed to our host that I
had tarbooed them as my hicarnies /cs:aikane/ or friends for
the time being. Supper being finished we spent the evening
with the old man who gave us an account of the estate and its
resources, and the yearly rent which he had prepared to send
the High Priest which consisted of about two hundred large
salted fish, two hogs of the largest size, five suits of tar-
per /cs:tapa/, five pows /cs:pa'u/ and ten maros. Having no
knowledge of the value of gold and silver and no standard
circulating medium by which to establish the relative value
of things, the rents are paid in the produce of the soil and
the quantity is proportionate to the size of the farm.
January 9th. The transfer of the estate being settled
and the old man reinstated as superintendant, we retired to
rest in an old hut which served as the sleeping house of all
the family, men and women, hogs, dogs and fleas.
In one corner our host had prepared some clean new mats
and two suits of new tarpers for our comfort. Here we laid
ourselves down to rest. The jabbering of the inmates gradu-
ally subsided and nothing was heard save the grunt of a hog,
or the whining of a whelp caused by a host of fleas levying
contributions on their half starved carcasses; or the ejacu-
latory plaint awa ker ootoo (oh, dear, the fleas) which now
and then escaped from our guides.
Our new bedding for some time preserved us from this
troublesome insect, but after having been asleep a short
time I awoke and found myself literally covered with them.
My friend storming like a madman, rushed out of this worse
than hornets nest, and finding I must retreat, I soon follow-
ed him, and we took up our quarters in the open field, where
we passed the remainder of the night in undisturbed repose.
In the morning we commenced our line of march homeward,
and, as is the custom, after being hospitably entertained,
and provided with new tarpers, we paid our host the compli-
ment to take the tarpers along with us...
After proceeding for some time over an uncultivated
plain, we arrived at a small village situated on the sea
shore. It consisted of about twenty huts occupied by fish-
ermen, by the side of the pathway there was a fine bed of
watermelons, and we sat down on a fallen cocoa nut tree to
rest ourselves, several of the natives came to us and one of
them offered us some melons. We gladly accepted his kind of-

> fer and told our servants to pull some for us, but the Indian who had offered us the melons, said something to them which deterred them from going on to the ground. He however bade us pull what we might want, which we did. Our servants would not eat or touch any. We shortly discovered the reason of their mysterious conduct, for the kindness of the Indian had like to have caused some trouble. This generous fellow in his zeal to serve the white men had overstepped the bounds of honesty, and given us what was not his. The rightful owner came and was somewhat exasperated to see us encroaching upon his property without asking his consent. We assured him of our honest intentions, telling him the circumstances without pointing out the offender, which he desired us to do, but knowing the motives which had actuated our friend, we declined giving the information, at the time offering him compensation for his melons, which after some hesitation he accepted. He was very desirous to discover who it was that had given us the liberty but was not satisfied on this point, although there were a number of the villagers who had witnessed the whole transaction, some of whom even upbraided him, his want of generosity in receiving recompence, he however, became passified and we parted friends, having supplied ourselves with a number of very fine melons. (Whitman, 1979:74, 78-82)

In 1828, missionary Levi Chamberlain completed his second circuit of the island of Oahu, examining students and in general evaluating the effectiveness of teachers and education upon the native populace. His remarks demonstrate that within Kahuku there still existed a viable and fairly progressive community - one whose scholars were numerous and whose head-man apparently valued formal education.

> Tuesday Feb. 5th. After breakfast I examined two schools, belonging to Laie & Malaekahana, and was pleased with the appearance of the scholars. At a quarter before 11 A.M. we set out for Kahuku, and after travelling about two hours over a level sandy country, arrived at the school house, where we found 83 scholars assembled, waiting to be examined. A lad of about 11 years of age had the direction of the school. His father the head man of the place was present, and gave countenance to his son, who managed the school with a good deal of address. I gave books to those of the scholars who were destitute, whom I found able to read....
>
> A good hog had been cooked for us, & when the examination closed, dinner was waiting. I had not been very well since morning, and had not much appetite to eat, but my attendants made a hearty meal; and the remainder of the food was placed in the calabashes of our natives, and carried along to furnish

> food for us when we should be again in need. (Chamberlain, 1957:35-6)

The mid-1800's brought enormous transformations in land ownership patterns. At that time, Kamehameha III relinquished absolute ownership of land in the Islands and individuals were allowed to register legal verifiable claims to their houselots and agricultural plots.

Numerous awards were granted within the project boundaries; a detailed discussion of each can be found in this report under the headings of "Archival Documents" and "Original Land Ownership: Land Commission Awards."

As part of his Crown Lands, Kamehameha III chose to retain the ahupuaa of Kahuku and Kawela (Indices, 1929:27-8). The remaining ahupuaa within project boundaries were all classified as Government lands (ibid.:40-44). Rights of native tennants in these Crown and Government lands were strictly respected.

Almost immediately after this land division occurred, sales and leases of parcels within these seven ahupuaa were conveyed. Thus, over the years an intricate chain of title arose. Suffice it to say, for the purpose of this preliminary study, that large tracts of land were obtained in fee or in lease-hold by men such as C. G. Hopkins in 1850-1 (Index, 1916:53) and Robert Moffitt Stoney for the purposes of sheep and cattle and thorough-bred horse ranching.

The following news article provides a brief history of ownership and a description of Kahuku Ranch (which stretched from Kahuku Point northward) at the time it was purchased by James Campbell:

> Kahuku Ranch. This fine ranch, covering the north portion of Oahu, formerly the property of the late R. Moffitt, and more recently of Juluis L. Richardson, Esq., was last week sold by the latter to James Campbell, Esq., one of the proprietors of the Pioneer Sugar Mill of Lahaina, for the sum of $63,500 cash. It includes 25,000 acres in fee simple, and large tracts of mountain land under long leases, with $34,000 worth of live stock, including 3,000 head of cattle, with the choice band of merino sheep and horses now on it. It is unquestionably the best stock ranch on these islands, and it has been brought to a high state of perfection under the management of the late proprietors, who divided the plain into ten or twelve large paddocks, walled with heavy stone walls. It stretches from Laie to Waimea, a distance of thirteen miles, and those who have ever visited it must have admired its lovely green pastures of manienie grass so fattening to stock. It is the intention of Mr. Campbell to increase his band of sheep to 30,000 of the choicest breed. The price paid is a handsome one, securing to its present proprietor the most desirable ranch on the Islands, and to Mr. Richardson a comfortable fortune, the result in part of his industry and good management, and in part of the Reciprocity Treaty, the first fruit from which he has been so fortunate as to reap.... (Hawaiian Gazette, 10/4/1876, p.3:2)

Campbell's development of his lands, his deep involvement in sugar cultivation and the post-1900 history of the project site demand much additional research time and therefore will not be addressed in this preliminary work.

CARTOGRAPHIC RECORDS

Tax maps and the maps on file at the State Survey Division revealed the general location of a sizeable number of original awards deeded during the Great Mahele of Kamehameha III (mid-1840's through early-1850's). In spite of the fact that a proportion of these early awards were neither plotted nor even surveyed and also considering that for those parcels that were delineated, the accuracy of location can not be guaranteed - one is still quite able to gain a fair understanding of residential and agricultural patterns existing over a century ago in these particular districts.

Pertinent data from several of these maps was collected and all the awarded claims which were shown have been roughly sketched on current Tax Maps of the area. These Tax Maps as well as a map depicting the placement of the seven ahupuaa comprising the total land area under study have been included at the end of the present preliminary report (Figures 16-18).

Once a comprehensive list of land claims falling within the project's bounds was drafted and Land Commission Award numbers were compiled, then archival land records were carefully examined.

ARCHIVAL DOCUMENTS

During the Mahele, it was a requirement for individuals to register claims only for those lands actively used for farming and for residence. Testimony was then submitted by witnesses who verified or contested an individual's claim.

Data gleaned from these registers proved to be particularly useful as claimants often submitted detailed inventories of their fixed properties - mentioning even the number of taro patches, cultivated plots, fisheries, varieties of trees and sometimes the general location of each.

A full tally of all holdings mentioned within the entire ahupuaa was then developed in an effort to re-create broad land use patterns for each district. They are as follows:

Opana contained

- 7 taro patched, some in cultivated kula lands
- 1 cultivated kula plot
- 1 cluster of hala trees

Kawela contained

- 28 taro patches
- 11 houselots
- 10 upland gardens planted with noni, sweet potatoes, gourds, bananas, sugar cane and wauke
- 17 kula plots and gardens planted with wauke, noni, ulu, sweet potatoes, sugar cane, bananas and ohia
- 1 fishery
- 2 watercourses
- 1 salt land
- 5 clusters of hala trees
- 1 ulu tree

Hanakaoe contained

- 1 fishery
- 1 salt bed
- 1 salt pool
- 1 hala grove
- several gardens and kula plots planted with noni, onions, sweet potatoes
- 1 cultivated upland plot

Oio contained

- 15+ gardens and kula plots planted with awa, taro, banana, noni, wauke, sugar cane, sweet potato, gourd, edible friuts
- 36 koa canoe trees
- 5 houselots
- 4 taro patches
- 3 groves of hala
- 3 salt bed lands
- 1 sweet potato patch cultivated upon cliffs
- 4 cultivated upland plots planted with banana, awa, sugar cane, wauke, sweet potato, gourd

Ulupehupehu contained

- 15+ kula plots and gardens planted with wauke, sweet potato, gourd, banana, sugar cane
- 7 koa canoe trees
- 2 cultivated upland plots planted with wauke, banana, orange trees
- 1 banana plantation
- 1 cluster of hala
- 1 houselot

Punalau contained

- 10 taro patches
- 1 fish pond named Puekahi
- 10 kula plots and gardens planted with sweet potato, banana, noni, ulu
- 4 cultivated upland plots
- 8 houselots
- 4 coconut trees
- 3 shore areas/fisheries
- 2 koa canoe trees

Kahuku contained

- 162 taro patches
- 39 kula plots and gardens planted with awa, banana, wauke, gourd, sweet potato, sugar cane, noni, watermelon, pili grass
- 7 cluster of hala
- 6 salt lands
- 4 koa canoe trees
- 2 fishponds
- 10 houselots
- 1 sweet potato patch cultivated upon cliffs
- 1 watercourse bank
- 3 cultivated upland plots
- 1 brackish spring
- 1 wooded upland area of ulu, ohia, kukui, koa, ti leaf, noni, etc..

The above listing is by no means complete nor is it restricted only to the project area; it serves merely as a guideline. However, the next set of data compiled from the registers, testimony and survey notes relate to the specific parcels plotted within the project.

ORIGINAL LAND OWNERSHIP: LAND COMMISSION AWARDS

Opana Ahupuaa

1. Claimant Kookoo (LCA 2897:2)
"I have a claim at Opana with three lo'i and a kula, bounded on the north by the sea, on the east by the kula, on the south by the pali, on the west by Pahipahialua." (Native Register v.3:683)

2. Claimant Paukoa (LCA 2734:3)
"I have a little claim for two lo'i at Opana, bounded on the north, east and south by a kula, on the west by Kookoo's /land/...My claim is from my makuas, from the time of Kamehameha I to the present." (Native Register v.3:612)

3. Claimant Kuheleloa (LCA 2835:2)
"At Opana I have a claim for two lo'i, surrounded by kula, it is cultivated kula land." (Native Register v.3:657)

Boundaries of the above parcel, translated from the survey notes state:
"Parcel 2. One taro patch at Opana. Commence at the south angle and run N. 18 W. 100 links
then N. 74 E. 57 "
then S. 14 E. 98 "
then S. 72 W. 48 " . It is surrounded by Konohiki lands. .05 acre." (Survey Notes RP 509)

Kawela Ahupuaa

1. Claimant Kookoo (LCA 2897:2)
"I, Kookoo, have a claim for land at Kawela.
1. Three lo'i,...the boundaries are: North, Kaili's lo'is, east and south, kula, west, Peelalau's /land/...
4. I also have a claim for salt land, bounded on the north and east by the sea, on the south by the kula, on the west by Kauahi's /land/...
There is a houselot at Kawela, bounded on the north by the shore, on the east by Kekua's lot, on the south by the Road, on the west by Makaino's lot.
These are my claims which were from my makuas, from the time of Kamehameha I to this time." (Native Register v.3:383)

"Kalakoa, sworn, says he knows the land claimed by Kookoo in Kawela. It consists of 3 kalo patches and a House site. The 3 kalo patches form one piece, bounded on Hauula side by the kula land, mauka and Waialua side by Lono's land, makai by the Konohiki.
The kula land claimed has not been cultivated for some time. The House site is near the kalo patches. It is enclosed with a wooden fence. Claimant has held the land for over ten years.
The Konohiki had no objections to this claim." (Foreign

Testimony v.10:159)

Translated survey notes give the boundaries of LCA 2897:2 as:
"Parcel 2. Houselot. Commence at the south angle and run
N. 15¼ W. 158 links
then N. 74¼ E. 158 "
then S. 15¼ E. 158 "
then S. 74¼ W. 158 " . It is surrounded by the Konohiki lands. ¼ acre." (Survey Notes RP 506)

2. Claimant Kamakai (LCA 2837:2)
"My house claim is at Kawela, bounded on the north by the sea, on the east by a pond, on the south by a sandy gulch, on the west by the lot of Peelalau." (Native Register v.3:658)

"His /Kamakai's/ House site is in Kawela. It is not enclosed. He got the land from Kaeo some 10 years ago. The Konohiki consented to this claim." (Foreign Testimony v.10:158)

Translated boundaries for LCA 2837:2 are:
"Parcel 2. Houselot. Commence at the south angle and run
N. 14 W. 116 links along Pailalau's /Peelalau's/ lot,
then N. 80 E. 100 "
then S. 9 W. 110 "
then S. 81 E. 72 " along the stone wall to the point of commencement. .09 acre." (Survey Notes RP 507)

3. Claimant Pailalau (or Peelalau) (LCA 3815:1)
"My houselot is at Kawela. My occupancy of these claims was since the time of Kamehameha II." (Native Register v.4:176)

"His /Pailalau's/ House site is near the sea side and is not enclosed. Claimant died about 2 years ago leaving the land to his widow. He got the land from Kaeo some ten years ago.
The Konohiki consented to this claim." (Foreign Testimony v.10:170)

Translated survey boundaries:
"Houselot. Commence at the south angle and run
N. 21 W. 114 links
then N. 80 E. 100 " along the stone wall
then S. 14 E. 116 " " Kamakai's lot
then S. 81 W. 74 " " the stone wall to the point of commencement. .1 acre." (Survey Notes RP 511)

4. Claimant Moo (LCA 2784)
"I, Moo, am a claimant for land at Kawela. There are four lo'i and also two kula. The boundaries are north, Kekua's land, east, Kaumahi, south, Kuheleloa, west, kula...
A houselot is another claim of mine, bounded on the north by the trail and a kula, on the east, a kula, on the west by the lot of Kawi. This is my claim which I had from the makuas, from the time of the Ali'i Kamehameha I, until the present." (Native Register v.3:634)

"Kalakoa, sworn, says he knows the land claimed by Moo in Kawela. It consists of 2 kalo patches and a House site. The 2 kalo patches are bounded on Hauula side by Kauaula's land, - mauka by Paku's land, - Waialua side by Kelemana's land, - makai by Paukoa's land. Claimant has no kula land in Kawela. His House site is near the kalo land and is not enclosed. He has held the land for about ten years....
The Konohiki consented to this claim." (Foreign Testimony v.10:156)

Translated survey boundaries for LCA 2784 are:
"Parcel 1. 2 taro patches. Commence at the south angle
and run N. 14 W. 100 links along Kauaula's lot
then N. 82 E. 122 " " the Konohiki's land
then S. 70 E. 41 " " Paukoa's lot
then S. 20 E. 59 " " Kalemana's lot
then S. 70 W. 165 " " Paku's lot to the point of commencement. .13 acre..
"Parcel 2. Houselot. Commence at the south-west angle
and run N. 2 W. 158 links
then N. 88 E. 158 "
then S. 2 E. 158 "
then S. 88 W. 158 " . It is surrounded by Konohiki lands. ¼ acre." (Survey Notes RP 512)

5. Claimant Kawi (LCA 2850)
"My houselot is at Kawela, bounded on the north by a fresh water pond, on the east by Moo's house, on the south by a land fence, on the west by the sea.
My right of occupancy is from the time of Kamehameha II." (Native Register v.3:663)

"Kalakoa, sworn, says he knows the kalo patch claimed by Kawi in Kawela. It is a Koele of the Konohiki. Witnefs /sic/ knows the House site of claimant in Kawela. It is near the sea side and not enclosed. Claimant has lived there some ten years.
The Konohiki consented to the claim for a House Lot, but claimed the kalo patch." (Foreign Testimony v.10:155)

Translated survey boundaries are:
"Houselot. Commence at the south angle and run
N. 3¼ W. 133 links
then N. 79 E. 173 "
then S. 30 E. 90 "
then S. 60 W. 228 " along the stone wall. It is surrounded by Konohiki land. .23 acre." (Survey Notes RP 515)

6. Claimant Makaino (LCA 2770:2)
"I, Makaino, am a claimant for land at Keokea /a land division in Kawela just mauka of Kamehameha Hwy./. There is one taro lo'i and a kai /fishery/ and a kula...
My house claim is at Kawela. My right of occupancy was from the time of Kamehameha II." (Native Register v.3:628)

"Claimant's House site is near the sea side, and not enclosed. Claimant has had this land about ten years. He got it from Kaeo.

The Konohiki consented to this claim." (Foreign Testimony v.10:155)

Translated survey boundaries for LCA 2770:2 are:
"Parcel 2. Houselot. Commence at the south-western angle and
run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " . It is surrounded by Konohiki land. ¼ acre."
(Survey Notes RP 513)

7. Claimant Kekua (LCA 2878:2)
"I, Kekua am a claimant of land at Kamooiki,...My house is at Kawela...." (Native Register v.3:676)

"Claimant's House site is in Kawela. It is near the sea side and is not enclosed. Claimant got his land from Kaeo, some 8 or 10 years ago.
The Konohiki had no objections to this claim." (Foreign Testimony v.10:155)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle and
run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " . It is surrounded by Konohiki land. ¼ acre."
(Survey Notes RP 516)

8. Claimant Paukoa (LCA 2734:3)
"I, Paukoa, have a claim for land at Kawela...The houselot is for my kaikua'ana, I dwell in the house. My claim is from my makuas, from the time of Kamehameha I to the present." (Native Register v.3:612)

"He /Paukoa/ has a House site makai of the land. It is not enclosed. He has held the land about ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:158)

9. Claimant Kauwahi (LCA 2838:2)
"My /Kauwahi's/ house claim is at Kawela, bounded on the north by the sea, on the east and south by kula, on the west by Kekua's /land/. My right of occupancy is from the time of Kamehameha I." (Native Register v.3:658)

"He /Kauwahi/ has a House site which is not enclosed...Claimant has held the land in Kawela for about ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:159)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south angle and run
N. 15¼ W. 225 links along Paukoa's houselot
then N. 74¼ E. 120 "
then S. 15 E. 225 "
then S. 74¼ W. 120 " " the Konohiki's land. ¼ acre."
(Survey Notes RP 510)

10. Claimant Paku (LCA 2724:3)
"My /Paku's/ house is at Kawela. My right of occupancy was from Kinau." (Native Register v.3:608)

"Kalakoa, sworn, says he knows the land claimed by Paku in Kawela...
His House Site is near the sea side and is enclosed with a wooden fence. Claimant has held the land for over ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:156)

Translated survey boundaries are:
"Parcel 3. Houselot. Commence at the south-western angle
and run N. 250 links along Kuheleloa's parcel
then E. 100 " " the Konohiki's land
then S. 250 " " " " "
then W. 100 " " " " " to the point
of commencement. ¼ acre." (Survey Notes RP 514)

11. Claimant Kuheleloa (LCA 2835:3)
"Claimant's House Lot is in Kawela. It is not enclosed. He has held the land since the time of Kaeo (10 years). The land belongs properly to Lono the wife of Kuheleloa, who divorced her husband for adultery.
The Konohiki consented to this claim." (Foreign Testimony v.10:157)

Translated survey boundaries are:
"Parcel 3. Houselot at Kawela. Commence at the south angle
and run N. 250 links
then E. 100 "
then S. 250 "
then W. 100 . It is surrounded by Konohiki land.
¼ acre." (Survey Notes RP 509)

12. Claimant I (deceased) (LCA 2682)
According to the Native Register (v.3:588), I claimed 2 lo'i and a houselot in Kawela. However I passed away before the claim could be awarded or surveyed, thus we have no record of the exact location of either the lo'i or the houselot.

"Kalakoa, sworn, says he knows the kalo patch claimed by I, in Kawela. It reverted to the Konohiki recently, on the death of I." (Foreign Testimony v.10:157)

Hanakaoe Ahupuaa

1. Claimant Kamakai (LCA 2837)
"I, Kamakai, hereby state my claim for land at...Hanakaoe is a kaheka pa'akai /salt pool/." (Native Register v.3:658)

2. Claimant Pailalau (LCA 3815)
"...My occupancy of these claims was since the time of Kamehameha II...At Hanakaee /sic/ is a fishery and a salt bed..." (Native Register v.4:176)

3. Claimant Kaili (LCA 235 H)
"Revd James Kekela, sworn, says at the time he was drawing up claims for the people of Kawela, the son of Kaili came to him and got Kaili's claim drawn up by witnefs /sic/. It was put in a parcel with other claims and given to Revd Mr. Emerson to bring to Honolulu.
Kane, sworn says, he knows the land of Kaili in Kawela. It consists of 5 kalo patches in two pieces.
The first piece, of 3 patches, is bounded on Hauula side by the Konohiki, Mauka by Kookoo's land, Waialua side by the Konohiki, Makai, by Kauaula's land.
The second piece, of 2 patches, is bounded on Hauula side by the Konohiki, Mauka by Kookoo's land, Waialua side by the Konohiki, Makai by Kelemana's land.
Claimant's House site is makai of the land. It is enclosed with a wooden fence - there is one house in it. Claimant held the land for about 12 years. He died in March 1849, leaving his property to his daughter Nahuli." (Foreign Testimony v.11:239)

Translated survey boundaries are:
"Parcel 1. 5 taro patches. Commence at the south angle and
run N. 16 W. 110 links along Paku's lot
then N. 73 E. 325 " " Kaunahi's lot
then N. 43 E. 56 " " the Konohiki's land
then S. 20 E. 155 " " " " "
then S. 73 W. 383 " " Kookoo's lot to the point of
commencement. .41 acre.

"Parcel 2. Houselot at Hanakaoe. Commence at the south angle
and run N. 14 E. 158 links
then S. 76 E. 158 "
then S. 14 W. 158 "
then N. 76 W. 158 " . It is surrounded by Konohiki
lands. ¼ acre." (Survey Notes RP 508)

Oio Ahupuaa

1. Claimant Pakanaka (LCA 2744:2)
"I, Pakanaka, the konohiki of Oio, hereby state my claim for land at Oio. It is...and salt bed land...
My houselot is at Oio, bounded on the north by that of Kauhikai, on the east by kula, on the south by I's /land/, on the west by the sea. My right of occupation is from the time of Kamehameha I." (Native Register v.3:617-8)

"The land claimed in Oio has not been cultivated for some time.
Claimant's House Lot is in Oio. It is not enclosed...
The Konohiki consented to the claim for one patch and House Lot." (Foreign Testimony v.10:177)

2. Claimant Kauaihikai (LCA 2936:2)
"I, Kauaihikai, hereby state my claim for land at Oio, some malas of 'awa, banana, wauke, sugar cane, two koa canoe trees, and some malas of sweet potato and gourd from the upland to

the sea...My house claim is at Oio, bounded on the north by a pig pen, on the east by a hala grove, on the south by Pakanaka's /land/, on the west by the sea.
My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:701)

"The other patches claimed, have been abandoned. The cultivation of the kula land has been abandoned.
Claimant's House site is in Oio, and is not enclosed... He died in 1848, leaving his land to Upai his widow, who now claims it.
The Konohiki consented to this Claim." (Foreign Testimony v.10:186)

3. Claimant Hoolae (LCA 2716:2)
"I, Hoolae, hereby state my claim for land at Oio...My houselot is at Oio and is bounded on the north by Kekohai's houselot, on the east by a kula, on the south by Kekuauli's lot, on the west by the sea. My right of occupancy is from the time of Kamehameha II." (Native Register v.3:601-2)

"Claimant's House site is in Oio, near the sea side, not enclosed. He has held the land for a long time. He says he has no kula land in Oio.
The Konohiki consented to this claim." (Foreign Testimony v.10:161)

4. Claimant Kekuauli (LCA 2935)
"My houselot is at Oio, bounded on the north and east by kula, on the south by a land fence, on the west by the sea. My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:700)

Ulupehupehu Ahupuaa

1. Claimant Waanui (LCA 2698:2)
"I, Waanui, hereby state my claim for land at...Ulupehupehu are some gardens of sweet potato and gourd. My houselot is at Ulupehupehu. On the north is the sea, on the east and the south is kula, on the west is the houselot of Kane.
My right of occupancy is from Kamehameha III." (Native Register v.3:595-6)

"Claimant's House site is in Ulupehupehu. It is not enclosed. He has also a patch of noni in that land, which is bounded on all sides by the Konohiki.
The Konohiki consented to this claim." (Foreign Testimony v.10:165)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " to the point of commencement; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 340)

Punalau Ahupuaa

1. Claimant Manukeokeo (LCA 2781:1)
"I, Manukeokeo, hereby state my claim for land...My house claim is also at Punalau and is bounded on the north by Kaohele's lot, on the east by a kula, on the south by the land fence, on the west by a kula. I have had the right of occupancy on these places from the year of our Lord 1842." (Native Register v.3:632-3)

"Claimant's House site is in Punalau. It is not properly enclosed. He has held the land for about ten years.
The Konohiki consented to the claim for kalo land and a House Lot." (Foreign Testimony v.10:177)

Translated survey boundaries are:
"Parcel 1. Houselot at Punalau. Commence at the south angle and run N. 15 W. 158 links
then N. 75 E. 158 "
then S. 15 E. 158 "
then S. 75 W. 158 " along the stone wall; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 533)

2. Claimant Kekua (LCA 2913:2)
"I, Kekua, hereby state my claim for land at Punalau. There is one lo'i bounded on the north and east by kula land, on the south by Kaopupahi's /land/, on the west by Kanehekili. There is cultivated kula and shore land....
My right of occupancy is from the time of Kamehameha I." (Native Register v.3:690-1)

"Claimant's House site is in Kahuku /in Punalau/, and is not enclosed...Kekua died about 2 years ago, leaving his land to Luiki who now claims it.
The Konohiki consented to this claim." (Foreign Testimony v.10:180)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " ; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 337)

3. Claimant Kaohele (LCA 2861:2)
"I, Kaohele, hereby state my claim for land at...Punalau is a cultivated kula...My house claim is at Punalau, bounded on the north by a kalawaone /curved beach, bigger than a cove, smaller then a bay/, on the east by Kainalu's lot, south by a land fence, on the west by a kula.
My right of occupancy is from the time of Kamehameha II." (Native Register v.3:667-8)

"Kailiuku, re-examined, says claimant's House site is near his kalo patches. It is not properly enclosed.
The Konohiki consented to this claim." (Foreign Testimony v.10:153)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-eastern angle and
run N. 4 E. 158 links along the taro patch
then N. 86 W. 158 "
then S. 4 W. 158 "
then S. 86 E. 158 " along the Konohiki's land to the point
of commencement. ¼ acre."(Survey Notes RP 524)

4. Claimant Kaopupahi (LCA 2869)
"I, Kaopupahi, hereby state my claim for land at Punalau. There is one lo'i, bounded on the north by Kekua's /land/, on the east by Iosua's /land/, on the south by the kula, on the west by Maulua's /land/. There is also a kula land, from the mountain to the sea...My house claim is at Punalau, bounded on the north by the sea, on the east by a sedge kula, on the south by a land fence, on the west by a kula. My right of occupancy is from the time of Kamehameha I." (Native Register v.3:671)

"Kiha, sworn, says he knows the kalo patch claimed by Kaopupahi in Punalau. Its cultivation has been abandoned. Lo has the cultivation of the kula land mentioned in this claim. Claimant resides lately in Honolulu. He has a House site in Punalau. It is not enclosed. He has held this House site for about ten years.
The Konohiki consented to the claim for a House Lot, but claimed the land." (Foreign Testimony v.10:181-181a)

Translated survey boundaries are:
"Parcel 1. Houselot. Commence at the south angle and run to
the N. 45 W. 158 links along the Konohiki's land then
N. 45 E. 158 " " " stone wall then
S. 45 E. 158 " " " Konohiki's land then
S. 45 W. 158 " to the point of commencement. ¼ acre."
(Survey Notes RP 6324)

5. Claimant Iosua Kiha (LCA 2864:2)
"I, I. Kiha, the konohiki of Punalau, hereby state my claim for land at Punalau. There is one lo'i, bounded on the north by a kula land, on the east and south by kula, on the west by Kaopupahi's /land/. There is also kula land, mountain land and shore land...My house claim is at Punalau, bounded on the north by the sea, on the east by the kula, on the south by the land fence, on the west by Kainalu's /land/.
My right of occupancy is from the time of Kamehameha I." (Native Register v.3:669)

"Kailiuku, sworn, says he knows the 2 kalo patches claimed by Kiha, one in Kahuku and one in Punalau. Neither of them are planted...
The kula land claimed is nahelehele /overgrown with weeds -cs/. It has not been cultivated for some time. Claimant's House Lot is in Punalau, and is not enclosed...
The Konohiki consented to this claim." (Foreign Testimony v.10:179)

Translated survey boundaries are:
"Houselot. Fenced in - Commence at S. angle and
run N. 73 E. 140 links along the Konohiki's land
then N. 17 W. 177 " " " " "
then S. 73 W. 140 " " " " "
then S. 17 E. 177 " " " " " . Area ¼
acre." (Survey Notes RP 520)

6. Claimant Kamalama (LCA 2909)
"I, Kamalama, hereby state my claim for land at Punalau. There are three lo'i, surrounded by kula, a kula cultivated in sweet potato and gourd...My house claim is at Punalau, bounded on the north by the sea, on the east by Kainalu's fence, on the south by a land fence, on the west by Kaohele's fence.
My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:688-9)

"Kiha, sworn, says he knows the kalo land of Claimant in Punalau. It consists of one patch. Its cultivation has been abandoned, as also that of the kula land mentioned in this claim.
Claimant's House Lot is in Punalau and is not enclosed. ..Kamalama died a few months ago, leaving a widow, Kaloena.
The Konohiki consented to the claim for a House Lot only." (Foreign Testimony v.10:182)

7. Claimant Kainalu (LCA 2892:2)
"I, Kainalu, hereby state my claim for land...My houselot is at Punalau, bounded on the north by the sea, on the east by Kika's /sic-Kiha's-cs/ houselot, on the south by a land fence, on the west by Kaohele's houselot. My right of occupancy is from the time of Kamehameha II." (Native Register v.3:681)

"Claimant's House Lot is in Punalau and is not enclosed.
The Konohiki consented to the claim for kalo land and a House Lot." (Foreign Testimony v.10:183)

Translated survey boundaries are:
"Parcel 2. Houselot at Punalau. Commence at the south-western
angle and run to the N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " ; it is surrounded by the
Konohiki's land. ¼ acre." (Survey Notes RP 252)

8. Claimant Kupihea (LCA 2885)
"I, Kupihea, hereby state my claim for land at Punalau, consisting of one lo'i bounded on the north and west by a kula, on the east by Kaopupahi's /land/, on the south by Maulua's /land/. There is also a kula land, mountain land, and a kai /shore area or fishery/...My house claim is at Punalau. My right of occupancy is from the time of Kamehameha I."

"Kailiuku, sworn, says he knows the land claimed by Kupihea. There is one patch in Kahuku and one in Punalau...The patch in Punalau has not been cultivated for a long time. Claimant has no kula land, - he had no House Lot, but lived with some

friend. He held the kalo patch in Kahuku several years. He left Kahuku some months ago and gave his land to Kiha.
The Konohiki consented to this claim." (Foreign Testimony v.10:181)

9. Claimant Maulua (LCA 2771 - unawarded)
"I, Maulua, hereby state my claim for land at Punalau. There are two lo'i, bounded on the north by Kupihea's /land/, on the east by Kaopupahi's /land/, on the south by kula land, on the west by a kula. There are a fish pond /named/ Puekahi, a kula land, and a mountain /land/ and a shore land...My house claim is at Punalau, bounded on the north by the sea, on the east by a pond, on the south by the kula, on the west by a row of hala. My right of occupancy is from the time of Kamehameha III." (Native Register v.3:629)

"Kiha, sworn, says he knows the 2 kalo patches claimed by Maulua in Punalau. One of them is a Koele and belongs to the Konohiki, and the cultivation of the other has been abandoned. The cultivation of the kula land mentioned has been abandoned.
Claimant has no House Lot - he lives with some one else.
The Konohiki claims all the land mentioned in this claim." (Foreign Testimony v.10:182)

Kahuku Ahupuaa

1. Claimant Kauihawale (LCA 2928:2)
"I, Kauihaiwale, hereby state my claim for land at Kahuku... a salt land, and one koa canoe tree. My houselot is at Kahuku, bounded on the north by a mala of wauke, on the east by a taro lo'i, on the south and west by a kula.
My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:697)

"...Claimant's House site is distinct from his land, and is not enclosed....
The Konohiki consented to the claim for...a House Lot." (Foreign Testimony v.10:168)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle
and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " . This parcel is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 251)

2. Claimant Umeume (LCA 2679:2)
"I, Umeume, hereby state my claim for land at Kahuku...Here at Kahuku is a puna pa'akai /brackish spring7/ and my two hala trees. My houselot is here in Kahuku. Its boundaries are surrounded by kula." (Native Register v.3:2679)

"...Claimant's House Lot is distinct from his land, and is enclosed with a wooden fence...He has held his land in Kahuku for over 15 years.
The Konohiki consented to this claim." (Foreign Testimony v.10:174)

Translated survey boundaries are:
"Houselot. Commence at North West angle and
run East 230 links along a Road
then South 110 " " Konohiki
then West 230 " " same
then North 110 " " same to the point of Commencement.
Area ¼ acre." (Survey Notes RP 259)

3. Claimant Malailua (LCA 2775:2)
"I, Malailua, hereby state my claim for land at Kahuku...A row /or cluster/ of hala trees is at Amo, at Luahine...A salt land is at Luahine. My house claim is here in Kahuku, bounded on the north by a land fence, on the east, south and west by a hala grove. My right of occupancy was from the time of Kamehameha II." (Native Register v.3:630)

"...Claimant's House site is distinct from his land and is not enclosed.
He has held the land for over twenty years...
The Konohiki of Kahuku consented to this claim." (Foreign Testimony v.10:166)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the north angle
and run S. 68 E. 158 links along the stone wall
then S. 22 W. 158 "
then N. 68 W. 158 "
then N. 22 E. 158 " " " Konohiki's land to the point of commencement. ¼ acre." (Survey Notes RP 534)

4. Claimant Waanui (LCA 2698:1,3)
"I, Waanui, hereby state my claim for land at Kahuku. The name of the mo'o is Puaakea, and I have two lo'i. On the north is Lokea's, on the east is Kailiuku's, on the south is Kaukaha's land, on the west is Napoe's land.
My right of occupancy is from Kamehameha III." (Native Register v.3:595-6)

"Kailiuku, Sworn, says he knows the two kalo patches claimed by Waanui in Kahuku.
They are bounded on Hauula side by Pahanui's land, - Mauka by Kaukaha's land, - Waialua side by Hea's land, - Makai by Puu's land.
...He has held the land in Kahuku for over ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:165)

Translated survey boundaries are:
"Parcel 1. 2 Taro Patches at Kahuku. Commence at the south angle and run N. 13 W. 71 links along the Konohiki land
then N. 81 E. 250 " " " " "
then S. 8 E. 74 "
then S. 81 W. 241 " " " " " .

.18 acre...

"Parcel 3. Open flat lands. Commence at the south angle
and run N. 10 W. 160 links
then N. 77 E. 205 "
then S. 15 E. 170 "
then S. 80 W. 215 " ; it is surrounded by Konohiki
land. .32 acre." (Survey Notes RP 340)

5. Claimant Lokea (LCA 3809)
Waanui also assumes this claim as Lokea had passed away before it was completely processed and awarded.

"I, Lokea, am a claimant for land and kula at Puaakea, consisting of seven taro lo'i and the kula...My house is at Puaakea. My right of occupancy is from the time of Kamehameha I." (Native Register v.4:174)

"Kailiuku, sworn, says he knows the kalo land claimed by Lokea in Kahuku. There are 3 patches planted. They are bounded on Hauula side by Pahanui's land, - Mauka by Kaukaha's land, - Waialua side by Heea's land, - Makai by Puu's land. The kula land claimed by Lokea is nahelehele /overgrown with weeds - cs/. Claimant's House Lot has been abandoned. He held the land for about 12 years. He died the present year leaving his land to Waanui who now claims it.
The Konohiki consented to this claim." (Foreign Testimony v.10:165)

Translated survey boundaries are:
"3 Taro Patches. Commence at the south-western angle
and run N. 103 links along the Konohiki's land
then N. 81 E. 241 links along Waanui's land
then S. 8 E. 122 " " Kanahuna's land
then S. 85½ W. 256 " " Puu's land to the point of
commencement. .27 acre." (Survey Notes RP 334)

6. Claimant Holoaia (LCA 2706:2)
"Kailiuku, sworn, says he knows the kalo land of Holoaia in Kahuku...
Claimant's House site is near the sea side and is not enclosed.
Holoaia held the land for over ten years. He died recently, and his daughter Kaleikini is his Heir.
The Konohiki consented to this Claim." (Foreign Testimony v.10:186)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south angle
and run N. 10 W. 158 links
then N. 80 E. 158 "
then S. 10 E. 158 "
then S. 80 W. 158 " ; it is surrounded by Konohiki land.
¼ acre." (Survey Notes RP 244)

7. Claimant Kaukaha (LCA 4341:2)
"I, Kaukaha, hereby state my claim for land in Kahuku...My house claim is at Kahuku. It is bounded on the north by the pasture and on the east, south and west by kula. My right of occupancy is from the time of Kamehameha I." (Native Re-

gister v.4:266)

"Pahanui, Sworn says, he knows the kalo land of Clt. in Kahuku...
Claimant's House lot is makai of his land - not enclosed.
He has held the land for over ten years.
The Konohiki consented to this claim." (Foreign Testimony v.11:320)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south angle
and run N. 42 E. 165 links
then S. 54 E. 150 "
then S. 38 W. 143 "
then N. 61 W. 164 " along the stone wall; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 526)

8. Claimant Makilo (LCA 2779:2)
"I, Makilo, hereby state my claim for land at Kahuku...The kula land is Kuhiwa, also Hoahale. My right of occupancy is from the time of Kamehameha III." (Native Register v.3:632)

"...Claimant has also a piece of kula land fenced in. It is bounded on all sides by the Konohiki's land. It is planted with wauke, banana' &c. Claimant has held the land over 3 years.
The Konohiki consented to this claim." (Foreign Testimony v.10:167)

Translated survey boundaries are:
"Open flat land. Commence at the south angle
and run N. 70 E. 190 links
then N. 5 W. 367 "
then S. 54 W. 310 "
then S. 23 E. 280 " ; it is surrounded by Konohiki land.
3/4 acre." (Survey Notes RP 530)

9. Claimant Nauluhao (LCA 3958:2)
"I, Nauluhao, hereby state my claim for land...My right of occupancy, to this day, is from the time of Kamehameha I.
My house is at Kalimaloa..." (Native Register v.4:200)

"Kahikapu, sworn, says he knows the land claimed by Nauluhao in Kahuku...
Claimant's House site is in Kahuku, but it is distinct from the land. It is not enclosed. Claimant derived the land from his parents and has held it about 30 years.
The Konohiki consented to this claim." (Foreign Testimony v.10:151)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the north-western angle
and run N. 84 E. 158 links along the stone wall
then S. 6 E. 158 "
then S. 84 W. 158 "
then N. 6 W. 158 " ; it is surrounded by Konohiki land.
¼ acre." (Survey Notes RP 254)

10. Claimant Palu (LCA 2738:3)
"I, Palu, hereby state my claim for land in Kahuku...There is a salt land at Ahamau, a wauke garden and a row of hala trees. My houselot is at Kahuku, and is surrounded by kula.
My right of occupation is from the time of Kamehameha I." (Native Register v.3:614)

"...Claimant's House site is distinct from the land and is not enclosed. He held the land since the time of Kam. II.
Palu died about 2 years ago, leaving his land to his widow, Iheihei.
The Konohiki consented to the...House site." (Foreign Testimony v.10:183)

Translated survey boundaries are:
"Parcel 3. Houselot. Commence at the south-western angle
and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " ; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 518)

11. Claimant Luiki (LCA 2690:2)
"I, Luiki, hereby state my claim for land at Kahuku...My house claim is at Kahuku and is bounded on the north by the land fence, on the east by the weed grown kula, and likewise on the south, on the west, a kula.
The occupation of my claim has been from the time of Kamehameha I." (Native Register v.3:591-2)

"...Claimant's House site is distinct from the kalo land and is not enclosed. He derived the land from his ancestors who held from the time of Kam. I...
The Konohiki consented to this claim." (Foreign Testimony v.10:164)

Translated survey boundaries are:
"Houselot. Commence at south angle and run
N. 28 W. 200 links along the Konohiki's land
then S. 62 W. 125 " " " same
then S. 28 E. 200 " " " same
then N. 62 E. 125 " " " same to point of commencement. Area ¼ acre." (Survey Notes RP 339)

12. Claimant Kupau (LCA 2880:2)
Luiki /Luike/ also assumes this claim as Kupau had passed away before it was completely processed and awarded.

"I, Kupau, hereby state my claim for land at Kahuku...A kula land is planted in sweet potato, noni, sugar cane and banana. ..My right of occupancy is from the time of Kahahana." (Native Register v.3:675)

"...Claimant has a piece of cultivated kula land also. It is planted with wauke, bananas &c. It is bounded on Hauula side by a path, - on all the other sides by the Konohiki...
...Kupau has held the land in Kahuku since the time of

Kam. I. He died the present year, leaving his land to Luiki who now claims it.
The Konohiki consented to this claim." (Foreign Testimony v.10:164)

Translated survey boundaries are:
"Parcel 2. Open flatland. Commence at the south angle
and run N. 76 W. 115 links
then N. 20 E. 140 "
then S. 71 E. 100 "
then S. 12 W. 120 " ; it is surrounded by Konohiki land. .14 acre." (Survey Notes RP 338)

13. Claimant Kaohele (LCA 2861:1)
"I, Kaohele, hereby state my claim for land at Kahuku. The name of the mo'o is Lanahu. There are five lo'i bounded on the north by Kaihu's holua /a sliding place for sport/, on the other three sides by kula....
My right of occupancy is from the time of Kamehameha II." (Native Register v.3:667-8)

"Kailiuku, sworn, says he knows the land claimed by Kaohele in Kahuku. It consists of 5 kalo patches, in one piece, bounded on Hauula side by the Konohiki, - Mauka and Waialua side by kula land, - Makai by Makoli's land...Claimant has held the kalo land for over 20 years...
The Konohiki consented to this claim." (Foreign Testimony v.10:153)

"Parcel 1. 5 taro patches. Commence at the north-south angle
and run S.25 E. 74 links along the Konohiki's land
then S.61 W. 132 " " Pakanaka's land
then S.27 E. 81 "
then N.76 E. 216 " " " "
then S.8½ E. 196 " " the Konohiki's land
then W.64 links
then N.57 W. 103 links
then S.12½ W. 90 "
then N.87 W. 84 "
then N. 2 E. 170 "
then S.70 W. 272 "
then N.35 W. 117 " along the Konohiki's land
then N. 5 E. 188 "
then N.42 E. 73 "
then S.57 E. 122 "
then S.74 E. 85 "
then N.15 E. 70 " along the Konohiki's land
then S.88 W. 122 " " Makole's land to the point of commencement. 1.36 acres." (Survey Notes RP 524)

NOTE: Kaohele's houselot (LCA 2861:1) adjoins the above-described taro patches. This houselot is listed under Punalau ahupuaa; see description for claimant #3.

14. Claimant Pakanaka (LCA 2744:1)
"I, Pakanaka, the konohiki of Oio, hereby state my claim for land...At Kahuku is one lo'i adjoining those of Kaihiholua

and Lonoopuakauila...
My right of occupation is from the time of Kamehameha I." (Native Register v.3:617-8)

"Kailiuku, Sworn, says he knows the kalo patch claimed by Pakanaka in Kahuku.
It is bounded on Hauula side by the Konohiki, - Mauka and Waialua side by Kainalu's land, - Makai by Makole's land....
...He has held the patch in Kahuku ten years.
The Konohiki consented to the claim for one patch..." (Foreign Testimony v.10:177)

15. Claimant Kapaiaala (LCA 2868:2)
"I, Kapaiaala, hereby state my claim for land at Kahuku... My house claim also is surrounded by kula." (Native Register v.3:670)

"Kailiuku, sworn, says he knows the land claimed by Kapaiaala in Kahuku...The House site of claimant is distinct from his land. It is not enclosed. Claimant has held the land for 20 years or more.
The Konohiki consented to this claim." (Foreign Testimony v.10:153)

Translated survey boundaries are:
"Houselot. ¼ acre.
N. 20 E. 158 links along the Konohiki's land
S. 70 E. 158 links " " " "
S. 20 W. 158 links " " " "
N. 70 W. 158 links " " " " ." (Survey Notes RP 531)

RECOMMENDATIONS

Additional research hours should be expended in locating more references, specific in nature, that will serve to expand what has been presented both mythologically and historically.

Land records relating to individual awards need to be analyzed and a sketch mapping land use should be drafted from the raw data presented herein.

Early government correspondence and court records relative to land-owners and lands within project boundaries should be examined for new historical and cultural material.

Finally, a cohesive narrative utilizing available data should be developed; this final report should be fairly comprehensive and well-documented.

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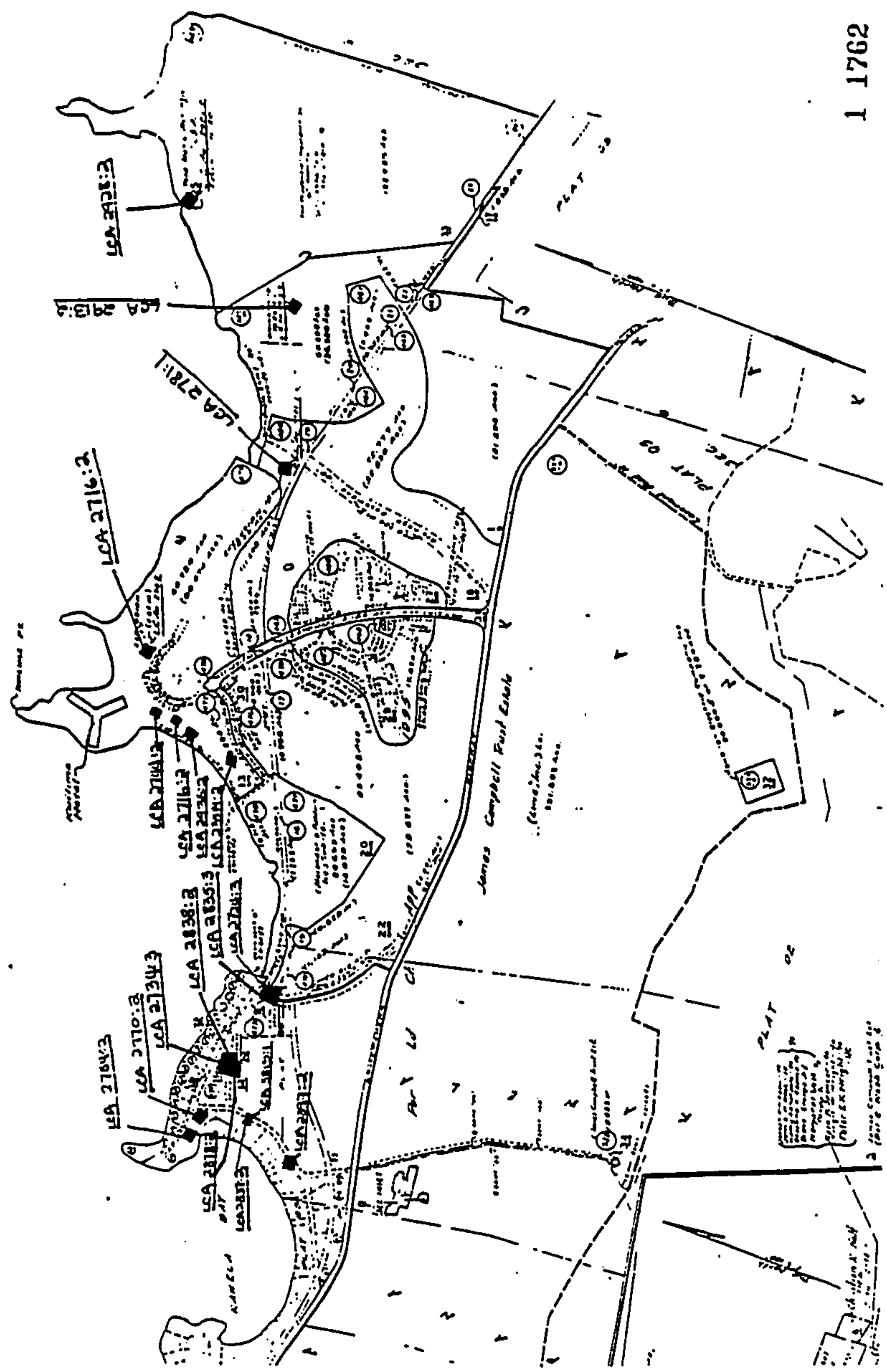
Figure 16.

TAX MAP AND LAND COMMISSION AWARDS (LCA):
KAWELA BAY TO KAHUKU POINT



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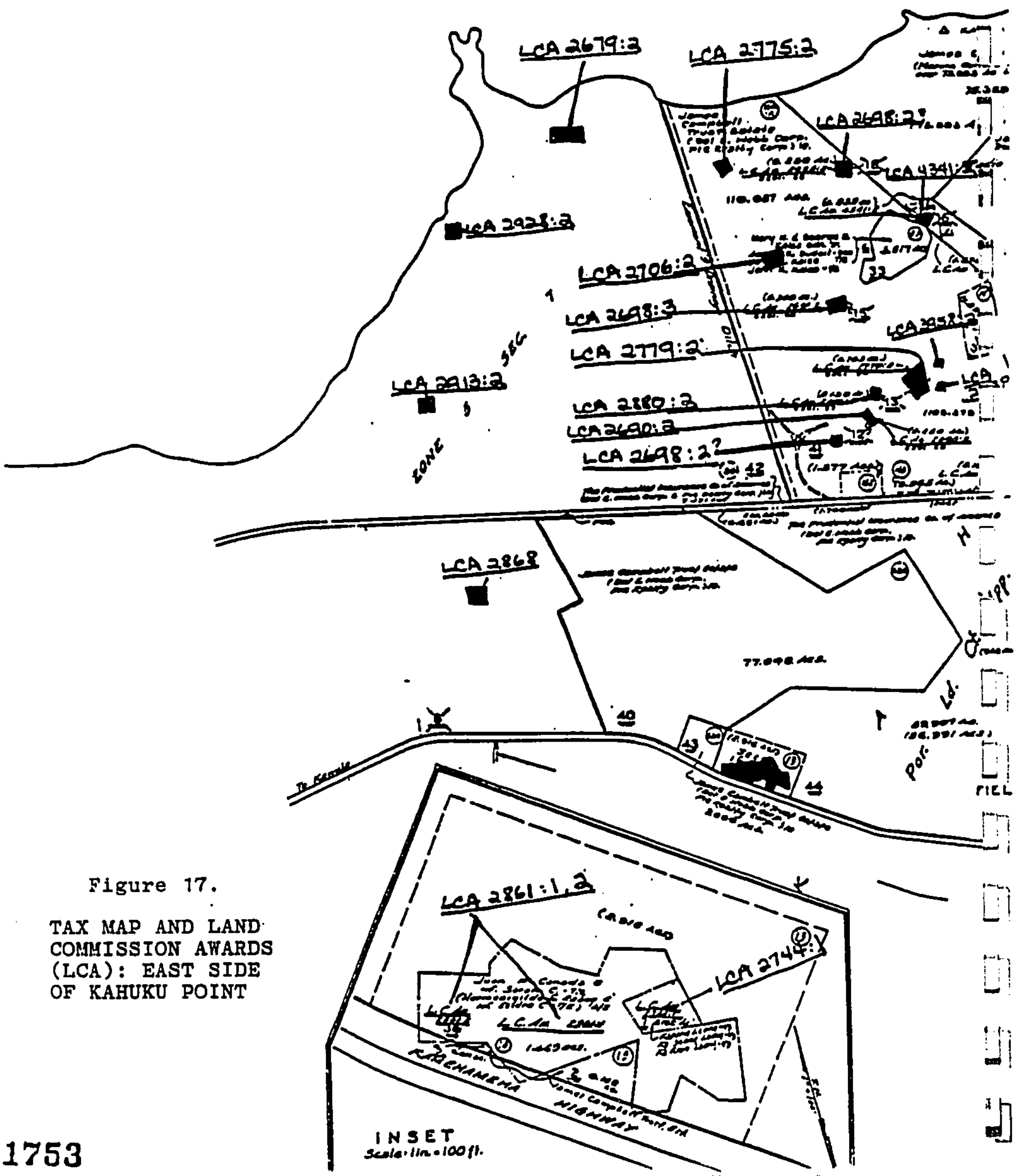
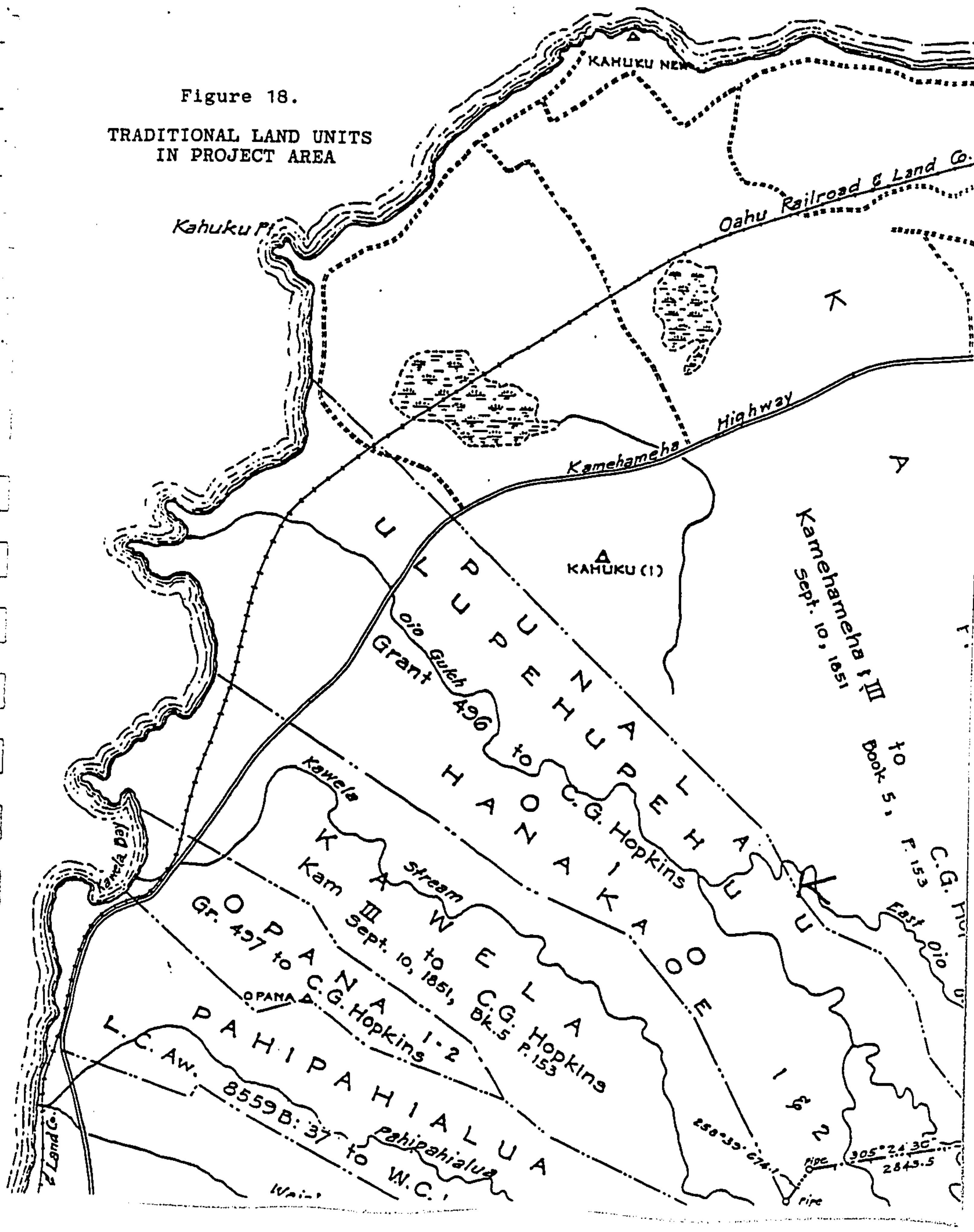


Figure 17.

TAX MAP AND LAND COMMISSION AWARDS (LCA): EAST SIDE OF KAHUKU POINT

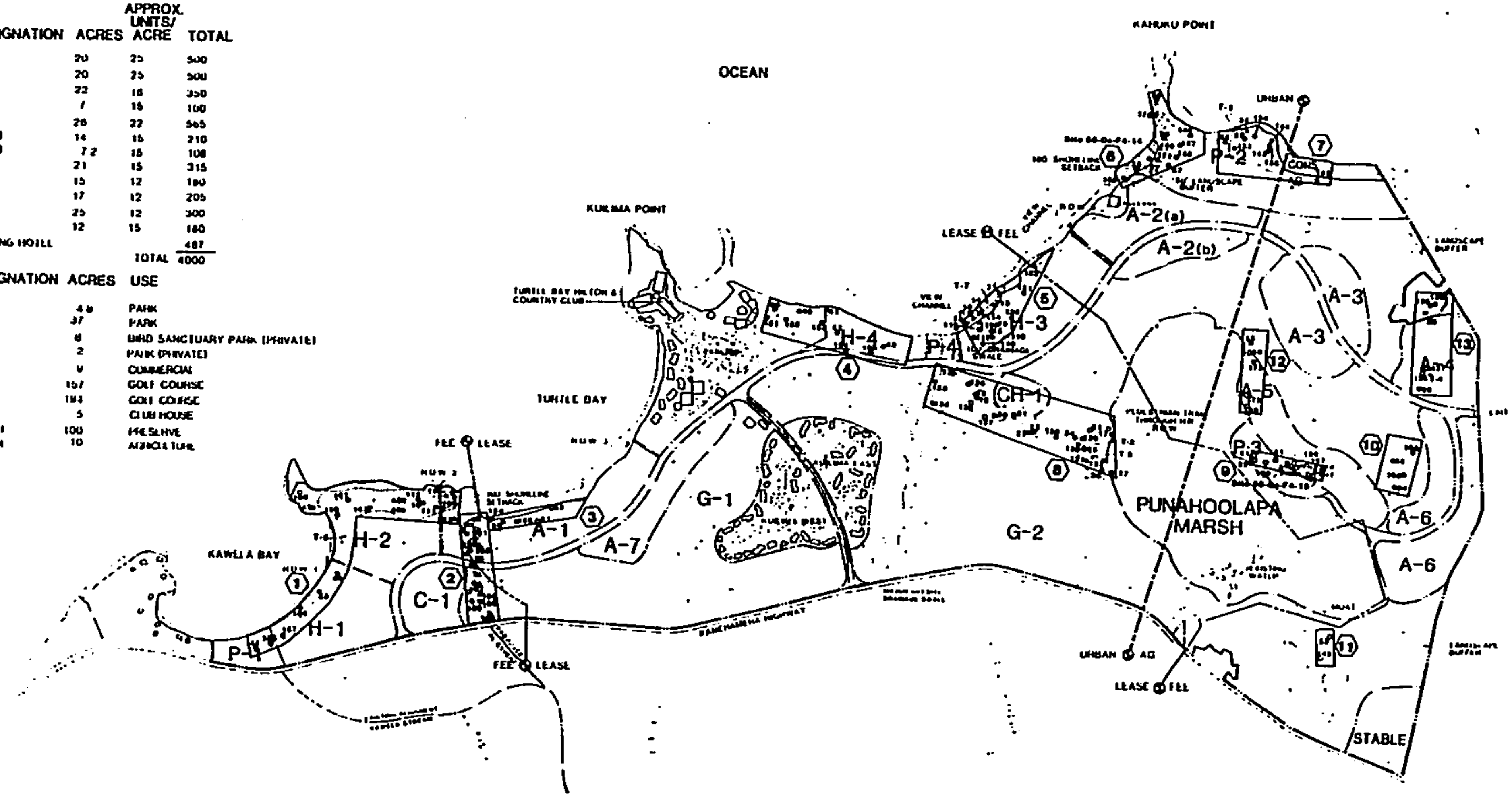
Figure 18.

TRADITIONAL LAND UNITS IN PROJECT AREA



DESIGNATION	ACRES	APPROX. UNITS/ ACRE	TOTAL
H 1	20	25	500
H 2	20	25	500
H 3	22	16	350
H 4	7	15	100
A 1	26	22	565
A 2(a)	14	15	210
A 2(b)	7.2	15	108
A 3	21	15	315
A 4	15	12	180
A 5	17	12	205
A 6	25	12	300
A 7	12	15	180
EXISTING HOTEL			487
		TOTAL	4000

DESIGNATION	ACRES	USE
P 1	4.8	PARK
P 2	37	PARK
P 3	8	BIRD SANCTUARY PARK (PRIVATE)
P 4	2	PARK (PRIVATE)
C 1	9	COMMERCIAL
G 1	157	GOLF COURSE
G 2	194	GOLF COURSE
CH 1	5	CLUB HOUSE
MARSH	100	PRESERVE
STABLE	10	AGRICULTURE



KUILIMA RESORT

• BASE MAP
• MASTER PLAN

Figure 9
Survey Area and Test Location Map

GROUP 70
ARCHITECTS AND PLANNERS

NORTH

APPENDIX I

AIR QUALITY STUDY

AIR QUALITY STUDY

FOR THE PROPOSED

KUILIMA RESORT EXPANSION

OAHU, HAWAII

Prepared by

Barry D. Root
Kaneohe, Hawaii

December 21, 1984

TABLE OF CONTENTS

EXHIBITS

TABLES

1. PROJECT DESCRIPTION

The proposed Kuilima Resort Expansion involves site preparation and construction of four hotels totalling 1,450 rooms; seven resort condominium clusters totalling 2,063 units; 40,000 square feet (gross floor area) of commercial space; golf courses; parks; and associated roadways and infrastructure to be added to the existing Turtle Bay Hilton and Kuilima Estates Resort on 808 acres of land in the vicinity of Kahuku Point on Oahu as shown in Exhibit 1. The proposed Development Master Plan is shown in Exhibit 2.

Development work on the expansion is expected to begin in 1985 and to take place in three phases over a 15 year period ending near the end of the century. Work areas will generally progress from west to east beginning with hotel developments in the Kawela Bay area and ending with resort condominium construction along Marconi Road near the eastern boundary of the site.

The purpose of this study is to describe existing ambient air quality in the project area, to estimate and evaluate the impact of any increase in short or long term air pollutant concentrations resulting from actions related to the proposed project, and to suggest potential mitigative measures that might be employed to alleviate any adverse air quality impacts that could be directly or indirectly attributed to the project as proposed.

2. AIR QUALITY STANDARDS

State of Hawaii and Federal Ambient Air Quality Standards (AQS) have been established for six classes of pollutants as shown in Table 1. An AQS is a concentration not to be exceeded over specified sampling time periods which vary for each pollutant depending upon the type of exposure necessary to cause adverse effects. Each of the regulated pollutants has the potential to cause some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration.

Federal AQS have been divided into Primary and Secondary levels. Primary AQS are designed to prevent adverse health impacts while Secondary AQS refer to welfare impacts such as decreased visibility, diminished comfort levels, damage to vegetation, animals or property, or a reduction in the overall aesthetic quality of the atmosphere. State of Hawaii AQS have been set at a single level which in most cases is significantly more stringent than the lowest comparable Federal limit.

The State of Hawaii Department of Health has proposed that the Hawaii State AQS for particulates and sulfur dioxide be changed to match Federal limits. Public hearings were held on the proposed changes in May, 1984, but to date these changes have not been made official.

3. PRESENT AIR QUALITY

There are no ambient air quality monitoring stations within the immediate vicinity of the proposed project. For a windward location such as this with no industrial activity upwind for thousands of miles it seems reasonable to assume that present air pollution levels are very low. The only significant sources of man-made air pollution in the area are motor vehicles traveling along Kamehameha Highway adjacent to the mauka project boundary. There is no agricultural activity requiring open field burning in the immediate project area.

Natural air pollutant producers which could affect air quality in the project area include the ocean (sea spray), plants (aero-allergens), dust, and perhaps a distant volcanic eruption on the Island of Hawaii. Concentrations of air pollutants from these kinds of sources should be fairly uniform for most windward Oahu locations.

The only long term air pollution monitoring station along the windward coast of Oahu is located in Waimanalo, about 32 miles southeast, and only particulates are measured at that location. For the past 15 years 24 hour and annual averages of particulate measurements at Waimanalo have been running at about one half of the allowable State of Hawaii AQS.

4. DIRECT AIR QUALITY IMPACT OF PROJECT CONSTRUCTION

During the site preparation and construction phases of this project it is inevitable that a certain amount of fugitive dust will be generated. Field measurements of such emissions from apartment and shopping center construction projects has yielded an estimated emission rate of 1.2 tons of dust per acre of construction per month of activity. This figure assumes medium level activity in a semi-arid climate with a moderate soil silt content. Actual emissions of fugitive dust from this project can be expected to vary daily depending on the amount of activity and the moisture content of the exposed soil in work areas.

One major generator of fugitive dust is heavy construction equipment moving over unpaved roadways. This problem can be substantially mitigated by completing and paving roadways as early in the development process as possible.

It is also inevitable that construction equipment will emit some air pollutants in the form of engine exhausts. The largest equipment is generally diesel powered. For this type of equipment individual carbon monoxide emissions are usually no more than those of the average automobile, but nitrogen dioxide emissions can be quite high. Fortunately, nitrogen dioxide emissions from other sources in the area should be relatively low and the overall impact of pollutant emissions from construction equipment should be minor compared to levels generated on Kamehameha Highway nearby.

5. AIR QUALITY IMPACT OF INCREASED ENERGY UTILIZATION

Estimating about 400,000 square feet of hotel space, 40,000 square feet of commercial space, and 2,000,000 square feet of condominium space with energy consumption rates at the power plant of 266,000 BTU per square foot for hotels, 500,000 BTU per square foot for commercial space, and 72,000 BTU per square foot for resedential apartment usage yields a total requirement for about 250 billion BTU of energy. If this need is to be met totally by burning fuel oil, then the additional fuel requirement would be on the order of 40,000 barrels of oil per year.

This energy requirement could be cut significantly if all units in the complex are equipped with solar water heaters when they are built. Hawaiian Electric Company also has some options available other than burning fuel oil to meet this demand. These options include wind energy generation at a site almost directly across Kamehameha Highway from the project and the possibility of an Ocean Thermal Energy Conversion Plant off the leeward coast.

The major impact of any fuel burned to supply the needs of this project, however, will be increased sulfur dioxide and particulate levels in the vicinity of present Hawwaiian Electric power plants, primarily the Kahe Plant on the Waianae coast.

6. INDIRECT AIR QUALITY IMPACT OF INCREASED TRAFFIC

Once construction is completed the proposed project will not in itself constitute a significant direct source of air pollutants other than minor air conditioner losses and fugitive cooking aromas. By serving as an attraction for increased motor vehicle traffic in the area, however, the project must be considered to be a significant indirect air pollution source.

Motor vehicles, especially those with gasoline-powered engines, are prodigious emitters of carbon monoxide. Motor vehicles also emit some nitorgen dioxide and those burning fuel which contains lead as an additive contribute some lead particles to the atmosphere as well. The major control measure designed to limit lead emissions is a Federal law requiring the use of unleaded fuel in most new automobiles. As older cars are removed from the vehicle fleet lead emissions should continue to fall. In fact the Federal Environmental Protection Agency has recently advocated that lead be removed from all automobile fuel as soon as possible.

Federal control regulations also call for increased efficiency in removing carbon monoxide and nitrogen dioxide from vehicle exhausts. By 1995 carbon monoxide emissions from the vehicle fleet then operating are mandated to be little more than half the amounts now emitted.

In order to evaluate the air quality impact of increased traffic and decreasing emission levels per vehicle in the project area a detailed carbon monoxide modeling study has been carried out. This study was designed to yield carbon monoxide concentration values which could be directly compared to allowable State and Federal Air Quality Standards.

7. CARBON MONOXIDE DIFFUSION MODELING

Three critical receptor sites were selected for micro anlaysis and one receptor site was chosen to assess the regional or downstream impact of project development. Sites 1, 2, and 3 are on the mauka side of Kamehameha Highway near the intersections of Kuilima Drive, West Kuilima Drive, and Marconi Road respectively. Site 4 is on the makai side of Kamehameha Highway in the vicinity of Waimea Bay. The locations of these sites are indicated on Exhibit 1. Expected worst case concentrations of carbon monoxide at these receptor points was computed as described below for the present case and for future years with and without the proposed project.

At present highest daily peak hour traffic volumes in the project area occur between 2:00 and 3:00 PM on weekends. Existing and forecast traffic volumes on Kamehameha Highway for each development phase as well as expected turning movements at each of the major intersections are described in the traffic study for the project. For the purposes of this study it is assumed that Phase I will be completed by 1990, Phase II by 1995, and Phase III by 2000.

The existing vehicle mix on Kamehameha Highway adjacent to the project site is as follows: 83% gasoline-powered automobiles, 13% light duty gasoline-powered trucks and vans, 0.5% heavy duty gasoline powered vehicles, 1% diesel-powered automobiles, 0.5% diesel-powered light duty trucks, and 2% diesel-powered heavy duty trucks and buses. This mix is not expected to change significantly over the years studied.

At present Kuilima Drive is the only intersection providing access to the project area and egress at that point is controlled only by a stop sign. The traffic study for the project recommends that by the end of Phase II the Kuilima Drive intersection be signalized and that left turn/storage lanes be constructed on Kamehameha Highway at both Kuilima and West Kuilima Drives. By the end of Phase III it is recommended that both West Kuilima Drive and Marconi Road intersections be signalized as well. This air quality modeling study considers the intersection traffic flow with and without the recommended signals.

Average vehicle speeds on project access roads upstream from stop signs or signals are assumed to be 5 mph, while right turn traffic in and out of the project is assumed to travel at 15 mph. Vehicles in the left turn storage lanes on Kamehameha Highway are assumed to move at at average rate of 5 mph, while traffic in unimpeded flow moves along at 35 mph. Twenty percent of all vehicles are assumed to be operating in the cold start mode.

Vehicular carbon monoxide emission rates for the years studied were determined using the latest version of EPA's computerized Mobile Source Emissions Model (MOBILE 2). Worst case afternoon rush hour teruperature was assumed to be 68 degrees F.

The EPA computer model HIWAY-2 was used to calculate carbon monoxide concentrations at selected receptor sites with and without project-related traffic. Stability category D (4) was used for determining diffusion coefficients. This stability category represents the most stable (least favorable) atmospheric condition that is likely to exist in a suburban area such as this.

To simulate worst case wind conditions a uniform wind speed of one meter per second was assumed with the worst case wind for sites 1 and 2 being the very frequent northeast tradewind, that for site 3 being a relatively rare northwest wind, and that for site 4 a southwesterly wind.

At each receptor site concentrations were computed at a height of 1.5 meters to simulate levels that would exist at within the normal human breathing zone. Background contributions of carbon monoxide from sources or distant roadways not directly considered in the analysis were assumed to be zero.

Results of the peak hour carbon monoxide analysis are presented in Table 2. Concentrations of carbon monoxide are predicted to be within allowable State of Hawaii AQS with or without the proposed project at all four selected critical receptor sites even under the worst case traffic and meteorological conditions considered in the diffusion modeling analysis.

Peak eight hour traffic volumes were not provided in the traffic analysis for the project, but it is herein estimated that the average hourly intersection volume during eight hours will be about 80 percent of the peak hour volume. Eight hour carbon monoxide values are determined by this average hourly traffic volume and the additional application of a 'meteorological persistence factor' of 0.6 as recommended in EPA guidelines to account for the fact that meteorological dispersion conditions are likely to be more variable (and hence more favorable) over an eight hour period than they are for a one hour period.

Multiplying the projected peak hour carbon monoxide concentrations shown in Table 2 by a combined factor of about 0.5 will yield values that are about one half those shown. The State of Hawaii eight hour AQS for carbon monoxide is also one half the one hour standard, or 5 milligrams per cubic meter. Thus the conclusions reached above with regard to the one hour State of Hawaii carbon monoxide AQS will hold with respect to the eight hour standard as well.

All carbon monoxide concentrations calculated in the above analysis are well within the less stringent Federal one and eight hour AQS whether the project is constructed or not and no matter which traffic configuration is employed at critical intersections.

8. MITIGATION MEASURES

A. SHORT TERM

As indicated by the foregoing analysis, the only direct adverse air quality impact that the proposed project is likely to create is the emission of fugitive dust during the construction phase of the project. State of Hawaii Department of Health Rules and Regulations stipulate the control measures that are to be employed to reduce this type of emissions. Primary control consists of wetting down loose soil areas with water or suitable chemicals. An effective watering program can reduce particulate emission levles from construction sites by as much as 50 percent. Other control measures include good housekeeping on the jobsite and pavement or landscaping of bare soil areas as quickly as possible.

B. LONG TERM

Once completed, the proposed Kuilima Resort Expansion is expected to have little direct impact on the air quality of the surrounding region. The only potential long term indirect impact will be in the form of increased power plant emissions associated with provision of electricity to residences within the project and increased automobile emissions from vehicles arriving and departing the project area.

It is possible to cut down electrical requirements considerably by installing solar water heaters in all new residential units, but project planners can do very little to decrease emission levels from vehicles operating within or near the project area. Reductions in these emissions depend on actions by the Federal government and given the nascent economic recovery of the nation's automobile industry it is difficult to tell if the stringent emissions reduction program now being pursued will in fact be followed in coming years. It is possible that the emission values used here to predict future pollutant concentrations will prove to be too optimistic. On the other hand this analysis did not consider the possibility that technological innovation may lead to new vehicular power systems which produce little or none of the air pollutants that are currently of concern.

In any case the modeling study carried out for this project indicates that air pollutant concentrations from vehicular sources in and around the project can be expected to be within allowable air quality standards even under worst case traffic and meteorological conditions. For this reason no special mitigation measures seem necessary in this regard.

9. SUMMARY

1. The proposed Kuilima Resort Expansion involves site preparation and construction of four hotels and seven resort condominium clusters along with associated commercial areas, golf courses and parks on about 808 acres of land adjacent to the existing Turtle Bay Hilton and Kuilima Estates at Kahuku Point on Oahu.

2. Present air quality in the project area is estimated to be very good since there are no major contributing sources other than vehicles traveling on Kamehameha Highway adjacent to the project site.

3. Except for short term dust emissions during the construction phase of the project no significant direct air quality impacts are expected.

4. Indirect air quality impacts are expected to result from demands for electrical energy. This impact is likely to occur in the Waianae area near the Kahe Power Plant where increased particulate and sulfur dioxide emissions can be expected.

5. Increased traffic generated by the project will increase emissions of carbon monoxide and nitrogen dioxide in the project area and at congested locations along Kamehameha Highway leading to and from the project. Predicted concentrations of these pollutants, however, are expected to be within allowable State and Federal Ambient Air Quality Standards.

6. Solar water heating is suggested as a mitigative measure to reduce the impact of increased electrical demand, adequate control measures are available to limit emissions of fugitive dust from construction activities, but special mitigative measures to control emissions from motor vehicles in the immediate area of the project are not considered to be necessary. This conclusion is based solely on air pollution considerations, however, and does not abrogate the need to implement improvements that have been recommended in previous environmental and traffic studies of the windward portion of Kamehameha Highway.

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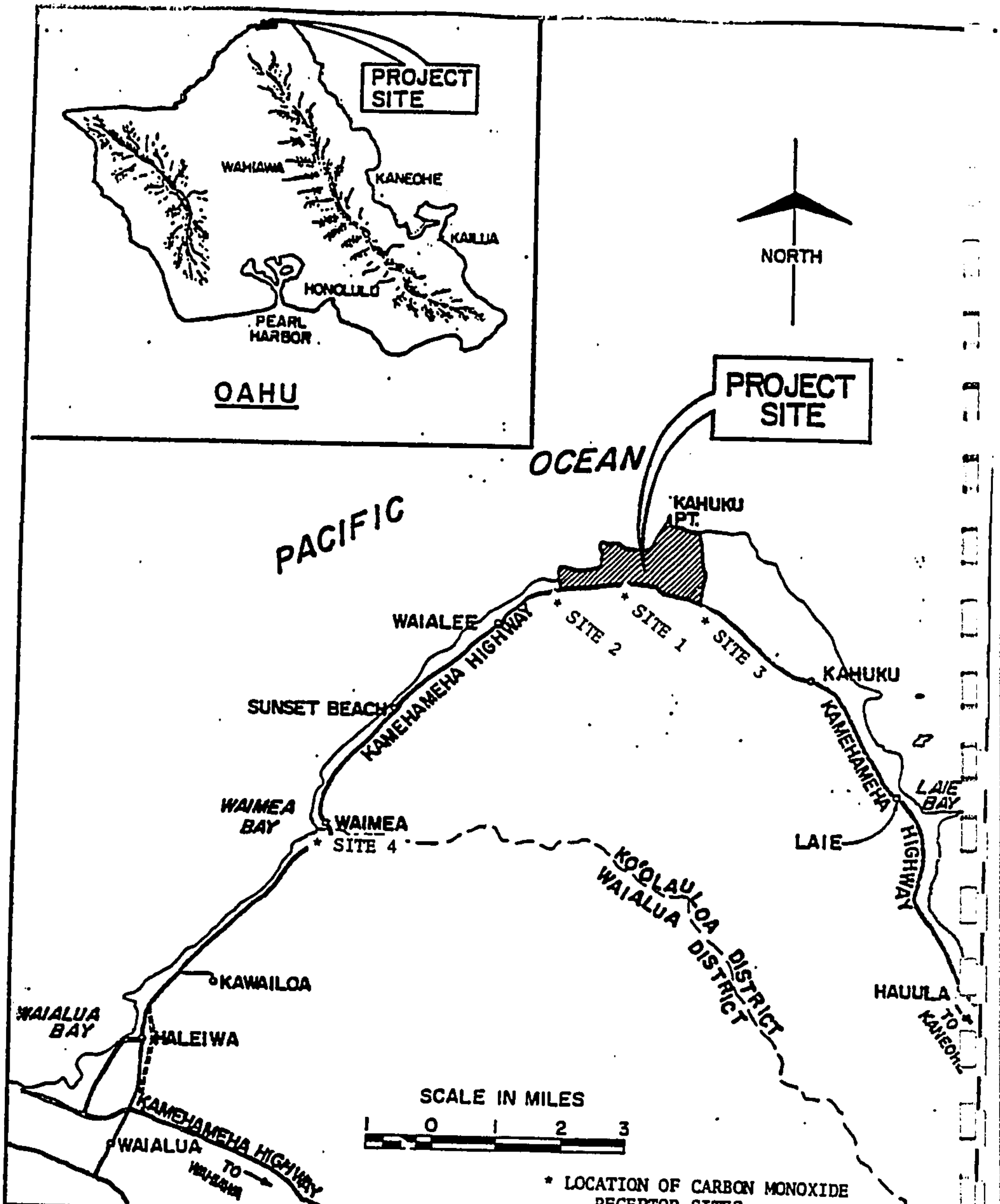
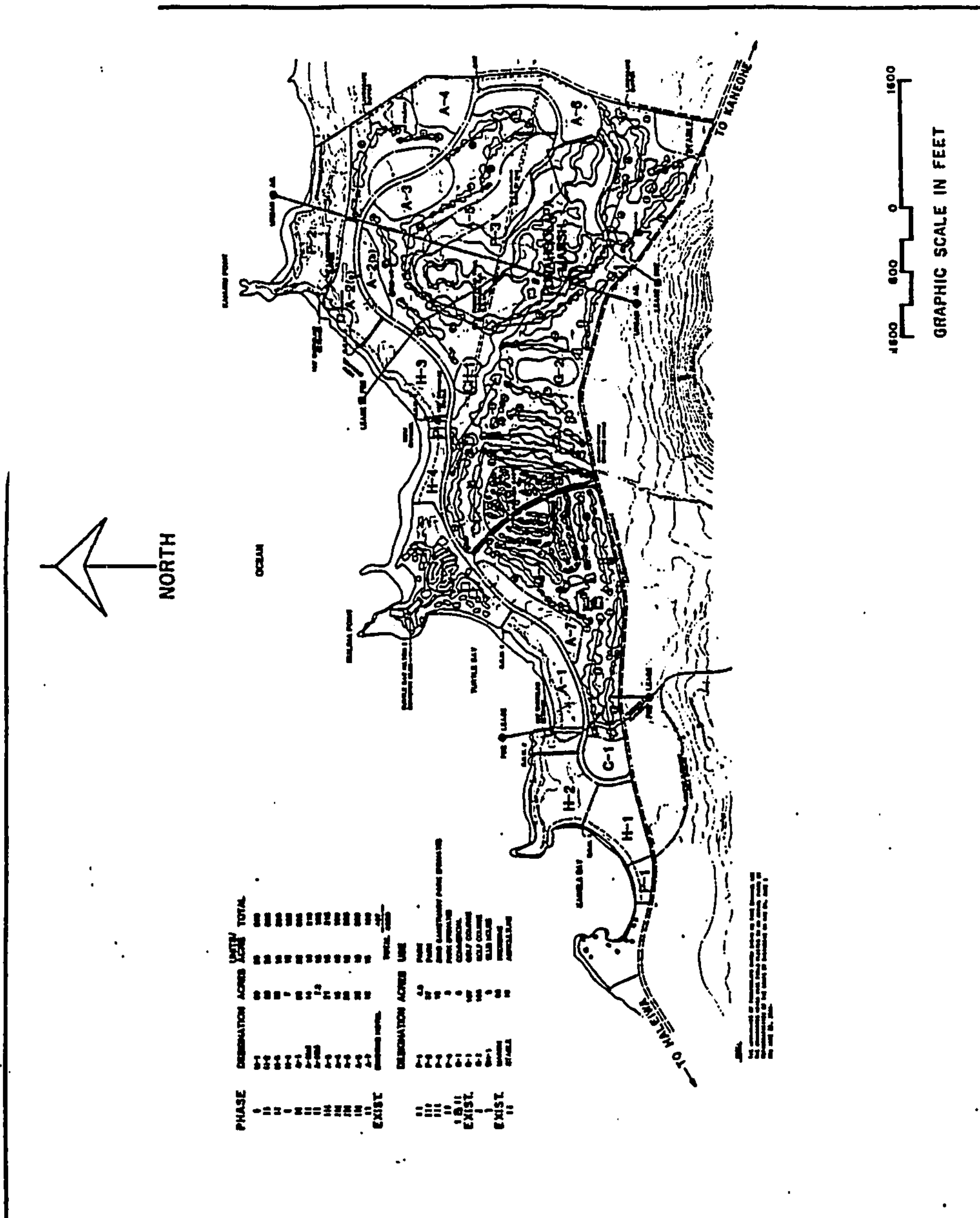
3. U.S. ENVIRONMENTAL PROTECTION AGENCY, Guidelines for Air Quality Maintenance Planning and Analysis, Volume 9: Evaluating Indirect Sources, January, 1975.

4. CALIFORNIA DEPARTMENT OF TRANSPORTATION, Energy and Transportation Systems, December, 1978.

5. AUSTIN, TSUTSUMI & ASSOCIATES, INC., Traffic Impact Report for the Proposed Kuilima Resort Expansion, November, 1984.



KUILIMA DEVELOPMENT COMPANY TRAFFIC IMPACT REPORT FOR THE PROPOSED KUILIMA RESORT EXPANSION KOOLAULOA, OAHU, HAWAII	AUSTIN, TSUTSUMI, & ASSOC., INC. ENGINEERS SURVEYORS · HAWAII, GUAM LOCATION AND VICINITY MAP	EXHIBIT 1



KUILIMA DEVELOPMENT COMPANY TRAFFIC IMPACT REPORT FOR THE PROPOSED KUILIMA RESORT EXPANSION KOOLAULOA, OAHU, HAWAII	AUSTIN, TSUTSUMI, & ASSOC., INC. ENGINEERS SURVEYORS • HAWAII, GUAM DEVELOPMENT MASTER PLAN	EXHIBIT 2

TABLE 1

SUMMARY OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS
(Micrograms per Cubic Meter)

POLLUTANT	SAMPLING PERIOD	AMBIENT AIR QUALITY STANDARDS NATIONAL Primary	NATIONAL Secondary	HAWAII
Particulates	Annual Geometric Mean	75	60	—
	Annual Arithmetic Mean	—	—	55
	Maximum 24-Hour Average	260	150	100
Sulfur Dioxide	Annual Arithmetic Mean	80	—	20
	Maximum 24-Hour Average	365	—	80
	Maximum 3-Hour Average		1300	400
Nitrogen Dioxide	Annual Arithmetic Mean		100	70
Ozone	Maximum 1-Hour Average		240	100
Carbon Monoxide	Maximum 8-Hour Average		10	5
	Maximum 1-Hour Average		40	10
Lead	Calendar Quarter		1.5	1.5

Notes: 1. Carbon Monoxide Standards are in milligrams per cubic meter.
2. National Standards based on 40 CFR Part 50; Hawaii Standards based on Title 11, Administrative Rules, Chapter 59.

TABLE 2

RESULTS OF PEAK HOUR CARBON MONOXIDE ANALYSIS
(milligrams per cubic meter)

	1984	1990	1995	2000
SITE 1 (Kuilima Drive)				
No Build	1.5	1.1	1.0	1.1
Build (no signal)		1.1	1.1	1.2
Build (with signal)			1.6	1.8
SITE 2 (West Kuilima Drive)				
No Build	0.6	0.5	0.5	0.6
Build (no signal)		0.8	1.2	1.3
Build (with signal)			1.8	2.0
SITE 3 (Marconi Road)				
No Build	0.5	0.3	0.4	0.6
Build (no signal)		0.4	0.5	1.0
Build (with signal)				1.5
SITE 4 (Kam Hwy near Waimea)				
No Build	9.3	8.6	6.7	7.8
Build		8.7	7.3	8.6

STATE OF HAWAII AQS: 10
FEDERAL AQS: 40

NOTES: See Exhibit 1 for location of receptor sites.
At Site 4, vehicle speeds = 5 mph.

APPENDIX J

SOCIO-ECONOMIC IMPACT ASSESSMENT

A SOCIO-ECONOMIC IMPACT ASSESSMENT OF PROPOSED ADDITIONAL DEVELOPMENT AT THE KUILIMA RESORT

November 1984

Prepared For:

GROUP 70

Prepared By:

COMMUNITY RESOURCES, INC.

and

A. LOND LYMAN, INC.

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1.0 INTRODUCTION

1.1 Purpose

The Kuilima Development Company (KDC), a wholly-owned subsidiary of the Prudential Insurance Company of America, is seeking various government land use approvals to expand existing and currently approved resort activities at Kuilima, near Kahuku, on the island of Oahu. This report analyzes socio-economic impacts and implications of the proposed Kuilima Resort expansion, particularly the portions covered under the 1984-85 proposed amendments to the Development Plan. (However, as will be more fully explained in Sections 4.1 and 5.1, it is sometimes difficult to separate planned expansions which are "already approved" from those which are "proposed.") While this document is intended as an appendix to the overall Kuilima environmental impact statement, a summary will appear in the EIS itself.

The term "socio-economic impact" is a broad one, and certain topics may be judged by some individuals, but not by others, to fall within this category. The scope of this report excludes certain topics which are perhaps related to community socio-economic fabric--e.g., traffic, archaeological sites, etc. However, these will be separately addressed in the EIS by other consultants.

1.2 Comments on Methods and Assumptions

Socio-economic impact assessment requires a variety of methods, from relatively firm forecasts of quantifiable impacts (e.g., employment and income) to highly speculative discussion of less tangible social consequences (e.g., social structure and cohesion). The principal techniques involved include (1) statistical analysis of both existing and proposed conditions; (2) qualitative input from interviewing knowledgeable community and government agency "key informants;" and (3) analysis of out-comes of similar resort development in comparable rural Hawaii areas.

Three important assumptions affecting the overall thrust of this report are:

(1) While certain islandwide economic impacts will occur and will be noted in this report, the primary socio-economic impact Region will be the Oahu areas of Koolauloa and the North Shore (and, to a lesser extent, Wahiawa).

(2) The population guidelines of the City and County General Plan for Koolauloa and the North Shore, as reflected in the limited supply of residential land in the Development Plans for these areas, will remain in place.

(3) For many types of socio-economic impacts, managing outcomes is often more important (and sometimes easier to address) than predicting them. This is particularly true in regard to employment of area residents, and this report will give considerable attention to potential job training programs, among other measures to mitigate or enhance possible impacts.

1.3 Structure of Report

The following chapter provides an overview of the project and summary of major impacts and mitigations. Chapter 3 focuses on existing socio-economic conditions, including community needs, values, and issues which help define important impact topics. Chapter 4 provides necessary context for impact assessment (e.g., expected future changes independent of the Kuilima expansion), while Chapter 5 discusses impacts and management strategies.

2.0 OVERVIEW AND SUMMARY

2.1 Major Project Characteristics

A detailed description of the overall project--existing, currently approved for future development, and proposed additional expansion--is contained in the overall EIS (and partially replicated in Section 5.1). The purpose here is to give a more general overview of characteristics with particular implications for residents of the Koolauloa/North Shore communities. Such characteristics would include:

- hotel and commercial development, which provides both jobs and de facto population increase;
- condominium development, which provides not only visitor units but also a limited supply of housing for employees and other residents;
- employment opportunities which may eventually exceed (by varying degrees, depending on job training programs) the labor supply available in the Region;
- consequent change in economic base for the Region (i.e., greatly expanded tourism activity), which may be translated into a change of daily work environment at the individual human level;
- also, eventual population and housing pressures, which will be determined by City Development Plan constraints as well as by employment opportunities;
- increased presence of visitors in the Region--meaning more potential business customers, crime targets, objects of social interchange, etc.;
- dislocation of humans and activities currently on undeveloped portions of the site--six agricultural lessees and 37 residential lessees (of whom 19 are full-time occupants) on East Kawela Bay; and
- new or expanded recreational opportunities for residents as well as visitors, including potential park facilities and beach access rights-of-way.

2.2 Major Impacts and Potential Mitigations

Following is a summary of the major findings to be presented at more length in the following chapters. Each summary will note the appropriate following chapter section or sections where more detailed discussion may be found.

2.2.1 Community Needs, Values, and Issues

Most organized community groups in the Koolauloa/North Shore Region which have taken positions in the last year support all or most aspects of the proposed expansion, although the Koolauloa Neighborhood Board opposes resort condominium construction (Section 3.7.4). At the same time, the number of years over which development approvals have been sought has contributed to a feeling of extended controversy, as reflected both in past opinion surveys (Sections 3.7.2 and 3.7.3) and in-depth interviews held this year with various community leaders to provide a better understanding of issues and concerns (Section 3.7.5).

At a very general level, there is an apparent value difference between residents who are primarily concerned with preserving a "country" feeling and those who are more concerned with preserving a current "community" for existing family and friends. While most people would like both, they tend to lean to one or the other if forced to choose. As plantation agriculture has declined in the Region, proposals such as the Kuilima expansion have resulted in many people feeling they are indeed facing a choice between economic survival of communities and preservation of the "country" environment. Kuilima Development Company's recent creation of a North Shore Strategy Committee (Section 3.6) and major reductions in proposed development scale have resulted in some feeling that the proposal now better serves both values, but there is still a tendency in the wider community for "country"-oriented people to be concerned about negative impacts and for "community"-oriented people to be more optimistic and supportive.

Those inclined to preserving "country" question whether residents of the Region, particularly young people, truly want to work in tourism and will not outmigrate anyway. Their concerns about project impacts include both physical effects (traffic, water, aesthetics, etc.) and socio-economic impacts (employment quality and working conditions, population change, land values, crime, etc.)

Those inclined to preservation of "community" tend to place by far the most weight on new employment opportunities. They believe that many outmigrating young people will remain (or return) if jobs are provided--whether in the resort itself or in surrounding businesses created or strengthened by Kuilima's expansion. Their primary concerns involve the future hotel operators' commitment to employing area residents, need for adequate job training, and apprehensions about community power base once all land use approvals have been granted.

While the issue of younger residents' desire for resort jobs is a central theme in this value debate, the present report cannot definitively answer the question (although limited evidence reviewed in Sections 5.1 and 5.12.3 suggest there is a clear potential for resort jobs to attract young people in the Region). It is likely that--as with many other social impacts--

it is more useful to try to manage this outcome through job training and other programs than to attempt to predict it.

2.2.2 Defining the Future Without the Proposed Development

Some changes will occur in the Koolauloa/North Shore Region whether or not Kuilima expands, but City development policies indicate these will be limited in the next few years, especially in regard to population or housing growth (Section 4.2). Planned lease-to-fee conversion of Kahuku households--which also involves construction of new housing--is perhaps the largest single likely change, although the economic future of the Waialua Sugar Plantation represents an even more significant potential change.

Focusing on the project itself, it is somewhat difficult to separate out the effects of "already approved" future Kuilima expansion from the current set of Development Plan proposals. This is because the presently approved Development Plan for Kuilima is considered economically unfeasible by the developer, which is likely to divest itself of the property--either to one purchaser or on a piecemeal basis--if the additional proposed development is disallowed (Section 4.1). It is unknown what the new owner or owners would do on those parcels for which development approvals have already been obtained. It is probable that these parcels would be developed, but on a lower-quality and less labor-intensive basis than would be the case with the requested additional permits (Section 5.1), although the uncertainties involved also make it possible that no further construction at all would take place for some period of time. For more quantifiable impact topics (e.g., employment) it is possible to estimate the difference between a future involving construction only of the "already approved" plan vs. the future with the "additional proposed" units and other changes. However, for more intangible social impacts (e.g., social cohesion), the usual strategy will be a more conservative one--i.e., contrasting a future with significant expansion at Kuilima with a future not involving much additional development.

2.2.3 Alternative Regional Economic Opportunities

The economic development in the Region has been much more limited than in the rest of the County. The limitations are reflected in lower average income, higher rates of unemployment, and relatively fewer residents participating in the civilian labor force.

Unless an economic base such as tourism is developed in the Region, the area's future economic development should continue to lag behind that of the County as a whole. The following summarizes our synopsis of the alternative economic activities in the Region:

Light Industrial Development in the Region is likely to be limited by the relatively smaller population base in the Region and the fact that the Region it is not an advantageous location for most light industrial operations.

Diversified Agriculture is currently a major component of the Region's economy and may be expected to remain an important part of the Regional economy. However, there are several reasons to be cautious. One reason is that the feasibility of sugar continuing at Waialua is uncertain. Another, is that diversified agriculture has grown very slowly on Oahu compared to the other islands. Another reason, is that while the interest in agriculture as a means of earning a livelihood continues, the interest must be considered in relationship to the decline in the total agricultrual employment that has occurred in recent years.

Aquaculture businesses have developed rapidly in the Region, which now hosts the state's most significant concentration of aquaculture development. However, while an intensive user of land, aquaculture requires relatively little labor per acre and therefore makes proportionately modest contributions to the Region economy.

Commercial Fishing is pursued by residents of the Region as both a means of supplementing family incomes and a recreational past time. However, the commercial aspects of fishing based in the Region have been hampered by the lack of berths for commercial fishing vessels, and the lack of ice-house facilities at the Haleiwa and Heeia small boat harbors.

Tourism is generally acknowledged as being the driving force in the economic growth experienced by both the State and County since the mid-1960s. In addition to the development planned for the Kuilima Resort, discussed in a subsequent section, resort development is planned on an 640-acre site at West Beach. Further development of tourism of off-Waikiki visitor facilities is important for the County inasmuch as the County has lost a significant percentage of its market share to Maui since the early 1970s. The lost market share reflects an decline in the County's role in the State's visitor industry. As in the past twenty years, the expansion of the County's visitor industry holds the greatest promise for providing new employment and business opportunities.

2.2.4 Employment/Job Training

Construction jobs generated by the total proposed Kuilima expansion, including indirect and induced jobs, based on the current approvals, Table 5.1-3 indicates that construction employment is estimated to generate 915 equivalent annual jobs in the Region and another 1,325 outside the Region. Construction of the project as proposed is estimated to generate 3,466 equivalent annual jobs in the Region and another 5,018 outside the Region. Approval of the proposed amendments is estimated to increase employment by 2,551 equivalent annual jobs in the Region and another 3,694 outside the Region, or a total of 6,244 equivalent annual jobs islandwide.

Operational employment based on the present approvals (excluding the limited present development) is estimated to generate 1,155 new jobs in the Region and 883 outside the Region, or a total of 2,038 islandwide. The projected employment based on the proposed plans is 3,555 new jobs in the Region and 2,719 outside the Region, or a total of 6,274 islandwide. Without the proposed amendments to the land use controls determining the development permitted at the Resort, employment would be reduced by 2,400 in the Region and 4,236 islandwide.

Provided that appropriate training is available, much of the supply for this on-site labor demand could be met from within the Region itself and/or nearby Wahiawa: currently unemployed persons; anticipated increases in labor force participation; future high school graduates; underemployed persons; some commuters switching to jobs nearer homes; and dependents of Wahiawa-based military personnel. However, maximizing employment benefits for Region residents will depend on the effectiveness of job training programs in the area. The developer has expressed a commitment to fashioning such programs--whether through improved coordination of existing programs or creating new ones--and has helped underwrite the North Shore Career Training Corporation.

A plan encompassing training and related mitigation measures is still being formulated. Section 5.13.1 provides a discussion of possible elements to such a plan to assure that residents of the Region can qualify for construction and operating jobs generated by development at the Resort. The following briefly summarizes possible elements of such a plan:

> Coordination of training needs and resources is an important function that will have an impact on the extent of publicly assisted training made available. Coordination with existing publicly funded training programs should be centralized and be undertaken either by a representative of KDC or delegated to a third party (such as the North Shore Career Training Center). Meetings with public sector providers of services should be arranged to coordinate future needs with program requirements.

Provision of information and counseling--including an active outreach component--is needed so that area residents will be maximally aware of opportunities and can evaluate their own interests and training needs. Potentially, such information could be provided using a computerized list of Regional residents interested in jobs in the area. Another aspect of providing information would be a staff person trained and experienced in personnel counseling.

Construction period opportunities would range from relatively unskilled construction laborers to highly skilled construction trades and crafts. Linking these opportunities to Regional residents will depend on their having the necessary skills, and the need for a co-operative effort, involving the developer of a particular site and representatives of both the general contractor and the construction trade unions. A final factor would be the need to coordinate training efforts with anticipated job opportunities.

Efforts to provide construction employment opportunities to Regional residents will be most effectively addressed prior to the completion of construction contract negotiations for the development of individual sites at the Resort. It is not realistic to set quotas for future construction employment in light of uncertainty regarding the skills that are or will be available among Regional residents, and the uncertainty regarding the future level of unemployment in the construction industry. At this point in time, the most realistic commitment that KDC should entertain regarding construction period employment is a commitment to coordinating the efforts of site developers, contractors, unions, and providers of training services.

Visitor industry career information about the diverse spectrum of resort job opportunities should be centralized and made available to both high school students and other residents of the Region. This could motivate individuals in terms of their thinking about future jobs, and should also be beneficial with respect to their attitudes. KDC and representatives of Resort property operators should participate in such efforts. Their participation could include career days for students and organized tours of properties, including "the back-of-the-house", for students and community groups. An important category of participants representing operators would be residents of the Region who have established careers in the visitor industry. Such individuals would serve as role models for students and interested community groups.

Middle- and upper level management positions: While greater priority should be given to non-management jobs, effort should also be directed towards middle- and upper management positions. Entry into these management positions requires both formal education and moderate to extensive on the job training. Opportunities for Regional residents would be enhanced by establishing scholarships for residents at any of three the Travel Industry Management (TIM) schools on Oahu.

Employee transportation involves coordinating public and private transportation services. The former would entail working with the County to provide public bus services that matches employee shift changes. The latter may entail encouraging car pooling efforts, by providing parking in closer proximity of participants. If the Wahiawa area residents become a significant source of labor, it may be appropriate to consider supplementing public bus service with service provided by the Resort. Hotel operators at Kaanapali presently provide bus service for employees living in central and east Maui.

Day care services would be useful for potential employees with young children. The feasibility of providing such services at the Resort should be examined.

2.2.5 Population and Housing

On-site resort population would increase in proportion to the increase in the overall number of units--from an estimated average daily total of 2,607 (including the existing 740 daily count) under current approvals to 5,523 under the proposed plan.

Off-site residential population impacts are constrained by City General Plan and Development Plan policies, which allow only enough zoning for the Region to maintain roughly its present proportion of the islandwide population over the next several decades (Section 5.2). Since this implies putting sharp brakes on recent historical growth rates, a very tight housing market may be expected with or without any further expansion at Kuilima. In effect, Kuilima expansion will not be permitted to increase long-term population growth, but it will further increase pressures on housing through (1) employees desiring to move into the Region and, to a lesser extent, (2) increasing out-of-state interest in rural Oahu vacation home and/or investment units.

Population and housing impacts would be minimized by giving emphasis to training Regional residents who desire employment in the Resort's hotels, retail outlets, and other facilities. Housing pressures from employees desiring to move into the Region will be greatly reduced if such job training efforts succeed in maximizing employment for current (already-housed) residents.

Other potential mitigations--discussed at more length in Section 5.13.3--include the developer's plans to construct 90 to 100 affordable housing units in Kahuku or elsewhere off-site to meet general housing need. A possible additional mitigating action could include establishing an employee housing rental information pool. The purpose of the pool would be to facilitate employees finding landlords with suitable rental housing located in the Region, where rental housing turnover is historically high. This is an untried concept, and the recommendation is essentially for a feasibility study only at this time.

2.2.6 Additional Business Development

Further development at the Kuilima Resort would stimulate other economic activities, both inside and outside the Region (Section 5.3). The majority of these economic activities are expected to be concentrated in eating and drinking and in retail establishments, and transportation services. Although the relative distribution of sales is smaller, the visitor industry also would stimulates the agricultural, manufacturing, wholesaling and service sectors.

As discussed at more length in Section 5.13.2, the likelihood of Regional residents attaining a share of the business opportunities would be enhanced by information about, and referral to, technical and financial assistance. Financial assistance refers to business loan programs such as those offered by the Federal Small Business Administration (SBA). Technical assistance is defined as third party business or technical expertise intended to assist in identifying, diagnosing and resolving business problems that either jeopardize a business continuing or inhibit growth. The "target market" for both technical and financial assistance would be new and existing small businesses based in the Region. Potential providers of technical assistance include individuals who are small business persons, professionals such as attorneys and bookkeepers, and academicians involved in business education. It is recommended that a volunteer committee of interested business professionals from the Region be formed to provide technical assistance that supports the expansion of existing and the development of new small business opportunities in the Region.

2.2.7 Other Regional Land Use Impacts

The extent of the potential increased demand for additional retail, commercial and industrial land is being analyzed in a separate report being prepared by another consultant. Ultimately, the supply of retail, commercial and industrial land will depend on County land use policies. If public policy does not provide for sufficient commercial and retail land in the Region, users would tend to bid up the value of the available supply, and the pent-up or unsatisfied demand would be directed to areas outside the Region (see Section 5.4).

Further development at the Resort is expected to intensify the already existing demand for ocean-front property, such as along Kawela Bay. Since the demand for such uniquely located property is finite, than the values of such properties has tended to be higher and to appreciate at a faster rate then most other land. The rate of future appreciation is a function of many variables, and is generally regarded as being speculative. Therefore, we make no attempt to guess what the extent of the appreciation would be for ocean-front land.

The appreciation of residential land not located on ocean-front sites is expected to be most significantly impacted by public policy restricting the supply of such land. The impact that the development at the Resort has on such land values would be indirect, in that public policy would be the factor limiting supply. Increased demand attributable to the Resort's development is expected to be derived almost entirely from potential employees (and, to a very limited extent, by non-employees attracted to the Region by the Resort).

2.2.8 Personal Income

In 1979, 23 percent of the Region's families had incomes below 125 percent of the poverty level standard set by the United State's Department of Housing and Urban Development. (For example, the poverty threshold for a four-person family was $7,412 in 1979.)

During the construction and operating phases, respectively, the total direct income attributable to 'construction activity (stated in 1983 dollars) is expected to generate $39.1 million based on existing approvals and $148.3 million based on proposed development. Once the Resort is fully developed, the Resort is projected to generate an annual earnings of $24.3 million based on existing approvals and $ 74.8 million based on proposed development. (A fuller discussion is presented in Section 5.5.)

2.2.9 Tax Revenues

State and local tax revenues generated by the visitor industry ranged between 16.8 percent and 17.7 percent of household income between 1980 and 1982, the most recent year data is available. (State of Hawaii, Department of Planning and Economic Development, 1983.) The following estimate is based on a 17 percent rate of tax generation for state and local taxes, stated in terms of 1984 dollars.

- State and local taxes from construction wages are estimated to be $6.6 million based on existing approvals and $25.2 million based on proposed development.
- Once the Resort is completed, state and local taxes from operating wages is estimated to be $4.1 million based on existing approvals and $12.7 million based on proposed development.

It is difficult accurately to estimate exactly what proportion of the above figures would accrue to the City and County of Honolulu in the form of increased real property tax revenues, because this would depend on future market values both of the units themselves and of the underlying land. However, considering only the value of the units, an illustrative estimate can be made based on some rough assumptions. Assuming that the average value per unit of the improvements for the development that is approved were $150,000, than the real property tax on the improvements would be $2.2 million. Assuming that the average value per unit of the improvements for the development that is proposed were $200,000, than the real property tax on the improvements would be $4.8 million. These figures--based on the foregoing assumptions and not including revenues due to increased underlying land values--indicate that the additional property taxes from the improvements alone could be over 100 percent of the taxes that might be derived from development based only on existing approvals.

2.2.10 Political Implications

The lack of induced population growth suggests minimal implications for electoral politics in the Region, unless one resort workers' labor union gains control at most hotels and hence gains significant influence at general election time (Section 5.7). Union elections themselves could become a significant political dimension in everyday life for resort workers. Another political dimension--community-based vs. absentee decision-making power--will be addressed under "Resident-Visitor Interaction" (Section 2.2.13).

2.2.11 Dislocation

The planned expansion will involve termination of the month-to-month agricultural leases of six individuals raising crops or livestock on Kuilima land, plus termination for 37 lessees of residential properties--of which 19 are occupied full-time and the rest are occupied part-time or are unoccupied--along the eastern part of Kawela Bay. All tenants have been on a low-rental, month-to-month basis since 1980, when they were informed of plans for eventual termination of their leases (Section 5.8). These terminations will probably occur whether or not the currently requested development approvals are granted, because disapproval would likely lead to sale of the property and subsequent development of some sort by the new owner or owners. Mitigation measures will involve ample notice for each of the lessees before actual termination (Section 5.13.4).

2.2.12 Outdoor Recreation and Food Gathering

Hotel and condominium expansion at Kuilima is not expected to have disproportionate impacts on nearby off-site recreational facilities because (1) the availability of full-service resort facilities means most guests will tend to remain on site, and (2) available evidence indicates that off-site trips will be oriented more toward Honolulu than nearby communities (Section 5.9.2).

On-site impacts are anticipated to be very positive from the perspective of nearby residents--particularly in the Kahuku-Laie area, which now has very little public beach park frontage on areas sheltered from the wind. The developer will dedicate land for a 4.8-acre park on Kawela Bay (one of the calmest stretches of ocean near Kahuku and an area long "off limits" to most residents), as well as a 37-acre public park at Kahuku Point. The site will contain two other park areas--privately-maintained but open to the public--as well as five beach rights-of-way, each with free parking for 15 vehicles (Section 5.9.1).

The only negative on-site aspects will be (1) an eventual greater sense of crowding for small numbers of fishermen currently utilizing the eastern part of the Kuilima coastline and concurrent exposure of more people to occasional unsafe surf conditions there, and (2) various intrusions on the now-secluded lives of West Kawela Bay residents from future Kawela park-goers. Potential mitigations include lifeguard service on the eastern beaches and landscaping/security measures at the Kawela park (Section 5.13.5).

2.2.13 Resident-Visitor Interaction

The quality of resident-visitor interactions is of direct import to the long-term economic viability of resort areas and of indirect significance to residents' overall quality of life (Section 5.10). The Region's community most affected by visitor presence to date has been Laie--site of the Polynesian Cultural Center--and community leaders there report no negative resident reactions except to traffic problems caused by tour buses. However, a variety of studies indicate that the nature of resident-visitor interaction can be affected by a great variety of factors--including perceived competition for resources, location of encounters, age levels, visitor respect for residents, and the extent to which residents feel they have control over or involvement in resort-related decision making which affects their communities as well. The last factor is particularly significant in light of the previously-mentioned resident concerns about the willingness of future operators to

honor the commitments of the developer and about the community's continuing involvement and input once land use approvals have been granted.

In these regards, forecasting social impacts seems of less value than managing them, and Section 5.13.6 elaborates on the following suggested strategies:

- Creation of a Kuilima Resort Association--comprised of the developer and all Kuilima operators and businesses--to provide a single and continuing entity with whom the community can communicate. It is further suggested that the Association fund an office of community affairs coordination which can coordinate both local small business contracts for the overall resort and many of the suggested communication channels with nearby communities (following paragraph).

- Various communication mechanisms, including (1) publication of a "North Shore Guide" for all visitors, to direct them toward places or events where they are desired by residents (and perhaps away from sensitive areas); (2) bulletins for regular part-time condominium occupants to assist social integration into the community; (3) writing columns for regional newspapers on developments at Kuilima; (4) creation of a standing citizens' advisory committee--perhaps an extension of the existing North Shore Strategy Committee--to provide an ongoing communication link and perhaps help plan community events at the resort (below).

- Search for opportunities to stage events of interest to both visitors and residents--e.g., water competition on Kawela Bay; holiday festivals recognizing both national and Hawaiian holidays; resident discount days for recreational facilities.

- Resort developer and operator support for area youth programs aimed at early familiarization of school children with resort grounds and visitors, in order to (1) reduce any sense of alienation; (2) improve attitudes toward (and aptitudes for) future resort employment; (3) improve attitudes toward visitors as people; and (4) provide a controlled opportunity for older school-aged children to tour each new hotel and facility as or before it opens.

2.2.14 Social Psychological Aspects of Resort Employment

Section 5.11 reviews a number of socio-political and psychological aspects of resort employment--some of them associated with any major workforce situation in a rural Hawaii setting and some of them relatively unique to tourism. These include (1) social group competition for jobs and potential resentments if certain groups seem to receive favoritism for better jobs; (2) alleged self-image and mental health concerns of tourism employment (stemming either from the "service" nature of the work or sex role confusion)--which appear to have a base in reality for some persons but which may also be heavily outweighed by demonstrated negative mental health consequences of poverty and unemployment; (3) threats to marital stability from factors such as shift work, increased exposure to the opposite sex, and changing sex roles--which, again, must be weighed against demonstrated family problems associated with unemployment; and (4) concerns about adequate supervision of children when both parents are employed and working schedules are uncertain.

It is felt that if any such issues become of significant concern to a large number of employees, mitigations will probably be determined through union-management negotiations. However, two mitigations suggested in Section 5.13.7 involve (1) consideration of on-site or nearby day care facilities and (2) occasional resort events or recreational programs for employees' families.

2.2.15 Social Structure and Cohesion

The major perceived tourism threat to social harmony is increased crime. However, the true relationship between tourism and crime is still being explored. A detailed analysis of known statistical studies on tourism and crime (Section 5.12.1) reveals conflicting and contradictory findings, although robberies and rape (serious but infrequent crimes) have been correlated with tourism in more studies than other crimes. However, most such studies reflect an urban tourism setting. An examination of changes in overall crime rates for several rural Hawaii resort areas somewhat comparable to Kuilima indicates that--while crime has been increasing everywhere in Hawaii--crime rates have <u>not</u> increased more rapidly in these rural areas with high tourism growth.

Because of limitations on statistical crime-tourism studies, interviews were conducted with police in various rural Hawaii resort areas. Among the responses (presented at more length in Section 5.12.2): (1) rural resorts generate very little on-site crime, whether at hotels or condominiums; (2) the most frequent off-site crimes involve theft of property from visitors, rarely crimes of violence; (3) nearby residents of resort areas are not felt to be affected by tourism development; and (4) despite publicity over the recent Sacred Falls robbery and earlier vandalism of tour buses going to Laie, Koolauloa police report the area has a low crime rate and experiences few problems from the existing Kuilima development.

Section 5.13.4 discusses possible Kuilima impacts on overall social values and structure of the various communities from Kaaawa to Waialua (although it is noted that such impacts are among the "most intangible and speculative" of social outcomes). It is felt that Kuilima expansion would little affect social

values or structure in <u>Kaaawa</u>, <u>Kahana</u>, or <u>Punaluu</u>. <u>Hauula</u>, with significant poverty problems, will potentially benefit from employment opportunities, although residents there may be particularly divided if there is any perceived inequity in distribution of jobs. Employed <u>Laie</u> residents now work primarily in Laie itself; provision of large numbers of jobs at Kuilima can provide an alternative to commuting to Honolulu for Laie's expanding labor force, at the same time requiring some value adjustments for residents working in a non-Mormon environment for the first time. The recent housing developments and planned future additions in <u>Kahuku</u> suggest a natural period of social divisions between oldtimers and newcomers with or without Kuilima expansion; provision of employee housing in Kahuku could contribute to a "company town" feeling more familiar to longtime, ex-plantation residents than to newcomers. Current residents of <u>Kuilima condominiums</u> will eventually find their numbers strengthened, but current <u>West Kawela</u> residents (especially renters) may leave due to the effects of increased property values and property taxes.

On the North Shore side, housing pressures in the <u>Sunset/Waimea/Pupukea</u> communities may make it more difficult for young people leading a "surfer" lifestyle to obtain low-rent lodgings without doubling and tripling up. Impacts on <u>Haleiwa</u> would be significant only if entrepreneurs capitalize on increased tourist presence in such a fashion that a Lahaina-style "street scene" is created; however, this can only happen if public agencies permit significant amendments to Haleiwa's Special Design District and Development Plan. Kuilima development should have little impact on social structure or values in <u>Waialua</u> unless there are significant employment cutbacks at the sugar plantation <u>and</u> many new jobs simultaneously become available at Kuilima, conceivably leading to some of the extensive social restructuring experienced by Kahuku residents more than a decade ago.

2.3 <u>Groups Subject to Particular Costs/Benefits</u>

The question of "who bears the costs of socio-economic change and who reaps the benefits?" is one which can rarely be answered for certain, even after a project is implemented. If the requested approvals results in economic viability or increased profitability for the developer, then the developer would clearly be foremost among the beneficiaries. More indirectly, the general public will benefit in two ways--through increased tax revenues for local government and through stimulation of the overall Oahu economy.

Focusing on residents of the Koolauloa/North Shore Region, the identities of beneficiaries and cost-bearers are not completely certain, but several groups can reasonably be placed in each category.

Costs

(1) Displacees--These consist primarily of the six agricultural and 37 residential lessees (about half of whom are full-time occupants) whose month-to-month leases would be terminated to permit development. However, it is highly probable that these individuals will be displaced whether or not the currently requested land use approvals are granted.

(2) West Kawela Bay Homeowners and Renters will experience a change in the visual character of the landscape and increased numbers of outsiders in the area, due to development of two hotels on the eastern side of the Bay and dedication of land for a public park at the middle of the Bay. While property values are expected to rise significantly (with consequent implications for property taxes and rents), at least some owners now say they prefer conditions as they are.

(3) Residents Opposed to Economic (and/or Resort) Growth in the Region comprise a group which by definition will at least feel disappointment if substantial economic/resort development does occur. The size of this group and intensity of feeling is unknown, although there are clearly a number of people in the Region who believe it is more important to "Keep the Country Country" than to provide jobs for the present or future population.

Benefits

(1) Future Resort Job Holders: As previously noted, the proposed overall expansion will create an estimated additional 2,580 full-time equivalent jobs in the Region, 1,520 more than would likely occur without the specific approvals currently being requested. There will also be significant construction employment. The extent to which these jobs benefit residents of the Region itself will depend on such factors as job training programs. It should be noted that the Koolauloa area--and a few particular communities therein, such as Hauula--are among Oahu's lowest-income areas.

(2) Ocean Users in the Region, particularly around Kahuku, should experience a net gain, although a small number will eventually lose a current sense of isolation and limited competition for food resources along the eastern coastal portions. However, Kahuku-area residents will gain their first nearby public park on sheltered ocean waters (at Kawela), as well as a major regional park at Kahuku Point and substantially improved beach access throughout the project site.

(3) Region Businessmen will benefit both from the improved resident economy and from the increased market of visitors, although special marketing efforts may be needed to encourage Kuilima guests to shop in nearby communities. Well-established visitor attractions such as the Polynesian Cultural Center and Waimea Valley Park would be most likely to benefit from the increased number of Kuilima tourists.

(4) Residents Supporting Economic (and/or Resort) Growth for reasons other than direct personal employment would at least feel satisfaction over this desired form of economic progress in the Region. As with their opposite number, it is not possible to measure the exact number of people or intensity of feeling within this group. It tends to consist of residents hoping to preserve their present communities through increased employment opportunities for grown children or other friends/family facing possible outmigration for economic reasons.

3.0 OVERVIEW OF EXISTING SOCIO-ECONOMIC CONDITIONS

The purpose of this chapter is to provide an overview of current conditions, recent history, and relevant trends for the following topics: (1) geography, history, and community character; (2) selected demographic indicators; (3) selected economic indicators; (4) housing; (5) land use patterns; (6) existing resort and relation to community; and (7) community needs, values, and issues.

3.1 Geography, History, and Community Character

The following area and community descriptions are primarily qualititative in nature. Detailed quantitative information from the U.S. Census and other government reports are presented in the various following detailed sections on demographics, economic indicators, etc.

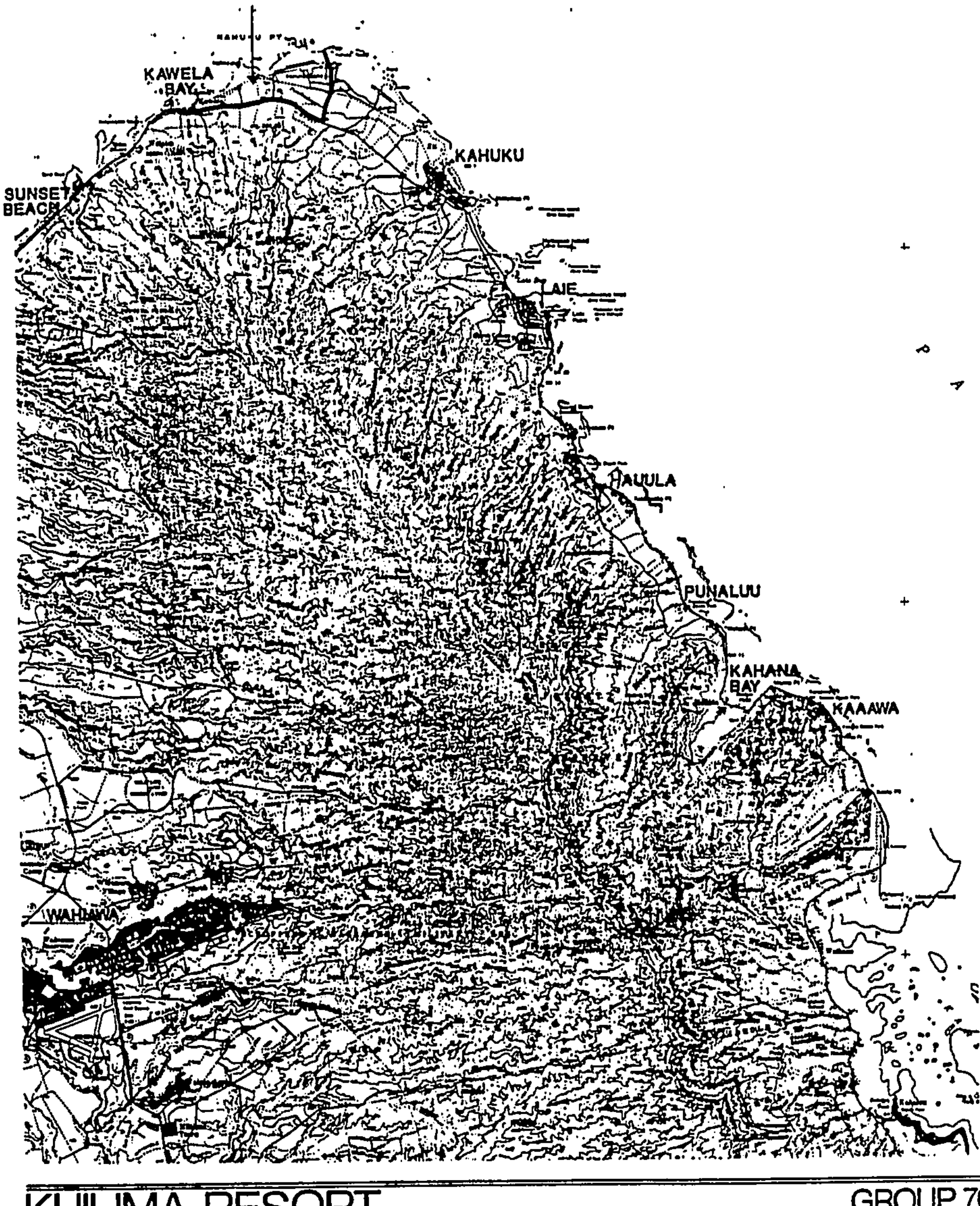
3.1.1 Overview of Region

The Region consists of the northernmost portion of the island of Oahu, which is comprised of the two U.S. Census divisions termed "Koolauloa" (tracts 101, 102.01, and 102.02) and "Waialua" (tracts 99.01, 99.02, and 100). The Waialua Division is more commonly called the "North Shore," and it is this term which will be usually used in this document to avoid confusion with the town of Waialua, which is one of the North Shore communities. Thus, "the Region" and "Koolaulua/North Shore" are synonymous terms.

(The term "study area" will be used to denote both the Region and the adjacent town of Wahiawa, which is a potential source of labor for the proposed expanded resort area. However, this section will focus only upon the communities of the Region, identified in Figure 3.1-1, since these are the communities likely to feel the greatest impacts of the project.)

The Region also consists of the City and County's "Development Planning Areas" known as "Koolauloa" and the "North Shore" (which coincide with the Koolauloa and North Shore neighborhood board areas). The Development Planning Areas differ from the census divisions primarily in that a portion of Census Tract 101 (part of the Koolauloa Census Division) is regarded by the City as being part of the North Shore, rather than the Koolauloa Development Planning Area (see Figure 3.1-2). This part of Census Tract 101 includes the areas known as Sunset Beach, Waimea, and Pupukea. In the past, these communities oriented more to Koolauloa, and they are still included in the region served by Koolauloa's major secondary school, the Kahuku High School. However, in recent years Sunset and Waimea in particular have had increasingly stronger social ties with the Haleiwa area. Therefore, the Sunset area will generally be treated in this report as part of the North Shore rather than Koolauloa, although it will

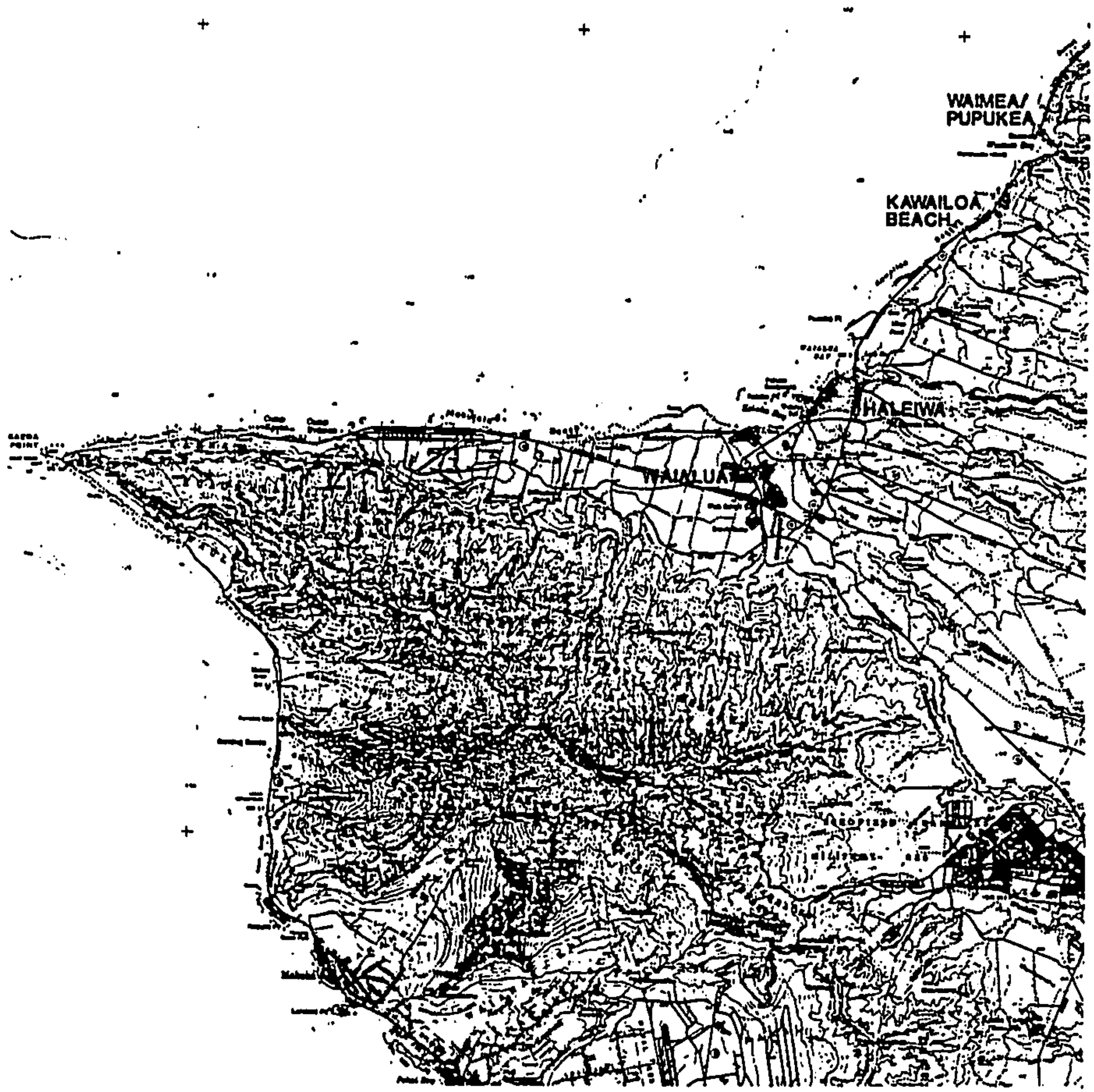
KUILIMA RESORT
EXPANSION AREA



KUILIMA RESORT

GROUP 70
ARCHITECTS AND PLANNERS

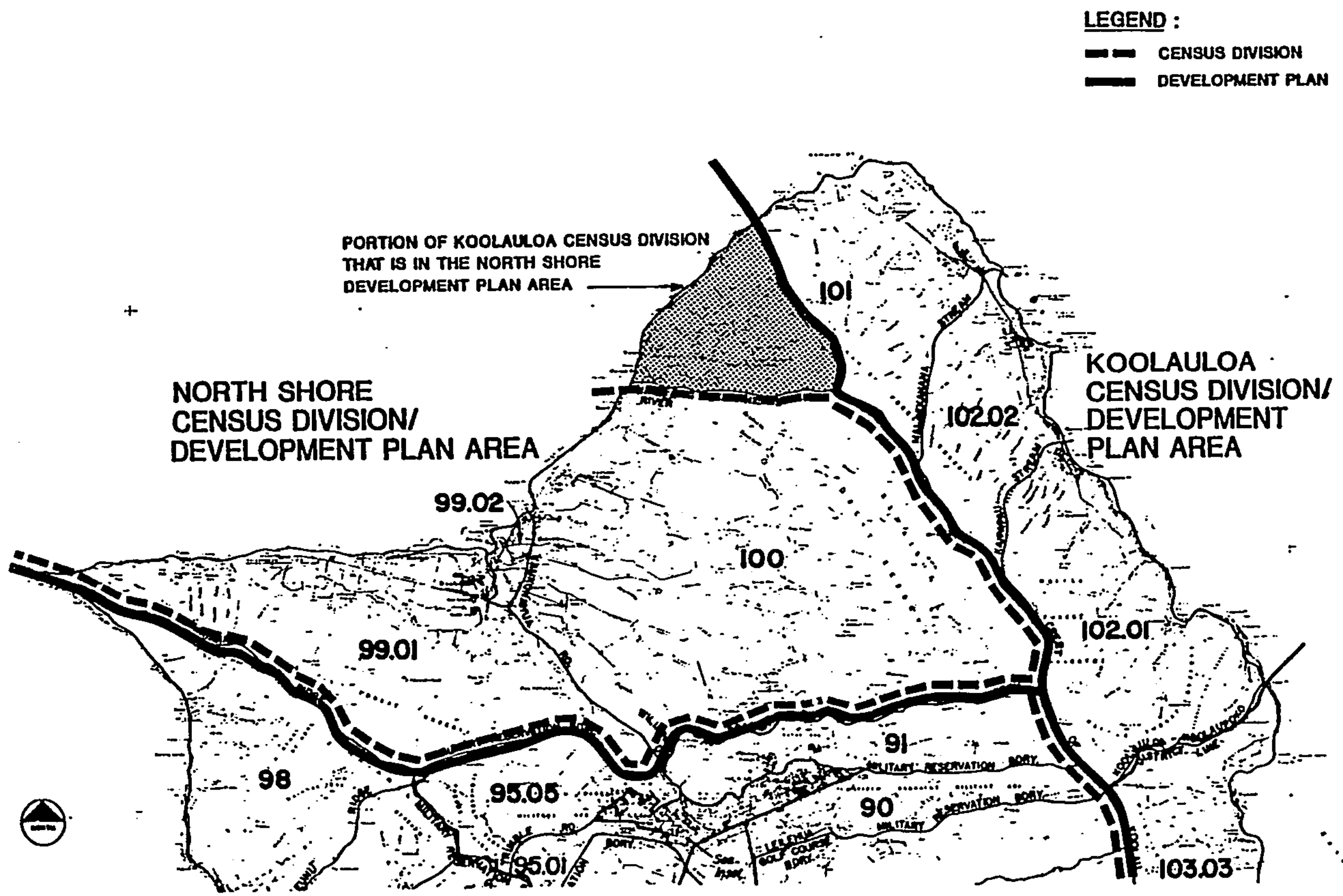
FIG. 3.1-1 MAP OF STUDY AREA & MAJOR COMMUNITIES



KUILIMA RESORT

GROUP 70
ARCHITECTS AND PLANNERS

FIG. 3.1-1 MAP OF STUDY AREA & MAJOR COMMUNITIES



KUILIMA RESORT

GROUP 70
ARCHITECTS AND PLANNERS

FIG. 3.1-2 KOOLAULOA & NORTH SHORE:
CENSUS DIVISIONS VS. DEVELOPMENT PLAN AREAS

still be included with Koolauloa for census and population-count purposes.

The Kuilima project site is situated midway between the geographical limits of the Region, the inhabited part of which may be viewed as a coastal strip extending approximately 14 miles in each direction from Kuilima. The project site is less than a mile west of Kahuku Point, the northern tip of Oahu. While it is located entirely in the Koolauloa Census Division (and/or the Koolauloa Development Planning Area), the project's proximity to the North Shore communities makes it appropriate to consider the North Shore as an equally important portion of the Region.

The combined Region represents one of Oahu's two major areas which may be regarded as "country" (the other being Waianae, which is effectively isolated from the North Shore by the lack of a paved road around Kaena Point). The Region's 114,950 acres represents 30.3% of Oahu's total area, but its 1980 population of 24,044 represented less than 3.2% of the City and County of Honolulu's total population of 762,565.

In certain regards, however, while still being decidedly more rural than most of the island, the Region is more densely settled than the foregoing figures would suggest. This is because much of the land in Koolauloa and the North Shore consists of terrain too mountainous to be inhabitable. Virtually all of the inhabitable land is a narrow strip between the mountains and the ocean (plus a portion of Oahu's central valley which surrounds the community of Waialua in the inland part of the North Shore), and there are only a few stretches of highway through this coastal strip which have no bordering houses or subdivisions.

Nevertheless, the beauty of the Koolauloa coastline makes it both an aesthetic asset for all of Oahu's residents and an economic asset for the island's visitor industry due to its scenic appeal. Similarly, the surf sites and beach parks of the North Shore draw both residents and tourists in large numbers.

At least five factors provide Koolauloa and the North Shore with a sense of shared or similar identity:

Economic History Rooted in Sugar: The Kahuku Sugar Plantation, which closed in 1971, covered much of the northern portions of Koolauloa, providing a common heritage to longtime residents of Hauula, Laie, and particularly Kahuku, the "company town." The plantation was operated by Alexander & Baldwin, but much of the land belonged to Campbell Estate. On the North Shore, the Waialua Sugar Company still struggles to survive on lands owned by its parent company, Castle and Cooke, and by the Bishop Estate. The plantation's economic problems, shared by many other contemporary Hawaii sugar operations, have been manifested by annual shutdowns between harvest and planting seasons. The

current workforce layoff is the most protracted in the company's history.

Some common legacies of the past for both areas include strong memories of the paternalistic system (which still carries on in lesser form in Waialua); the presence of many immigrant families (and/or their descendants), particularly from the Philippines; an enduring respect for labor unions; and the establishment of schools, fire stations, and other regional amenities in the two primary plantation towns of Kahuku and Waialua.

Recent Economic Transition to Tourism: Excluding Waialua Sugar's 460 workers, the major single employers in the Region at present are Kuilima's Turtle Bay Hilton Hotel with a current 488 employees (of which 440 are full-time, plus an additional 30 full-time positions at the golf course) and the Polynesian Cultural Center with nearly 1,000 employees (mainly part-time and/or student help). The nearby Mormon Temple is a visitor attraction as well as a religious center. Other visitor-oriented businesses include the Crouching Lion in Kaaawa, Pat's at Punaluu hotel-condominium and restaurant, and numerous arts and crafts shops and restaurants in Haleiwa. The existence of the "North Shore Visitors Association"--the Region's primary association of businesspeople--exemplifies the growing economic significance of tourism.

Other economic activities in the Region are extremely limited. There are a few small military facilities on the North Shore. Diversified agriculture has a small stronghold on Campbell Estate leasehold land near Kahuku, whose residents take pride in the area's watermelons and corn. The area between Kahuku town and the Kuilima project is also the cradle of Oahu's fledgling aquaculture industry; three separate companies raise shrimp, prawns, and other marine delectables there. However, despite the investment of various well-capitalized operators, some aquaculture businesses in the area have also encountered serious financial difficulties.

Increased Settlement by Newcomers with Reduced Economic Ties to the Region: In Koolauloa, many beachfront homes are weekend abodes for city-dwellers, and some of the newer residents (particularly in lower Koolauloa) are more likely to commute to work in Honolulu than has been the historical case for longtime residents. On the North Shore, commuters are joined by a population of surfers--both local and Mainland in origin, many of them youthful and somewhat transient (but many others, including some community leaders, now well-established middle-aged longtime residents). Some surfers are also commuters, but many work on the North Shore or manage a subsistence-type lifestyle.

High Schools: As in many Island communities, youth education and recreation programs bring together parents of diverse backgrounds. The Kahuku and Waialua high schools are particularly prominent in that they serve such large areas and acquaint persons who live as far apart as Kaaawa and Sunset.

Kamehameha Highway: This two-lane road is the physical and social link between Koolauloa and the North Shore--and, for that matter, between these areas and the rest of Oahu. Running along the coast, it is the only arterial in the region. In most of the communities within the two areas, the great majority of residents live within a few blocks of Kamehameha Highway (the prime exception being the town of Waialua, which is more set apart). The highway is each community's link with the rest of the world, and a sense of increasing congestion is a major source of frustration for area residents.

The highway provides a route which can be travelled upon in the next two sections to provide a more detailed picture of the individual communities of Koolauloa and the North Shore. This "guided tour" will begin in Koolauloa at the easternmost edge of the Region, continue northwest along Kamehameha Highway, past the Kuilima project site and into the North Shore area, southwest along Sunset Beach, and end in the town of Waialua.

3.1.2 Koolauloa

Koolauloa, the eastern portion of the Region, constitutes the northern third of Oahu's Windward side. In general, the inhabited portion consists of a coastal plain, situated between the shoreline and the Koolau Mountain Range, which extends along the entire length of the Windward side of the island. The coastal plain varies in width from a few thousand feet to approximately one mile. The area contains six principal residential communities (Kaaawa, Kahana Valley, Punaluu, Hauula, Laie, and Kahuku) which are loosely strung out almost equidistant along the region's single arterial road, Kamehameha Highway. Past Kahuku are the small residential areas of the Kuilima condominiums and Kawela Bay.

The community of Kaaawa extends along both sides of Kamehameha highway approximately fourteen miles southeast of the project site. Its population of about 1,000 persons is primarily Caucasian and Hawaiian/Part Hawaiian. Once an ancient Hawaiian agricultural area (Clark, 1977), its marshes and wetlands have slowly given way to residential development. Beachfront properties are occupied predominantly by a more affluent Caucasian population, while the mauka areas have been traditionally more "local" in character. Kaaawa represents an extension of the rural lifestyle characterized by the residents of Waiahole, Waikane, and Kahaluu to the south. Except for a school and a store or two, it has no "commercial center."

Two miles north of Kaaawa, near the Crouching Lion Inn, a famous local restaurant, the highway turns abruptly to the left and continues around a picturesque bay, behind which extends the broad valley of Kahana. Converted to a State park in the mid-1970's, Kahana Valley hosts a population of about 100 residents

(about 20 families). Having had their land condemned by the State in 1964, the residents remain today as the population of this "living park," engaging in agricultural endeavors and handicraft activities. During the period from 1870 to 1880, Kahana Valley was widely known as a major producer of rice, with over 100 acres of its valley floor devoted to rice cultivation. A sugar plantation replaced the rice paddies in 1915, and a small railroad line was built between Kahana and the nearby Kahuku plantation to enable sugar to be transported to the Kahuku mill (Mogi, 1978). Plantation operations ceased around 1931, and the valley remained relatively unproductive as a region until the 1940's, when it was used by the United States military as a jungle-training site. Today, the valley floor is overgrown with vegetation and its use is restricted to hikers and park visitors.

Continuing north past Kahana, the traveler comes upon the small residential community of Punaluu (population of roughly a few hundred persons, depending upon what its boundaries are considered to be). Similar in many ways to Kaaawa, it is a former agricultural area with most homes situated along the highway. Its small population is believed to be made up largely of Caucasian retirees and younger Hawaiians and Part Hawaiians. In addition to the beachfront homes and cottages, and the mauka home lots, the community is the site of the largest condominium development in the immediate region, Pat's at Punaluu. Originally built in the mid-1960's during the enthusiasm of a dawning tour industry, Pat's remains today as a multi-story residential/visitor condominium and restaurant. Punaluu is also the site of a new agricultural subdivision which has generated some local controversy because most farmers obtaining access to the land have originated outside the area.

Two miles past Punaluu, the shoreline highway winds into the town of Hauula. With a (1980) population of nearly 3,000, Hauula features substantially more urban amenities than the areas to the south. In addition to a small yet modern shopping center, the town contains a police/fire station complex, a satellite city hall, and an elementary school. Other than these commercial and government facilities, however, the town offers no major employment base, and it is among the least prosperous of the Koolauloa communities. Hauula has a number of Hawaiian Homesteads farm and residential lots, and the population is predominantly Hawaiian with a smattering of Caucasians and other recent in-migrants.

With a population of 4,600 residents in 1980, Laie lies four miles up the coast from Hauula. Originally a sparsely vegetated, windswept region, the area was cultivated as a plantation in the mid 1800's and purchased in 1865 by the Mormon mission. After an unsuccessful attempt to buy the island of Lanai from the Hawaiian monarchy, the Mormon church purchased 6,000 acres of land at Laie in order to institute a religious community for Pacific island members of the church. Further developing an existing plantation in order to create jobs for the native followers and a sound economic base for the mission, the Mormon population continued to cultivate sugarcane until 1931, when the land was finally leased to the Kahuku plantation. While the plantation eventually closed in 1956, the Mormon community of Laie prospered. Following the erection of the Mormon Temple in 1919, the community began to attract a sight-seeing/visitor population. In 1947, the community began what was destined to become a famous visitor attraction; its monthly hukilaus in Laie Bay. The Church College (now named the Brigham Young University, Hawaii Campus) was opened in 1955, and in order to take advantage of the growing tourist industry and at the same time employ its resident college students, the Mormon Church built the Polynesian Cultural Center and opened it in 1963. Today the Center occupies 42 arces of land and employs nearly 1,000 persons.

Because the Laie temple was the only temple in the Pacific, it began to attract many converts from the Samoan mission. A steady immigration of Samoans was culminated in 1952 with 958 Samoans arriving in Hawaii aboard a single United States naval vessel (Pierce, 1956). Many of the immigrants made their way to Laie, which continues to be a large Samoan community. More recently, a substantial number of Tongans have moved to the Laie area. Now the Region's single largest town, Laie boasts a small shopping center with Koolauloa's only motion picture theater. Most Laie residents are members of the Mormon Church, which imbues a strong self-help philosophy. Residents in economic difficulties turn for help first to family members, then to the Church, and only as a last resort to government agencies.

Laie to date is also one of the island's most economically self-sufficient communities, with most employed residents working in the town itself and for one of the Church-sponsored activities:

> A fall 1979 survey of Laie residents (which excluded single students who were not living with their parents) found that 80% of all employed Laie residents had a job in Laie and that the Polynesian Cultural Center (PCC) and BYU-Hawaii together accounted for almost 70% of all jobs held by Laie residents. (Zions Securities Corp., 1981, p. 15).

Two miles further north, the landscape shifts dramatically from the lush tropical vegetation of Laie to the flat cultivated plains of the Kahuku area. Because Kahuku is the closest major community to the Kuilima resort site (approximately three miles distant), and because it is has been the scene of particular change and development over the past 13 years, the town will be described at somewhat more length.

Established as a sugar plantation and mill camp in 1881, by the 1940's Kahuku had a population of roughly 3,000 and was clearly established as the commercial and population center of Koolauloa. As sugar entered its period of long economic decline, the town began to lose people, largely through outmigration of the young. When the mill and plantation actually closed

in 1971, the population had dropped to only about 900 persons, of primarily Filipino and some Japanese ancestry. Although the community's future at that point looked grim, Kahuku has since earned a measure of fame in Hawaii as a town that refused to die (Pitzer, 1977). A cooperative effort among the townspeople, landowner, sugar company, and ILWU union resulted in the establishment of the Kahuku Housing Corporation, which functioned as a combination landlord and municipal government for the old Kahuku Town area. Campbell Estate agreed to forego lease rents on plantation housing until 1983, during which period residents paid their rents to the Kahuku Housing Corporation, which in turn paid all property taxes and maintained the town's street lights, roads, and private water system. The residents are now in the midst of a housing conversion program in which lessees are being given the opportunity to buy the (approximately) 225 units from Campbell Estate and in which they are jointly planning with Campbell Estate to build about 150 more units in vacant lots in the old Kahuku Town area.

Meanwhile, resident-initiated planning has already resulted in significant growth in Kahuku. A 64-unit elderly housing project was completed in the late 1970's. This alone did not change Kahuku much, and its population at the time of the 1980 U.S. Census was still only 935 persons. However, the residents' initial housing development plans indirectly led to a City project, the Koolauloa Village, whose 280 units mauka of the highway has more than doubled Kahuku's population since its completion in 1982. (Because the majority of the new area's occupants came from outside the Koolauloa/North Shore area and do not generally share a plantation background, the new housing has also produced some social adjustment problems in the formerly tight and homogeneous community.)

Kahuku's residents have also been involved in several economic development efforts, both community-based and initiated by outside business interests. One group of former plantation workers organized into a truck farm cooperative, the Kahuku Farmers Association, which is now working 224 acres outside Kahuku on a long-term lease from the Campbell Estate. Kahuku residents also vigorously supported a short-lived tourist attraction at the old mill, where many of them worked. (The mill now stands empty, but it is a strong community goal to find other uses in order to preserve it as a symbol of the town's past.) Residents have further been active in supporting the new aquaculture ventures in the area, and they have been particularly strong in their support of the Kuilima resort project because of its value as an employment provider for the old town residents (Hawaii Business, 1979).

Past Kahuku is a three-mile stretch of mostly unpopulated countryside featuring grazing land, diversified agricultural operations, and the windmill-dotted new aquaculture ventures. At approximately the northernmost point of the highway is the entrance to the Kuilima project site on the makai side of the highway. Several hundred yards down the current major access road, surrounded by the project golf course, may be found the existing Kuilima condominium developments--the 200-unit "Kuilima Estates West" (completed in 1973) and 168-unit "Kuilima Estates East" (completed in 1975) projects. Both consist of detached and townhouse-style wooden structures; however, their separate dates of development resulted in separate homeowners' associations and somewhat different policies over landscaping, implementation of security systems, etc. According to estimates from Mr. Conrad Rodenbeck, president of the Kuilima West Homeowners' Association, and Mr. Melvin Kirkpatrick, resident manager for Kuilima East (personal communications, 1984), a combined total of approximately 151 of the 368 units are currently in full-time residential use (primarily long-term rentals, with some owner-occupants), with the remainder either held for occasional use by owners living elsewhere or in the resort rental pool. Residential rentals vary from $400 for studio units to $700 or $800 for units with several bedrooms. Renters reportedly are a mix of hotel mid-management personnel and professionals commuting to town, while owner-occupants are primarily retirees. No exact population count is available, but the estimated 151 residential units would suggest a population of around 300 or more.

At the western edge of the Kuilima project site is Kawela Bay, a calm and jewel-like cove ringed by approximately 65 houses on 70 parcels (some on the bay itself, some mauka of an access road). Of these, 39 are on Kuilima land; 18 are believed to be occupied by full-time residents, with the remainder being part-time or vacation residences. All of these are month-to-month tenants of Kuilima and would be terminated under the proposed project (see Section 5.8). By contrast, approximately 26 units on the western shores of Kawela Bay are owned in fee simple, although about ten of the owners rent to others. Access to the private road around Kawela Bay is by a short, narrow lane from Kamehameha Highway. Posted signs strongly discourage casual motorists from entering the little community. Around the point of the bay and to the west is an even smaller residential area called "Kawela Kai"; it is separate from the West Kawela homes.

3.1.3 North Shore

The North Shore extends southwest from the project site some 14 miles to Kaiaka Bay, at which point the coastline makes a sharp due-west turn to Kaena Point. (This far western portion of the North Shore is extremely sparsely populated and will be little discussed in this report.) A broad saddle, or upper plain, which transverses the entire island from south to north between its two mountain ranges, ends abruptly in a relatively steep pali or cliff immediately above the coastal plain of the North Shore area. Unlike Koolauloa, the North Shore is characterized by more sporadic residential development which extends almost continuously along the Kamehameha Highway. The scattered strip development of subdivisions cumulatively known as Sunset Beach fronts on Hawaii's premiere surfing area. Somewhat southwest of Sunset is the coastal area of Waimea, overlooked by

the mauka community of Pupukea. Some consider "Waimea" and "Pupukea" to be essentially identical, and so a standard term in this report will be "Waimea/Pupukea." (These areas of Sunset and Waimea/Pupukea are considered part of "Koolauloa" by the U.S. Census Bureau but are in the City's "North Shore" Development Planning Area.) Still further southwest is the Kawailoa area, also a scattering of houses along the highway. The highway turns inland by Haleiwa, the North Shore's commercial center, and runs by the sugar plantation town of Waialua, the largest single settlement on the North Shore. (Other small North Shore communities include Mokuleia, consisting of scattered residences and second homes along the coast due west of Haleiwa, and Paala Kai, a new subdivision located between Haleiwa and Waialua.)

Resuming the previous "guided tour" along Kamehameha Highway, past Kawela Bay the wide agricultural plain begins to narrow, and the rolling foothills of the Koolaus merge into a continuous pali. Dense kiawe replaces cultivated fields. After about two miles, the traveler enters the area known as Sunset Beach, a strip residential development extending approximately two more miles along the highway. Except for an elementary school and a "Mom 'n' Pop" store or two, there are few amenities in the Sunset area other than the parks which overlook the famed surfing beaches. Within a mile southwest, the traveler enters Waimea, overlooked by the hillside community of Pupukea. Pupukea differs from the makai communities in having a more "local" population, containing several expensive homes with dramatic views from the pali, and also featuring numerous small agricultural lots. The combined population of Sunset and Waimea/Pupukea was about 3,200 people in 1980 (see Table 3.2-5 in Section 3.2.1). A supermarket at the base of Pupukea Road is the coast's major commercial attraction. Several miles further down the road is the area known as Kawailoa Beach, very similar in its coastal-strip character to Sunset and Waimea. However, including the former outlying plantation camp mauka of the highway, Kawailoa has a higher proportion of longtime and/or non-Caucasian residents.

Between Waimea/Pupukea and Kawailoa come Waimea Bay and Waimea Valley. This area is little populated but represents a unique recreational and tourism asset. Once a relatively large Hawaiian settlement dominated by an important heiau overlooking the bay and the valley behind, Waimea was inundated by a great flood in 1894 which destroyed many home sites and agricultural fields in the valley (Clark, 1977). Today, the valley has been developed as a visitor attraction complete with a large restaurant. The white sand beach continues to attract weekend visitors from Honolulu, and two to three times every winter the Bay hosts some of the world's finest surfers, who attempt to tame its crashing 20 and 30 foot waves.

Four miles beyond, Kamehameha Highway enters Haleiwa, the origin of which is linked with the history of the neighboring plantation town of Waialua. When the final section of the island's first railroad, the OR & L (Oahu Railway and Land

Company) was completed in 1898, it connected the Waialua sugar mill to Honolulu. Owners of the railroad, recognizing the potential for attracting a passenger clientele, underwrote the construction of a resort hotel across the bay from the plantation town. Adopting the name of a missionary seminar which had been formerly located nearby, the establishment was called the Haleiwa Hotel, and quickly became known as one of the finest resort hotels in the territory (Clark, 1977). Although the hotel eventually closed in 1928, the community that had grown up around the famous site became known as Haleiwa.

Today Haleiwa is the North Shore's center for arts and crafts, restaurants, and retail establishments of all kinds. Many of the roadside stores and restaurants are largely visitor-oriented. Several new shopping centers constructed in the past five years have given the town a new face. While Haleiwa in the past was to some extent an adjunct of Waialua, it is today both socially and economically distinct. A little more than a decade ago, Haleiwa formed its own community association, splitting off from the Waialua Community Association. Haleiwa's 1980 population of 2,400 persons was primarily (and in near-equal parts) Caucasian, Filipino, and part-Hawaiian.

By contrast, Waialua's 1980 population of 4,000 people was strongly Filipino and secondarily Japanese. Waialua's ethnic and social make-up is the legacy of its plantation history. While the first sugar mill was built at Waialua in 1844, the plantation changed owners repeatedly and didn't achieve continued success until it was reformed as the Waialua Agricultural Company in 1898. The mill camp expanded around the mill with the importation of immigrant Japanese and Filipino workers and the plantation remains in production today (one of only two still operating on Oahu), although seasonal layoffs have become common in the past few years.

The modern town of Waialua has changed little during the past forty years except for expanded commercial development and public facilities. The construction of Paala Kai and other new residential subdivisions mauka of the mill town have added to the population and brought more young families back into what had begun to be an aging community, but life in Waialua is still dominated by mill activity. However, the recent shutdowns have made many residents nervous that Waialua may have to follow Kahuku's lead in fighting a battle to survive. With a substantially larger population than Kahuku, Waialua could have a more difficult time. However, Waialua shares with Kahuku a tradition of strong community organization supported by both plantation management and the ILWU.

Table 3.1-1 presents a summary description of the various communities which have been discussed at most length.

TABLE 3.1-1

Principal Communities of Koolauloa and the North Shore

Community	Capsule Description	Major Economic Activities	Population Characteristics
(Koolauloa)			
Kaaawa	Residential area situated along highway.	Small scale agriculture, Mom & Pop stores.	About 900 residents, mostly divided among Caucasians and Hawaiians; new influx of retirees.
Kahana Valley	State park with small residential community.	Subsistence farming and handicrafts.	About twenty families of ethnic mix.
Punaluu	Residential community with beach homes along highway.	Small scale farming, small retail outlets, condominium and restaurant.	A few hundred residents; elderly Caucasian retirees, and young Hawaiians.
Hauula	Residential community with satellite city hall, police and fire station.	Shopping center, farming, small retail outlets.	About 3,000 people, half of them part-Hawaiian.
Laie	Mormon community with Temple and University.	Polynesian Cultural Center, shopping center, Brigham Young University.	About 4,600 residents; large number of Samoans and Tongans; transient student population.
Kahuku	Former sugar plantation town, residential community.	Farming and agriculture.	About 900 residents in 1980, now doubled from new housing; predominantly Filipino; younger families slowly replacing plantation retirees
Kuilima condominiums	368 detached and townhouse units.	Some residents work at Turtle Bay Hilton hotel.	300+ persons, primarily renters.
Kawela Bay	About 64 houses around the bay.	None.	More weekend homes than full-time residences.
(North Shore)			
Sunset Beach Waimea/ Pupukea	Scattered beach homes, small residential subdivisions along highway.	Small retail outlets, visitor attraction at Waimea Bay.	Highly transient, mixed ethnicity, large number of Caucasians; about 3,200.
Haleiwa	Commercial center with small residential community.	Retail outlets, shopping centers.	Approx. 2,400 in 1980; Caucasian, Hawaiian, Filipino.
Waialua	Sugar plantation town, residential community.	Sugar cultivation and processing.	Approx. 4,000 in 1980, growing thru new housing; predominantly Filipino.

3.2 Selected Demographic Indicators

Table 3.2-1 shows long-term population trends for all parts of Oahu, including the Region, for the 30-year period from 1950 to 1980.

Tables 3.2-2(a) and (b) show detailed 1970 and 1980 demographic breakdowns and 10-year percentage changes for the Region (both the individual Koolauloa and North Shore census divisions, plus combined total region) and for Honolulu County as a whole. Tables 3.2-3(a) and (b) show similar demographic data for those communities broken out by the Census Bureau as "Census Designated Places" (CDP's) for the Koolauloa census division. Finally, Tables 3.2-4(a) and (b) show the same data for the CDP's in the "North Shore" division (technically the "Waialua division," but here called the "North Shore" to avoid confusion with the town of Waialua).

These tables provide the reference sources for the following discussions.

3.2.1 Population

The 1980 U.S. Census found 14,195 Koolauloa residents and 9,489 in the North Shore census division, for a combined total of 24,044. The City and County of Honolulu's Department of General Planning estimates the combined total population for 1982 (most current available data) was 1,598 greater than the 1980 total, or 25,632 (personal communication, Steven Young, 1984). This spurt in population was primarily due to completion of the Koolauloa Housing Project in Kahuku and the Paala Kai project by Waialua.

Table 3.2-1 shows that population growth for the Region has been occurring much more slowly than for the county as a whole, so that the relative proportion of Oahu's population to be found in the Koolauloa-North Shore region declined from 3.72% in 1950 to 3.13% in 1970, then up very slightly to 3.15% in 1980. However, it may also be observed that this was primarily due to the very slow growth in the North Shore area. Koolauloa's growth, while modest in absolute terms, has exceeded countywide growth rates, particularly in the 1970 - 1980 decade (see Table 3.2-2(b)). (NOTE: It should be recalled that the Sunset/Waimea/Pupukea area is counted with "Koolauloa" by the U.S. Census Bureau.)

The adjacent census divisions--Koolaupoko on Windward Oahu and the Wahiawa division in Central Oahu--have recently grown in population at a rate only slightly less than the islandwide rate, so that their proportions of the total population decreased very slightly from 1970 to 1980.

TABLE 3.2-1

Population of Oahu and Various Census Divisions: 1950 - 1980

Civilian Population	1950	1960	1970	1980
City & County of Honolulu	353,020	500,409	630,528	762,565
Koolauloa-North Shore Region:				
Koolauloa	5,223	8,043	10,562	14,195
North Shore	7,906	8,221	9,171	9,849
Total Region	13,129	16,264	19,733	24,044
Adjacent Areas:				
Wahiawa	17,363	34,595	37,329	41,562
Koolaupoko	20,779	60,238	92,219	109,373
Other Areas on Oahu:				
Waianae	7,024	16,452	24,077	31,487
Ewa	46,691	78,666	132,299	191,051
Honolulu	248,034	294,194	324,871	365,048
Distribution of Oahu Population				
Koolauloa-North Shore Region:	%	%	%	%
Koolauloa	1.48	1.61	1.68	1.86
North Shore	2.24	1.64	1.45	1.29
Total	3.72	3.25	3.13	3.15
Adjacent Areas:				
Wahiawa	4.92	6.91	5.92	5.45
Koolaupoko	5.89	12.04	14.63	14.34
Other Areas on Oahu:				
Waianae	1.99	3.29	3.82	4.13
Ewa	13.23	15.72	20.98	25.05
Honolulu	70.26	58.79	51.52	47.87

Sources: U.S. Bureau of the Census, 1980 (Summary Tape File 1A); State of Hawaii Department of Planning and Economic Development, 1973, Community Profiles for Hawaii.

TABLE 3.2-2(a)

Demographic Breakdown of Regional Population: 1970 and 1980

	Honolulu County 1970	Honolulu County 1980	Koolauloa Division 1970	Koolauloa Division 1980	North Shore Division 1970	North Shore Division 1980	Combined Total Region (Koolauloa/N. Shore) 1970	Combined Total Region (Koolauloa/N. Shore) 1980
TOTAL POPULATION	630,528	762,565	10,562	14,195	9,171	9,849	19,733	24,044
	%	%	%	%	%	%	%	%
ETHNICITY*								
Caucasian	41.2	34.4	39.5	38.2	31.8	31.2	35.9	33.2
Japanese	26.8	24.9	8.7	7.4	24.1	17.7	15.8	10.8
Chinese	7.7	6.9	4.0	3.2	2.0	1.0	3.1	1.9
Filipino	10.4	12.6	10.7	7.1	32.0	32.4	20.6	18.4
Hawn./Part Hawn.	8.5	10.5	25.0	22.9	6.7	11.6	16.5	18.5
Other	5.5	10.4	12.1	21.2	3.4	6.0	8.1	17.3
AGE								
Less than 5 yr.	9.3	7.9	11.5	11.6	10.5	9.0	11.0	10.5
5 - 17 yr.	26.2	20.2	28.0	22.8	28.1	20.0	28.1	10.6
18 - 64 yr.	59.5	64.6	55.7	59.4	54.7	61.9	55.2	60.4
65 or more yr.	5.0	7.3	4.8	6.3	6.7	9.1	5.7	7.4
Median age	24.6 yr	28.1 yr	21.4 yr	23.8 yr	24.3 yr	26.3 yr	NA	NA
PLACE OF BIRTH*								
Hawaii	56.1	55.1	54.9	50.9	56.3	55.2	55.5	52.6
Other U.S.**	NC	30.1	NC	31.4	NC	27.0	NC	29.6
Foreign country	9.1	14.8	14.8	17.7	18.5	17.8	16.5	17.8
RESIDENCE 5 YEARS PREVIOUS* (People aged 5 years, over)								
Same house	42.5	48.2	41.0	46.0	47.3	50.4	43.9	47.8
Elsewhere on Oahu	NC	25.5	NC	28.3	NC	24.2	NC	26.6
Different island	NC	1.3	NC	0.8	NC	2.8	NC	1.6
Different state	NC	18.4	NC	14.8	NC	18.9	NC	16.5
Different country	NC	6.6	NC	10.0	NC	3.7	NC	7.4
EDUCATION* (People aged 25 years or older)								
0-8 years completed	20.8	14.4	31.4	15.2	35.7	25.6	33.6	19.7
High school grad.	37.5	35.5	28.9	32.0	31.1	32.0	30.0	31.9
College, 4 yr. +	15.5	21.7	12.3	20.2	7.7	15.0	10.0	17.9

Notes: *Figures based on 15% sample; hence, numbers represent estimate.

**Including persons born in U.S. territories, and persons born abroad or at sea to American parent/s.

Sources: U.S. Bureau of the Census, 1970 and 1980 (Summary Tape Files 1A and 3A); State of Hawaii, 1973, Community Profiles for Hawaii; percentages computed by Community Resources, Inc.

TABLE 3.2-2(b)

Ten-Year Percentage Change in Population and Demographic Categories: Region, 1970 - 1980

	Honolulu County 1970 - 1980	Koolauloa Division 1970 - 1980	North Shore Division 1970 - 1980	Combined Total Region (Koolauloa/N. Shore) 1970 - 1980
	%	%	%	%
TOTAL POPULATION	20.9	34.4	7.4	21.8
ETHNICITY*				
Caucasian	-2.7	22.1	-1.2	12.5
Japanese	12.3	-4.8	-22.2	-17.1
Chinese	9.4	-17.5	-43.6	-25.4
Filipino	48.8	3.4	10.8	8.7
Hawn./Part Hawn.	49.3	28.8	70.0	36.6
Other	161.0	158.4	171.2	161.0
AGE				
Less than 5 yr.	2.5	35.5	-8.0	16.3
5 - 17 yr.	-6.5	9.3	-23.6	-6.0
18 - 64 yr.	31.3	43.3	21.7	33.3
65 or more yr.	76.4	74.7	44.8	58.3
Median age	14.2	11.2	8.2	NA
PLACE OF BIRTH*				
Hawaii	19.1	24.6	5.2	15.5
Other U.S.**	NC	NC	NC	NC
Foreign country	98.1	60.9	3.6	31.1
RESIDENCE 5 YEARS PREVIOUS* (People aged 5 years or more)				
Same house	39.9	50.9	15.4	33.0
Elsewhere on Oahu	NC	NC	NC	NC
Different island	NC	NC	NC	NC
Different state	NC	NC	NC	NC
Different country	NC	NC	NC	NC
EDUCATION* (People aged 25 years or older)				
0-8 years completed	-3.3	-23.5	-17.9	-20.4
High school grad.	31.6	74.2	18.2	44.5
College, 4 yr. +	94.3	157.7	123.2	144.0

Notes: *Figures based on 15% sample; hence, numbers represent estimate.

**Including persons born in U.S. territories, and persons born abroad or at sea to American parent/s.

Sources: U.S. Bureau of the Census, 1970 and 1980 (Summary Tape Files 1A and 3A); State of Hawaii, 1973, Community Profiles for Hawaii; percentages computed by Community Resources, Inc.

TABLE 3.2-3(a)

Demographic Breakdown of Koolauloa Census Designated Places (CDP's): 1970 and 1980

	Kahuku CDP 1970	Kahuku CDP 1980	Laie CDP 1970	Laie CDP 1980	Hauula CDP 1970	Hauula CDP 1980	Kaaawa CDP 1970	Kaaawa CDP 1980
TOTAL POPULATION	917	935	3,009	4,643	2,048	2,997	848	959
	%	%	%	%	%	%	%	%
ETHNICITY*								
Caucasian	7.7	16.4	39.4	30.0	29.9	25.3	51.9	49.0
Japanese	NA	15.6	5.1	4.1	4.8	6.3	NA	7.1
Chinese	NA	0.4	4.2	6.3	6.9	1.9	NA	0.6
Filipino	NA	51.8	1.8	1.6	3.9	2.3	NA	0.0
Hawn./Part Hawn.	NA	9.7	20.8	11.5	45.8	46.2	NA	36.9
Other	NA	6.1	28.8	46.5	8.7	17.9	NA	6.4
AGE								
Less than 5 yr.	9.3	6.7	9.6	14.7	13.5	13.2	10.6	8.0
5 - 17 yr.	24.5	23.1	26.9	22.6	34.1	31.5	30.1	22.0
18 - 64 yr.	55.1	46.5	60.6	59.9	48.3	51.2	53.2	60.5
65 or more yr.	11.1	23.6	2.9	2.8	4.1	4.1	6.1	9.5
Median age	NA	37.3 yr	20.0 yr	20.6 yr	19.3 yr	21.2 yr	NA	30.1 yr
PLACE OF BIRTH*								
Hawaii	NA	57.8	35.8	35.1	NA	78.0	NA	61.1
Other U.S.**	NA	13.3	NC	33.0	NA	12.2	NA	35.0
Foreign country	NA	28.9	29.0	31.9	NA	9.8	NA	3.9
RESIDENCE 5 YEARS PREVIOUS* (People aged 5 years, more)								
Same house	NA	41.2	24.8	32.7	NA	63.4	NA	43.3
Elsewhere on Oahu	NA	44.2	NC	22.4	NA	31.7	NA	46.5
Different island	NA	0.0	NC	0.6	NA	1.1	NA	0.0
Different state	NA	2.4	NC	19.6	NA	0.4	NA	9.0
Different country	NA	12.2	NC	24.7	NA	3.4	NA	1.3
EDUCATION* (People aged 25 years or older)								
0-8 years completed	NA	53.0	29.6	9.0	NA	11.1	NA	7.8
High school grad.	NA	18.2	20.2	26.2	NA	42.5	NA	44.6
College, 4 yr. +	NA	8.5	21.1	25.1	NA	12.5	NA	18.1

Notes: *Figures based on 15% sample; hence, numbers represent estimate.

**Including persons born in U.S. territories, and persons born abroad or at sea to American parent/s.

Sources: U.S. Bureau of the Census, 1970 and 1980 (Summary Tape Files 1A and 3A); State of Hawaii, 1973, Community Profiles for Hawaii; percentages computed by Community Resources, Inc.

TABLE 3.2-3(b)

Ten-Year Percentage Changes in Population and Demographic Categories: Koolauloa Census Designated Places (CDP's), 1970 – 1980

	Kahuku CDP 1970 – 1980	Laie CDP 1970 – 1980	Hauula CDP 1970 – 1980	Kaaawa CDP 1970 – 1980
	%	%	%	%
TOTAL POPULATION	2.0	54.3	46.3	13.1
ETHNICITY*				
Caucasian	112.7	17.5	18.8	21.1
Japanese	NA	25.5	82.8	NC
Chinese	NA	134.4	-61.0	NC
Filipino	NA	35.8	-17.5	NC
Hawn./Part Hawn.	NA	-14.7	41.5	NC
Other	NA	149.1	186.6	NC
AGE				
Less than 5 yr.	-25.9	134.8	43.3	-14.4
5 – 17 yr.	-4.0	29.7	35.1	-17.3
18 – 64 yr.	-13.9	52.7	55.1	28.6
65 or more yr.	116.7	47.7	47.0	75.0
Median age	NA	0.3	9.8	NA
PLACE OF BIRTH*				
Hawaii	NA	51.4	NA	NA
Other U.S.**	NA	NC	NA	NA
Foreign country	NA	69.5	NA	NA
RESIDENCE 5 YEARS PREVIOUS* (People aged 5 years, more)				
Same house	NA	93.5	NA	NA
Elsewhere on Oahu	NA	NC	NA	NA
Different island	NA	NC	NA	NA
Different state	NA	NC	NA	NA
Different country	NA	NC	NA	NA
EDUCATION* (People aged 25 years or older)				
0-8 years completed	NA	-49.6	NA	NA
High school grad.	NA	116.5	NA	NA
College, 4 yr. +	NA	98.0	NA	NA

Notes: *Figures based on 15% sample; hence, numbers represent estimate.

**Including persons born in U.S. territories, and persons born abroad or at sea to American parent/s.

Sources: U.S. Bureau of the Census, 1970 and 1980 (Summary Tape Files 1A and 3A); State of Hawaii, 1973, Community Profiles for Hawaii; percentages computed by Community Resources, Inc.

TABLE 3.2-4(a)

Demographic Breakdown of North Shore Census Designated Places (CDP's): 1970 and 1980

	Waialua CDP 1970	Waialua CDP 1980	Haleiwa CDP 1970	Haleiwa CDP 1980
TOTAL POPULATION	4,047	4,051	2,626	2,412
	%	%	%	%
ETHNICITY*				
Caucasian	24.6	17.5	28.3	30.1
Japanese	25.5	23.8	25.1	15.9
Chinese	1.3	1.0	3.5	0.4
Filipino	43.8	48.3	24.7	28.6
Hawn./Part Hawn.	2.6	5.0	13.0	23.8
Other	2.2	4.4	5.4	1.2
AGE				
Less than 5 yr.	9.9	8.2	10.8	9.2
5 - 17 yr.	26.5	20.5	30.8	23.2
18 - 64 yr	56.6	59.0	50.5	58.2
65 or more yr.	7.1	12.2	7.8	9.5
Median age	25.0 yr	29.4 yr	22.6 yr	26.7 yr
PLACE OF BIRTH*				
Hawaii	53.9	57.8	65.2	67.3
Other U.S.**	NC	12.3	NC	23.5
Foreign country	27.6	29.9	10.5	9.3
RESIDENCE 5 YEARS PREVIOUS* (People aged 5 years, more)				
Same house	50.6	58.2	54.3	55.7
Elsewhere on Oahu	NA	24.7	NA	26.6
Different island	NA	4.0	NA	1.0
Different state	NA	6.8	NA	15.5
Different country	NA	6.3	NA	1.1
EDUCATION* (People aged 25 years or older)				
0-8 years completed	43.4	35.8	31.7	18.9
High school grad.	38.5	27.3	54.9	35.1
College, 4 yr. +	6.0	11.8	7.2	14.0

Notes: *Figures based on 15% sample; hence, numbers represent estimate.

**Including persons born in U.S. territories, and persons born abroad or at sea to American parent/s.

Sources: U.S. Bureau of the Census, 1970 and 1980 (Summary Tape Files 1A and 3A); State of Hawaii, 1973, Community Profiles for Hawaii; percentages computed by Community Resources, Inc.

TABLE 3.2-4(b)

Ten-Year Percentage Changes in Population and Demographic Categories: North Shore Census Designated Places (CDP's), 1970 - 1980

	Waialua CDP 1970 - 1980	Haleiwa CDP 1970 - 1980
	%	%
TOTAL POPULATION	0.1	-8.1
ETHNICITY*		
Caucasian	-28.7	-3.5
Japanese	-6.6	-42.4
Chinese	-19.6	-89.1
Filipino	10.4	5.4
Hawn./Part Hawn.	88.8	66.3
Other	96.7	-79.6
AGE		
Less than 5 yr.	-17.0	-22.2
5 - 17 yr.	-22.4	-31.0
18 - 64 yr.	4.5	5.8
65 or more yr.	73.1	11.2
Median age	17.6	18.1
PLACE OF BIRTH*		
Hawaii	7.2	-6.2
Other U.S.**	NC	NC
Foreign country	8.5	-19.9
RESIDENCE 5 YEARS PREVIOUS* (People aged 5 years, more)		
Same house	19.7	-7.7
Elsewhere on Oahu	NC	NC
Different island	NC	NC
Different state	NC	NC
Different country	NC	NC
EDUCATION* (People aged 25 years or older)		
0-8 years completed	-6.4	-38.4
High school grad.	-19.5	-33.8
College, 4 yr. +	123.2	102.3

Notes: *Figures based on 15% sample; hence, numbers represent estimate.

**Including persons born in U.S. territories, and persons born abroad or at sea to American parent/s.

Sources: U.S. Bureau of the Census, 1970 and 1980 (Summary Tape Files 1A and 3A); State of Hawaii, 1973, Community Profiles for Hawaii; percentages computed by Community Resources, Inc.

In the North Shore census area, such population growth as did occur during the 1970's was primarily outside the Haleiwa and Waialua CDP's. However, these two settlements still accounted for nearly two-thirds of the area population in 1980.

In Koolauloa, the greatest growth in the 1970's occurred in Laie (as a result of the expansion of the BYU-Hawaii campus, immigration from the South Pacific, and large family sizes) and Hauula. Population growth was much less in Kaaawa and Kahuku (which suffered the impacts of the plantation shutdown). However, the tri-community area east and south of Kuilima (Kahuku, Laie, and Hauula) increased its share of the total Koolauloa population from 56.6% in 1970 to 60.4% in 1980.

Table 3.2-5 shows the distribution of 1980 population in the Region over the various CDP's. The table also shows the distribution as it would be calculated for the City's Development Planning Areas, in contrast to the Census divisions used in the preceding tables (the prime difference being that the Sunset/Waimea/Pupukea area is regarded by the City as part of the North Shore rather than as part of Koolauloa). A major conclusion to be drawn from Table 3.2-5 is that, perhaps in contrast to conventional wisdom, a majority of the Region's population lives in one of the urbanized settlements with commercial centers and community amenities, rather than scattered "rural" or "country" settings. Adding up the 1980 percentages for such settled communities (Waialua, Haleiwa, Kahuku, Laie, and Hauula), 62.5% lived in such a community. (It would be 66.5% if Kaaawa were included, and 79.9% if the Sunset/ Waimea/Pupukea areas were also counted; however, these areas tend to be more "country" than "community" in most aspects.)

Since 1980, it is likely that large family sizes in Laie and Hauula have continued to increase population there. Kahuku's population has more than doubled as a result of the City's new Koolauloa Housing Project, which added 280 units to the previous (approximately) 225 units in the old plantation area. The 307-unit Paala Kai subdivision between Waialua and Haleiwa has been completed and populated. Thus, it is probable that some two-thirds of the Koolauloa population now reside in relatively urban small-town settings, with the remainder in more "country" areas.

3.2.2 Ethnicity

Table 3.2-2(a) shows the overall region's dominant ethnic group consists of Caucasians, who accounted for approximately one-third of the population in 1980. Next were Filipinos and part-Hawaiians, each with about 18.5% percent, and "others" (including Samoans, Tongans, mixed non-Hawaiians, and everything else), with 17.3%. A comparison with the islandwide 1980 ethnic breakdown indicates the Region's population was proportionately much more Hawaiian, Filipino, and "other"; much less Japanese or Chinese. Table 3.2-2(b) shows the fastest-growing groups were

TABLE 3.2-5

Distribution of 1980 Population Over Various Area Communities

	Pop.	% of Census Division	% of Development Planning Area	% of Total Area
North Shore				
Waialua CDP	4,051	41.1%	31.0%	16.8%
Haleiwa CDP	2,412	24.5%	18.5%	10.0%
remainder south & west of Waimea River	3,386	34.4%	25.9%	14.1%
from Waimea River to Kaunala Ridge (Sunset/Waimea/Pupukea)	3,212	-----	24.6%	13.4%
Total in Census Division (excl. Sunset etc.)	9,849	100.0%	(75.4%)	(41.0%)
Total in DP Area (incl. Sunset etc.)	13,061	(132.6%)	100.0%	(54.3%)
Koolauloa				
Kahuku CDP	935	6.6%	8.5%	3.9%
Laie CDP	4,643	32.7%	42.3%	19.3%
Hauula CDP	2,997	21.1%	27.3%	12.5%
Kaaawa CDP	959	6.8%	8.7%	4.0%
remainder (excl. Sunset, etc.)	1,449	10.2%	13.2%	6.0%
REPEAT: Sunset Waimea/Pupukea	3,212	22.6%	------	(REPEAT:) 13.4%
Total in Census Division (incl. Sunset etc.)	14,195	100.0%	(129.2%)	(59.0%)
Total in DP Area (excl. Sunset etc.)	10,983	(77.4%)	100.0%	(45.7%)
Combined Total	24,044	-----	-----	100.0%

the Hawaiians and the "others" (although some care should be taken in viewing these 10-year percentage changes, since there were changes in ethnic reporting procedures from 1970 to 1980).

However, the various tables also indicate the different ethnic groups are not randomly distributed throughout the region. The North Shore division contained proportionately more Filipinos and Japanese, while the Koolauloa division was more Hawaiian and "other."

Even within divisions, different communities had greatly differing ethnic make-ups in 1980. Waialua and Kahuku, the current and past plantation communities, were heavily Filipino. Hauula and Kaaawa were primarily Hawaiian and Caucasian, with greater emphasis on the Hawaiian in Hauula and the Caucasian in Kaaawa. Laie was predominantly "other," reflecting the large numbers of Samoans and, to a lesser extent, Tongans living there--many of them in-migrants during the 1970's.

In both Koolauloa and the North Shore divisions, a majority of Caucasians lived in the "country" areas outside the more settled communities (Waialua, Haleiwa, Kahuku, Laie, and Hauula), while a majority of the other ethnic groups lived inside one of these communities.

3.2.3 Age

The following conclusions may be drawn from the census data presented earlier:

- The population in the Region, like that of the county as a whole, has been growing older, due in large part to lower fertility. However, the age distribution in the Region still includes proportionately more children, particularly in the category of age less than five years, than does that for Oahu as a whole.

- Again, there are clear differences between the age distributions for Koolauloa and the North Shore. North Shore residents were older on average to begin with in 1970 and were still older in 1980. Even the absolute number of children under 18 declined on the North Shore from 1970 to 1980. In Koolauloa, the proportion of the population under age five actually increased slightly from 1970 to 1980, and absolute numbers were clearly on the rise.

- Clear differences between communities were present for age as they were for ethnicity. The retirement-age population of Waialua increased more rapidly than was the case for Haleiwa. In Koolauloa, the communities of Hauula and particularly Laie--where large families are common--remain dramatically younger than in other places.

The Kaaawa population, on the other hand, has been growing much older because of the reduction in children and the increase in persons aged 65 or more.

Kahuku had the oldest population in 1980--median age 37.3 years, with nearly one out of every four persons aged 65 or more. However, the Kahuku population is now growing younger again, both because of the young families in the new housing and also because of a recent upsurge in returning children of plantation workers (expected to continue and intensify when the old housing is converted from leasehold and still more units are built in the old village area).

Additionally, it may be noted that different ethnic groups in the area tend to have different age structures (as is the case statewide). Caucasians and Japanese are older on average because they have fewer children. According to the State Department of Education's Student Information Services (personal communication), only 17% of 1984 Kahuku High School and 12% of Waialua High School graduates were Caucasian, whereas 33% of the overall Koolauloa/North Shore population was Caucasian in 1980.

3.2.4 Place of Birth

Compared to the island as a whole, the Region in 1980 was a little less comprised of the Hawaii-born and a little more of the foreign-born, but these difference were slight. The foreign-born have been increasing their proportionate population share more in Koolauloa and particularly in Laie, where nearly one in three is foreign-born. Other communities with high proportions of foreign-born are the plantation towns of Waialua and Kahuku, which are home to many people originating in the Philippines. The Mainland-born are a little more likely to be found in Laie and Kaaawa, but the numbers suggest an overall pattern in which Mainland-born people are more likely to be found outside most settled communities represented by the CDP's.

3.2.5 Residence Five Years Previous

The gross migration patterns suggested by this variable were very similar for the Region as for the island as a whole. The proportion of people who had lived in a foreign country was somewhat higher in Koolauloa. This was primarily due to Laie, where almost one in every four persons had been residing in a different country in 1975. Coinciding with the pattern for the Mainland-born, the figures suggest that people who had been living on the Mainland in 1975 were somewhat more likely than the general population in the Region to be living in a "country" area outside most of the communities represented by the CDP's.

3.2.6 Education

The average educational level of Oahu residents improved substantially from 1970 to 1980. It may have been improving even more rapidly in the Region, where the population of four-year college educated persons increased at seven times the rate of the overall population (see Table 3.2-2(b)). However, the historical education level was lower in the Region than in the overall population, and some gap still remained by 1980. This was primarily due to the lower average education levels in the North Shore area; the pattern for Koolauloa was essentially that of the county as a whole by 1980.

Not surprisingly, the communities with the highest proportions of people with less than nine years education were the plantation towns, Waialua and Kahuku. And the college town of Laie, where one out of every four persons could boast a four-year college record, led the field for education.

3.3 Selected Economic Indicators

This section presents and discusses selected economic indicators for the state, County, and the Koolauloa-North Shore Region. The first subsection provides an overview of the historical factors that have shaped the development of the State of Hawaii and the City and County of Honolulu. The second subsection discusses the current and expected trends in the State and County's economic growth. The third subsection discusses employment trends in the County and the Regional area that encompasses the coastal communities between Kaaawa and Waialua. To a limited extent, the adjacent Wahiawa area is also discussed in this subsection, inasmuch as its residents are expected to be a secondary pool of employees, with the primary employee pool being residents of the Region. A fourth subsection discusses County and Regional area residents. It is followed by a final subsection concerning housing.

3.3.1 Overview of Hawaii's Economy

Since the early 1800s, Hawaii has been an important crossroad in the Pacific. Its first major export was sandalwood shipped to the Far East. In the mid-1800s, Hawaii was the port for Pacific whaling fleets, and by the end of the century, Hawaii had become a trade center for the Pacific and Asia, and a major base of operations for American naval and army forces.

The City and County of Honolulu encompasses the entire island of Oahu, which since the mid-1800s, has been the center of economic activity in Hawaii. This favorable position has been attained partly because of its having natural harbor areas at Honolulu and Pearl Harbor. Additionally, the capital of Hawaii has been Honolulu since the mid-1800s.

In the mid-1900s, Hawaii's economy was based on three primary activities: sugar, pineapple, and federal expenditures, particularly defense-related outlays. Subsequent to Hawaii attaining statehood, the new state's economy diversified. Diversification resulted primarily from the significant growth in the State's tourism industry and moderate growth in the State's diversified manufacturing sector.

3.3.2 State and County Economic Trends

Table 3.3-1, summarizes data concerning the income produced by the major components of Hawaii's economic base in 1960, 1970 and 1983. The table provides one perspective for assessing the trends in the State's economy during the past twenty years. Trends reflected in the table are discussed below:

TABLE 3.3-1

Major Income Producers In Hawaii
1960, 1970, 1980 and 1983

	1960		1970		1980		1983	
	$Million	(%)	$Million	(%)	$Million	(%)	$Million	(%)
Visitor Expenditures..........	131.00	9.82	595.00	18.17	3,000.00	28.17	4,000.00	29.46
Manufacturing Sales:								
Sugar......................	127.20	9.53	198.10	6.05	594.60	5.58	409.60	3.02
Pineapple..................	119.40	8.95	134.50	4.11	229.20	29.15	219.00	1.61
Sub Total Sugar and Pineapple Mfg. Sales...	246.60	18.48	332.60	10.16	823.80	7.73	628.60	4.63
Diversified................	148.70	11.15	428.80	13.10	1,787.90	16.79	1,628.10	11.99
Sub Total Mfg. Sales.....	395.30	29.63	761.40	23.25	2,611.70	24.52	2,256.70	16.62
Non-Defense Outlays.........	112.70	8.45	395.30	12.07	1,907.90	17.91	2,422.30	17.84
Defense Outlays.............	373.10	27.97	675.20	20.62	1,399.20	13.14	2,032.20	14.97
Sub Total Federal.........	485.80	36.41	1,070.50	32.69	3,307.10	31.05	4,454.50	32.81
Construction Completed........	275.40	20.64	783.80	23.94	1,560.00	14.65	1,334.00	9.82
Diversified Agriculture.......	46.60	3.49	63.60	1.94	171.80	1.61	199.00	1.47
TOTAL.....................	1,334.10	100.00	3,274.30	100.00	10,650.60	100.00	13,578.20	100.00%

Source: Bank Of Hawaii, Annual Economic Review: 1981 and 1983.

1) During the past 20 years, tourism has become one of the most important factors in Hawaii's economy. In 1960, visitor expenditures comprised ten percent of the total expenditures derived from the State's primary economic activities, increasing to 18 percent in 1970, 28 percent in 1980, and 29 percent in 1983.

2) Sugar and pineapple continue to be important factors in the State's economy. However, their relative contribution to Hawaii's economy is declining. In 1960, combined sugar and pineapple manufacturing sales comprised 18 percent of the total expenditures derived from the activities in Table 3.3-1, decreasing to ten percent in 1970, eight percent in 1980, and less than five percent in 1983. The sharp decrease in 1980-83 reflects both declining sugar production and sugar prices as well as the growth of other economic sectors.

3) In 1960, diversified manufacturing sales comprised 11 percent of the total expenditures derived from the activities in Table 3.3-1, increasing to 13 percent in 1970, and 17 percent in 1980, then decreasing to 12 percent in 1983.

4) Federal expenditures are comprised of both defense and non-defense outlays, including federal assistance programs. They continue to be a very significant factor in Hawaii's economy. The relative contribution made by federal expenditures declined from 36 percent in 1960 to 31 percent in 1980. However, between 1980 and 1983 this trend changed, with total federal expenditures increasing from $3,307 million in 1980 to $4,455 million, or 33 percent of the expenditures in 1983.

5) Since the late 1960s, construction activity in Hawaii has followed a cyclical pattern, increasing for several years, followed by several years of declining activity. In 1960, construction completed comprised 21 percent of the total expenditures derived from the activities in Table 3.3-1, increasing to 24 percent in 1970, and then decreasing to 15 percent in 1980 and less than ten percent in 1983. The decrease between 1980 and 1983 reflects a decline in the expenditures attributed to completed construction: $1,560 million in 1980 and $1,334 million in 1983. Considering the impact that inflation has had on costs, this decline is significant.

6) Diversified agriculture is generally regarded to be one of the important growth areas for Hawaii's economy. As indicated in Table 3.3-1, income from diversified agriculture increased from $46.6 million in 1960 to $171.8 million in 1980, and to $199 million in 1983. However, the relative contribution made to the State's economy by the diversified agriculture sector decreased from 3.49 percent in 1960, to 1.94 percent in 1970, 1.61 percent in

1980, and 1.47 percent in 1983. Thus, while diversified agriculture has expanded, its growth has been relatively slower than other sectors of the State's economy.

Table 3.3-2 presents selected economic indicators for the State and the City and County of Honolulu. Generally, the indicators reflect the dominant role that the City and County of Honolulu plays in the State's economy. The following discusses the table.

1) In 1983, the City and County had 78 percent of the State's total resident population and 77 percent of the State's total civilian employment.

2) The population growth rate for the State increased during the 1970s relative to the 1960s. The County's growth rate since the late-1970s, however, was slower than it was in the 1960s. This is due to an increasing proportion of new residents, as well as existing residents, moving to the neighbor islands rather then either staying on or moving to Oahu. New employment opportunities on the neighbor islands have been a factor in the faster rate of population growth on these islands.

3) The rate of growth in employment in the State also increased during the 1970s compared to the growth rate in the 1960s. However, since the late-1970s, the County employment growth rate has declined below the rate in the 1960s.

4) The neighbor island hotel room inventory also increased at a faster rate than the City and County's during the past two decades. The expansion of the neighbor island's visitor facilities has been an important factor in the neighbor islands' faster population and employment growth rate relative to the growth experienced by Oahu.

5) The proportion of the State's total sugar production that is located on Oahu has declined from 19 percent in 1960 to 15 percent in 1983.

6) The proportion of the State's total diversified agricultural production located on Oahu has also declined from 51 percent in 1960 to 36 percent in 1980, and 32 percent in 1983.

7) The City and County of Honolulu continues to have a very high proportion of the State's construction activity, although the proportion has declined from 95 percent in 1960 to 86 percent in 1980, and 87 percent in 1983. This decline since the 1960s reflects the faster growth realized by the neighbor islands' economy compared to that of the City and County of Honolulu during the past decade.

TABLE 3.3-2

Selected Economic Indicators for the State and the City and County of Honolulu: 1960, 1970, 1980 and 1983

	-----Economic Indicators-----				Average Annual ----Rate of Change---		
	1960	1970	1980	1983	1960-1970	1970-1980	1980-1983
Resident Population (000)							
State	632.8	769.9	968.0	1,023.2	2.0	2.3	1.9
County................	505.2	634.7	764.9	796.0	2.6%	2.1%	1.3%
County as a percent of State total.........	80%	82%	79%	78%			
Employment (000)							
State.................	228.1	305.6	380.0	442.0	3.2	2.2	5.2
County................	179.4	246.4	324.0	339.5	3.7	3.1	1.6
County as a percent of State total.........	79%	81%	85%	77%			
Hotel Room Inventory							
State.................	9,522	32,289	56,769	62,448	13.0	5.8	3.2
County................	8,118	22,531	33,967	34,354	17.8	5.1	0.4
County as a percent of State total.........	85%	70%	60%	58%			
Sugar Production (thousand, tons)							
State.................	935	1,162	1,023	1,044	2.2	-1.3	0.7
County................	181	212	167	161	1.7	-2.1	-1.2
County as a percent of State total.........	19%	18%	16%	15%			
Diversified Agriculture ($million)							
State.................	$47	64	154	199	3.2	10.4	8.9
County................	24	28	62	64	1.9	11.9	1.1
County as a percent of State total.........	51%	44%	36%	32%			
Construction Completed ($million)							
State.................	$275	784	1,570	1,334	11.0	7.1	-5.3
County................	262	722	1,352	1,144	17.6	8.7	-5.4
County as a percent of State total.........	95%	92%	86%	86%			
Retail Trade ($million)							
State.................	$948	2,025	6,365	7,433	7.9	12.1	5.3
County................	822	1,773	5,401	6,347	11.6	20.5	5.5
County as a percent of State total.........	87%	88%	85%	85%			

Source: "Bank of Hawaii: Annual Economic Review - 1983."

8) The City and County of Honolulu continues to dominate the State's retail trade activity, although there has been a slight decline since the 1960s. In 1960, the County accounted for 87 percent of the State's total, compared to 85 percent in 1980 and 1983.

3.3.3 County and Regional Employment Indicators

The Regional area encompassing the Koolauloa and North Shore Development Plan districts, henceforth referred to as the Region, includes the coastal communities between Kaaawa and Waialua. The following discusses the County and Regional employment trends.

Employment Through Mid-1984

During the 1970s, one of the most significant economic trends in the County was the emergence of tourism-related employment and employment in the service sectors. As indicated in Table 3.3-3, between 1970 and 1980 the number of employed persons over 16 years increased by 93,900, representing an average annual growth of approximately 9,400 per year or an annual compound increase of 3.5 percent.

Estimates prepared by the State Department of Labor and Industrial Relations indicates that in during the first eight months of 1984, the County's employment averaged 345,900. This represents an average annual increase approximately 5,500 per year or a 1.6 percent annual increase. The two sets of data indicate that the growth in Oahu's employment has declined since the 1970s.

Regional employment for the first eight months of 1984, based on the State's job count, is estimated to be 10,300. This represents an increase of 850 jobs since 1980. The increase in employment among residents of the Region is attributable largely to the increase in the area's population which in turn results from an increase in the number of residential units in the Region. The increase in the Region's housing and residential population is reflected in data compiled by the City's Department of General Planning which indicates that the number of residential units in the Region increased by almost 400 between 1980 and 1982, and the Region's population is estimated to have increased by almost 600 residents during the same period.

County and Regional Employment By Industry 1970-80

During the 1970s, the County's employment expanded in all of the primary economic activities, with the exception of non-durable manufacturing. Secondary economic activity sectors also achieved significant employment increases the service sectors and in the wholesale and retail trade sectors. The following high-

lights the changes which occurred in the County's employment mix during the 1970s.

Construction employment decreased by 400, reflecting decreased development and related activity in the County.

Total manufacturing employment increased by 1,400. Although durable manufacturing employment decreased by 4,200, the decrease was offset by a increase of 5,600 in non-durable manufacturing employment.

Transportation employment increased by 9,800. However, employment in the communication and public utilities sector decreased by 200.

Wholesale trade employment increased by over 3,600. Retail trade employment increased by 24,800.

Finance, insurance and real estate employment increased by 13,296.

The business and repair service sector employment also increased by over 7,300.

Employment in the personal entertainment and recreation services category, which includes hotel employees, increased by 11,800.

Employment in the professional and related service sectors increased by 18,300. Health service employment increased by 7,500, educational service employment by 6,200 and other professional and related services by 4,600.

Public administration employment increased by 6,500.

1983 County Employment and Average Wages

A ranking by industry of the County's employment and average wages in 1983, based on workers covered by the State's employment security law and unemployment compensation for Federal employees indicates that of the 67 sectors included, hotel employment is ranked fifth in both average number of jobs and total annual wages, and 47 in average annual wages. The hotel sector's average annual wages in 1983, $12,664, is 24% below the overall average of $16,566.

Distribution of County and Regional Jobs

Table 3.3-4 presents employment data in 1980 by industry for the County and the Koolauloa-North Shore Region. The following discusses the highlights of the table.

TABLE 3.3-3

Distribution of Employment
In the City and County of Honolulu
1970 and 1980

	1970	1980	Compound Annual % Change
Agriculture, Forestry, Fisheries, and Mining	DNA	5,662	NA
Construction	21,811	21,423	-0.18
Manufacturing			
Non Durable	9,113	14,713	4.91
Durable	14,500	10,269	-0.31
Transportation	11,366	21,174	6.42
Communications and Other Public Utilities	8,974	8,771	-0.23
Wholesale Trade	9,647	13,286	3.26
Retail Trade	41,554	66,358	4.79
Finance, Insurance, and Real Estate	12,849	26,145	7.36
Business and Repair Services	7,397	14,726	7.13
Personal, Entertainment, and Recreational Services	14,425	26,252	6.17
Professional and Related Services:			
Health Services	10,924	18,429	5.37
Educational Services	19,933	26,113	2.74
Other Professional and Related Services	10,749	15,385	3.65
Public Administration	28,924	35,407	2.04
Other Industries	8,086	-	NA
TOTAL CIVILIAN LABOR FORCE	230,252	324,113	3.48

Source: U. S. Census of Population, 1970 and 1980.

TABLE 3.3-4

County and Regional Employment by Industry

	Honolulu County		Koolauloa-North Shore Region		Koolauloa		North Shore	
	1980	(%)	1980	(%)	1980	(%)	1980	(%)
Agriculture, Forestry Fisheries & Mining	5,662	1.75	737	7.78	298	5.13	439	11.99
Construction	21,423	6.61	759	8.01	483	8.31	276	7.54
Manufacturing:								
Nondurable Goods	14,713	4.54	530	5.60	111	1.91	419	11.45
Durable Goods	10,269	3.17	189	2.00	93	1.60	96	2.62
Transportation	21,174	6.53	469	4.95	269	4.63	200	5.46
Communication & Other Public Utilities	8,771	2.71	150	1.58	85	1.46	65	1.78
Wholesale Trade	13,286	4.10	133	1.40	66	1.14	67	1.83
Retail Trade	66,358	20.47	1,320	13.94	693	11.92	627	17.13
Finance, Insurance & Real Estate	26,145	8.07	425	4.49	286	4.92	139	3.80
Business & Repair Services	14,726	4.54	255	2.69	120	2.06	135	3.69
Personal Entertainment & Recreational Services	26,252	8.10	1,536	16.22	1,326	22.81	210	5.74
Professional & Related Services:								
Health Services	18,429	5.69	290	3.06	171	2.94	119	3.25
Educational Services	26,113	8.06	1,376	14.53	1,091	18.77	285	7.79
Other Professional & Related Services	15,385	4.75	359	3.79	213	3.66	146	3.99
Public Administration	35,407	10.92	944	9.97	507	8.72	437	11.94
TOTAL	324,113	100.00	9,472	100.00	5,812	100.00	3,660	100.00

Source: 1980 Census of Population.

Compared to the County, the Region derives a significant proportion of employment from the agriculture, forestry, fisheries and mining sectors. Almost eight percent of the employment in the Region is in these sectors compared to less than two percent for the County.

Employment in the construction sectors also represents a significant portion of the total employment in the Koolauloa-North Shore Region. In 1979, eight percent of the employment in the Region was derived from construction compared to less than seven percent for the County.

The distribution of employment indicates that the Region's residents also derive a significant share of their employment from the manufacturing sector. Manufacturing related employment represents almost eight percent of the Region's employment, or approximately the same proportion as the County as a whole. The Region's manufacturing employment is in large part attributable to the sugar processing activities located at Waialua.

The Region's retail employment is an important part of its employment mix accounting for almost 14 percent of its residents' employment. By comparison, retail employment comprises over 20 percent of the jobs in the County. The Region's lower share reflects the concentration of retail services outside the Region.

The personal entertainment and recreational services sector includes jobs in hotels and certain other visitor industry activities. This sector provides jobs for 16 percent of the Region's residents, or twice the proportion of the County. Included in this sector are jobs located at the Kuilima Resort and the Polynesian Cultural Center.

Public administration employment represents 11 percent of the County's employment, and almost ten percent of the Region's.

Over 14 percent of the Region's employment was derived from educational services, reflecting the jobs at Brigham Young University. By contrast, only eight percent of the County's jobs were in this sector.

Employment in the health and other professional and related services categories accounted for approximately seven percent of the jobs in the Region compared to over ten percent in the County.

Changes in Regional Employment 1970-80

Another perspective is provided by comparing the Regional employment by industry in 1980 and 1970, as shown in Table 3.3-5. The table indicates that the number of employed residents increased by over 1,200 during the ten year period. Sectors that registered decreasing employment included construction, manufacturing, health services, and public administration.

The decline in construction employment reflects the statewide decline in construction activity, and the decline in manufacturing employment is largely the result of Kahuku sugar plantation closing in 1972. Compensating for the decline in employment were the following sectors: transportation; retail; finance, insurance and real estate; business repair services; personal entertainment and recreational services; and educational services. Of the sectors reflecting increased employment, the most significant gain was in the personal entertainment and recreational services which includes jobs at the Kuilima Resort.

Regional Employment by Occupation in 1980

Table 3.3-6 presents employment by occupation. It indicates that compared to the County the Region had a relatively lower proportion of persons employed in the managerial/professional and the technical sales/administrative support categories. Approximately 43 percent of the Region's employment is in these two occupational categories compared to 58 percent for the County. Compared to the County, the Region's employment was relatively concentrated in the service occupations (23 percent versus 18 percent); farming, forestry, and fishing (eight versus two percent); and the operators, fabricators, and laborers categories (13 versus 11 percent).

Characteristics of the Civilian Labor Force in 1980

Table 3.3-7 summarizes selected characteristics of the persons 16 years and older. The table includes individuals who are in the armed forces, the civilian labor force, and other individuals who are 16 years and older but are neither in the armed forces or the civilian labor force. The civilian labor force is comprised of individuals, 16 years and older, who are (a) either employed or (b) unemployed and actively seeking employment. By definition, the civilian labor force excludes individuals who are either in the armed forces, retired or not actively seeking a job. The table also indicates the percent in the civilian labor force who are unemployed and the civilian labor force participation rate which is derived by dividing the civilian labor force by the number of individuals in an area who are 16 years and older. The following discusses the highlights of the table.

TABLE 3.3-5

Koolauloa-North Shore Regional Employment by Industry
1980 and 1970

	1980		1970	
	1980	(%)	1970	(%)
Agriculture, Forestry Fisheries & Mining	737	7.78	DNA	.00
Construction	759	8.01	1,081	13.13
Manufacturing:				
Non-durable Goods	530	5.60	815	9.90
Durable Goods	189	2.00	281	3.41
Transportation	469	4.95	367	4.46
Communication & Other Public Utilities	150	1.58	350	4.25
Wholesale Trade	133	1.40	265	3.22
Retail Trade	1,320	13.94	1,218	14.80
Finance, Insurance & Real Estate	425	4.49	297	3.61
Business & Repair Services	255	2.69	155	1.88
Personal Entertainment & Recreational Services	1,536	16.22	351	4.26
Professional & Related Services:				
Health Services	290	3.06	418	5.08
Educational Services	1,376	14.53	1,126	13.68
Other Professional & Related Services	359	3.79	429	5.21
Public Administration	944	9.97	1,078	13.10
Other Industries	NA	NA	1,097	13.33
TOTAL	9,472	100.00	8,231	100.00

Source: U. S. Census of Population, 1980 and 1970.

TABLE 3.3-6

EMPLOYMENT BY OCCUPATION

	Oahu		Koolauloa-North Shore Region		Koolauloa		North Shore		Wahiawa	
	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)
Managerial and Professional	79,934	24.66	1,958	20.67	967	22.47	991	19.17	1,433	16.14
Technical Sales and Administrative Support	109,521	33.79	2,147	22.67	1,069	24.84	1,078	20.86	2,621	29.52
Service Occupations	56,939	17.57	2,193	23.15	1,161	26.98	1,032	19.97	1,962	22.10
Farming, Forestry, and Fishing	5,838	1.80	723	7.63	253	5.88	470	9.09	333	3.75
Precision Production, Craft and Repairs	36,546	11.28	1,178	12.44	428	9.95	750	14.51	1,266	14.26
Operators, Fabricators and Laborers	35,335	10.90	1,273	13.44	425	9.88	848	16.41	1,264	14.24
Total	324,113	100.00	9,472	100.00	4,303	100.00	5,169	100.00	8,879	100.00

Source: 1980 Census of Population.

TABLE 3.3-7

Distribution of Persons 16 Years and Over by Labor Force Status

PERSONS 16 YEARS AND OVER BY LABOR FORCE STATUS	Honolulu County			Koolauloa-North Shore Region			Wahiawa		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Armed Forces	53,646	4,380	58,026	863	139	1,002	11,419	615	12,034
Civilian Labor Force:									
Employed	173,024	151,089	324,113	5,617	3,855	9,472	4,463	4,416	8,879
Unemployed	8,221	7,529	15,750	309	173	482	234	588	822
Not In Labor Force	60,301	116,713	177,014	2,181	4,072	6,253	1,990	6,212	8,202
Subtotal, Civilians 16 Years and Older	241,546	275,331	516,877	8,107	8,100	16,207	6,687	11,216	17,903
TOTAL Armed Forces and Civilians 16 Years and Older	295,192	279,711	574,903	8,970	8,239	17,209	18,106	11,831	29,937
PERCENT DISTRIBUTION									
Armed Forces	18.2	1.6	10.1	9.6	1.7	5.8	63.1	5.2	40.2
Civilian Labor Force:									
Employed	58.6	54.0	56.4	62.6	46.8	55.0	24.6	37.3	29.7
Unemployed	2.8	2.7	2.7	3.4	2.1	2.8	1.3	5.0	2.7
Not in Labor Force	20.4	41.7	30.8	24.3	49.4	36.3	11.0	52.5	27.4
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percent in Civilian Labor Force Unemployed	4.5	4.7	4.6	5.2	4.3	4.8	5.0	11.8	8.5
Civilian Labor Force Participation Rate	75.0	57.6	63.8	73.1	49.7	61.4	70.2	44.6	54.2

Source: 1980 Census of Population.

1) The armed forces comprises over ten percent of the individuals 16 and older in the County, less than six percent in the Region, and over 40 percent in the adjacent Wahiawa area.

2) In the County, 63 percent of the individuals 16 years and older were employed. This compares with 55 percent in the Region and only 30 percent in the adjacent Wahiawa area.

3) In 1980, the unemployed represented 4.6 percent of the County's civilian labor force, compared with 4.8 percent in the Region and 8.5 percent in the adjacent Wahiawa area. The unemployment statistic compiled by the State's Department of Labor and Industrial Relation indicates that the County's unemployment had increased 1.2 percentage points to 5.8 percent in August 1984. Data for areas within the County is not compiled. However, it is believed that the unemployment in the Region and the adjacent Wahiawa area has also increased.

4) In 1980 the County's overall labor participation rate was 66 percent. Approximately 75 percent of the County's civilian males 16 and older participated in the labor force compared to 58 percent of the females. The labor force participation rate was lower for the Region and the adjacent Wahiawa area. The table indicates relative to the County the overall participation rates was 3.4 percent lower in the Region and 11.6 percent lower in the Wahiawa area. The lower labor force participation rate in the Region and the Wahiawa area is attributable to both the lower number of jobs in these areas and the relatively younger populations in these areas. The median age of the population in the Region was approximately 24 to 25 years and in Wahiawa 22 to 24 years. By comparison, the median age of the County's population was 28 years.

Labor Force Status of Women

In both the Region and the Wahiawa area, there is a lower labor force participation rate among women 16 and older. Table 3.3-8 presents data concerning the labor force status of women relative to their having children through the age of 17 years.

The table indicates that in the County a lower proportion of women who have a child under the age of six years of age are in the labor force compared to women who have a child between the age of six and 17 years. It appears that women with younger children tend not to work, perhaps in order to care for their youngsters, but as children grow older their mothers tend to seek employment for both economic and other reasons.

The proportion of women with children under six years who are in the civilian labor force is lower in both the Region (42 percent) and the adjacent Wahiawa area (35 percent) is

TABLE 3.3-8

Labor Force Status of Women

Females 16 Years and Older By Family and Labor Force Status:	County (#)	County (%)	Koolauloa-North Shore Region (#)	Koolauloa-North Shore Region (%)	Wahiawa (#)	Wahiawa (%)
With Own Children Under 6 years:						
In Labor Force	24,828	51.04	734	41.56	1,230	34.51
Not In Labor Force	23,820	48.96	1,032	58.44	2,334	65.49
Total	48,648	100.00	1,766	100.00	3,564	100.00
With Own Children 6 to 17 years:						
In Labor Force	36,248	69.16	829	63.14	1,393	59.18
Not In Labor Force	16,167	30.84	484	36.86	961	40.82
Total	52,415	100.00	1,313	100.00	2,354	100.00
Other Women 16 Years and Over:						
In Labor Force	97,542	55.97	2,465	49.09	2,381	44.94
Not In Labor Force	76,726	44.03	2,556	50.91	2,917	55.06
Total	174,268	100.00	5,021	100.00	5,298	100.00
Total Women, 16 years and Older:						
In Labor Force	158,618	57.61	4,028	49.73	5,004	44.61
Not In Labor Force	116,713	42.39	4,072	50.27	6,212	55.39
Total						
Subtotal	275,331	100.00	8,100	100.00	11,216	100.00

Source : 1980 Census of Population.

significantly lower than in the County (51 percent). In the Region, this lower participation rate would reflect there being fewer employment opportunities in the area, fewer child care services in the area, and probable differences in the general skill profile of all residents. In the Wahiawa area, an added factor is the high proportion of armed forces dependents who generally experience difficulty in the labor market because of their distance from major employment centers, and because they are generally in the state on a temporary basis, typically three years with an option to remain for a second tour of duty.

Less Than Full-time Employment

Compared to the County, a smaller proportion of the Region's employment was comprised of individuals who worked 40 weeks or more in 1979 and also averaged 35 or more hours per week. As indicated in Table 3.3-9, 68 percent of the County's employed men and women, combined, were in this category compared with 59 percent for the Region. The remaining employed residents (32 percent for the County and 41 percent for the Region) may be considered to be employed on less than a full-time basis inasmuch as they either worked less than 40 weeks in 1979 and/or they worked less than 35 hours per week. Within the Region in 1979, a total of 3,300 men and women (27 percent of the Regional employment) worked less than 35 hours per week, and of these 1,600 (13 percent of the total Regional employment) worked less than 40 weeks in that year.

Commuting Time to Work

Employed residents of the Region tend to travel longer distances and consequently spend more time commuting to get to work. As indicated in Table 3.3-10, approximately 2,400 persons, representing 25 percent of the employed residents of the Region, indicted that they spent more than 45 minutes traveling to work. By comparison, only 12 percent of Oahu's employed residents spent a similar amount of time traveling to work.

The lack of employment opportunities in the Region is a factor in the higher proportion of residents traveling more than 45 minutes. Given the actual out-of-pocket cost associated with commuting, as well as the opportunity cost of the time spent traveling, it seems reasonable that a proportion of the Region's employed residents may be willing to take a job in the Region even if it entailed a lower income. What this proportion may be is unknown. Likewise, the trade-off between traveling a shorter distance to work and earnings is not known.

3.3.4 County and Regional Income

An important measure of the economic well-being of a population is data related to income. The following discusses

TABLE 3.3-9

Employment Distribution by Number of Weeks Employed and Average Time Worked Weekly

	Usually Work 35 or More Hours per Week						Usually Work Less Than 35 Hours per Week					
	Worked 40 Weeks or More in 1979			Worked Less Than 40 Weeks in 1979			Worked 40 Weeks or More in 1979			Worked Less Than 40 Weeks in 1979		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
City and County of Honolulu	183,329	101,310	284,639	24,581	25,275	49,856	19,031	25,080	44,111	15,410	26,039	41,449
Koolauloa-North Shore Region:												
Koolauloa	2,524	1,227	3,751	431	483	914	513	763	1,276	400	646	1,046
North Shore	2,477	970	3,447	411	368	779	206	238	444	196	358	554
Total Region	5,001	2,197	7,198	842	851	1,693	719	1,001	1,720	596	1,004	1,600
Wahiawa	13,026	2,851	15,877	1,426	1,458	2,884	836	889	1,725	629	1,220	1,849
Percentage Distribution Males/Females												
City and County of Honolulu	75.6	57.0	67.8	10.1	14.2	11.9	7.9	14.1	10.5	6.4	14.7	9.9
Koolauloa-North Shore Region:												
Koolauloa	65.3	39.3	53.7	11.1	15.5	13.1	13.3	24.5	18.3	10.3	20.7	15.0
North Shore	75.3	50.2	66.0	12.5	19.0	14.9	6.3	12.3	8.5	6.0	18.5	10.6
Total Region	69.9	43.5	58.9	11.8	16.8	13.9	10.0	19.8	14.1	8.3	19.9	13.1
Wahiawa	81.8	44.4	71.1	9.0	22.7	12.9	5.3	13.9	7.7	4.0	19.0	8.3

Source: 1980 Census of Population.

TABLE 3.3-10

Travel Time to Work

	Oahu		Koolauloa-North Shore Region		Koolauloa		North Shore		Wahiawa	
	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)
Less than 5 mins.............	13,075	3.61	611	6.41	363	6.64	248	6.11	2,924	14.80
5 to 9 mins..................	38,612	10.66	1,854	19.46	1,077	19.71	777	19.13	4,465	22.60
10 to 14 mins................	52,525	14.51	1,444	15.16	1,151	21.07	293	7.21	3,572	18.08
15 to 19 mins................	60,929	16.83	964	10.12	659	12.06	305	7.51	2,542	12.87
20 to 29 mins................	77,166	21.04	1,037	10.89	246	4.50	791	19.47	1,765	8.93
30 to 44 mins................	77,414	21.38	1,221	12.82	429	7.85	792	19.50	2,432	12.31
45 to 59 mins................	25,662	7.09	953	10.00	526	9.63	427	10.51	1,057	5.35
over 60 mins.................	17,703	4.89	1,442	15.14	1,013	18.54	429	10.56	1,002	5.07
Mean......................	22.6				25.9		25.1		17.3	

Source: 1980 Census of Population.

selected indicators of income for the County and the Koolauloa-North Shore Region.

Household and Family Income

Median household and family income is generally regarded as an indication of the economic well-being of a community and provides a basis of comparing the relative earnings of residents in different areas. Table 3.3-11 indicates that both the median family and household income for the County is significantly higher than that of the Koolauloa-North Shore Region. In 1979, the median household income in the County was $21,077 compared to $16,895 in the Koolauloa area and $17,721 in the North Shore area. Median household income in the Koolauloa and North Shore areas was 20 percent and 16 percent, respectively, below that of the County. The distribution of family incomes, not shown in the table, indicates that 29 percent of the County's families had incomes of less than $15,000 compared to 40 percent of the families in the Koolauloa area and 44 percent of the families in the North Shore area.

Poverty Level Income

The U. S. Department of Housing and Urban Development provides standards for poverty level income based on family size. For example, in 1979 the poverty threshold for a four-person family was $7,412.

Table 3.3-12 shows the proportion of persons with incomes below 125% of the poverty level. The table illustrates the disparity between the Region, and particularly the Koolauloa area, compared to the County. It also reflects both the Region, and particularly the Koolauloa and Wahiawa areas, having not shared in the County's economic prosperity. The proportion of Koolauloa residents with incomes below 125 percent of the poverty standard, 25.4 percent, is surpassed only by the proportion of Waianae area residents, 28.8 percent, in the same income range. By comparison, 13.8 percent of the County's residents were below 125% of the poverty standard.

Within the Koolauloa-North Shore Region in 1979, a total of 5,100 persons were in households with incomes below 125% of the poverty standard. Approximately 3,350 of these persons resided in the Koolauloa census division and the remaining 1,750 resided in the North Shore (Waialua) census division. Within the Wahiawa census division in 1979, there were 7,900 residents were in households with incomes below 125% of the poverty standard.

TABLE 3.3-11

Median Household and Family Income in 1979

	Household Income	Family Income
County	$21,077	$23,554
Region:		
Koolauloa	16,019	16,895
North Shore	17,721	19,566
Adjacent Areas:		
Wahiawa	13,343	13,841
Koolaupoko	26,077	26,795
Other Census Divisions:		
Ewa (Including Central Oahu)	24,385	25,136
Waianae	15,596	16,326
Honolulu	19,896	23,712

Source: 1980 Census of Population and Housing.

TABLE 3.3-12

Distribution of Individual Residents
Relative to Poverty Level Income Standard

	Below 75% of Poverty Level	Between 75% to 124% of Poverty Level	Below 125% of Poverty Level
County	5.9%	8.0	13.9
Region:			
Koolauloa	10.3%	15.1	25.4
North Shore	5.3	13.1	18.4
Total Region	8.3%	14.3	22.6
Adjacent Areas:			
Wahiawa	5.8%	17.0	22.8
Koolaupoko	4.3	5.7	10.0
Other Census Divisions:			
Ewa (Including Central Oahu)	4.4	6.3	11.7
Waianae	11.3	17.5	28.8
Honolulu	6.6	7.3	13.9

Source: 1980 Census of Population and Housing.

3.4 Housing

This section concerns housing in the County, Region and Wahiawa area. Separate subsection discuss selected housing trends, housing costs, turnover in occupancy, and other descriptive data.

3.4.1 Changes in Housing Inventory and Occupied Housing Units

Based on census data, Table 3.4-1 summarizes data concerning the 1970 and 1980 housing inventory and year-round occupied housing units. The latter excludes housing units that are vacant or used as a second-residence.

The housing inventory in the Region increased by 2,750 units between 1970 and 1980, representing 3.5 percent of the total increase in Oahu's housing inventory. The table indicates that the housing inventory increased at a slightly faster rate (4.2 percent) in the Koolauloa-North Shore Region, and particularly the Koolauloa area, than on Oahu (3.8 percent). The faster growth in the Koolauloa area reflects development of resort-housing units at Kuilima, as well as condominium development in Kaaawa and Punaluu. By contrast, the housing inventory increased at a relatively slower rate in Wahiawa, growing by 2.0 percent annually between 1970 and 1980.

The number of year-round occupied housing units located in the Region increased by approximately 1,900 units between 1970 and 1980, representing 2.9 percent of the island's growth in occupied housing units. The total change in the Region's year-round occupied housing unit count was identical to the change for Oahu, 3.4 percent annually. The total number of year-round occupied housing units in the Region increased by 1,900. However, 1,400 of these units were located in Koolauloa and the remaining 500 in the North Shore area.

3.4.2 Occupied and Vacant Year-Round Housing Units

Table 3.4-2 indicates that in 1980 8.2 percent of the County's year-round housing inventory was vacant. By comparison, the Region had approximately 16 percent of its units vacant, and Wahiawa had five percent vacant.

The vacant rental units comprised less than four percent of the County's inventory of year-round housing units, and six percent of the Region's units in 1980. Vacant condominium units located at the Kuilima Resort and in Punaluu accounted for a significant portion of the Region's vacant units for rent.

Within the Region, the 1980 census indicated that 425 vacant units were held for occasional use as second-homes or weekend retreats. This represents over five percent of the Regional inventory of year-round housing units and 18 percent of the

TABLE 3.4-1

Changes in Housing Inventory
and Year-Round Occupied Housing Units
In 1970 and 1980

	Housing Inventory			Year-round Occupied Housing Units		
	--1980--	--1970--	% Change 1970-80	--1980--	--1970--	% Change 1970-80
County	252,038	174,151	3.8	230,214	164,763	3.4
Koolauloa-North Shore Region:						
Koolauloa	4,963	2,886	5.6	3,742	2,362	4.7
North Shore	3,236	2,560	2.4	2,844	2,335	2.0
Total Region	8,199	5,448	4.2	6,586	4,697	3.4
Wahiawa	10,667	8,709	2.0	10,263	8,431	2.0

Source: 1980 Census of Population and Housing.

TABLE 3.4-2
Occupied and Vacant Year-round Housing

	Oahu		Koolauloa-North Shore Region		Koolauloa		North Shore		Wahiawa	
	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)
Distribution of Year-round Housing Units:										
Occupied	230,214	91.77	6,586	83.61	3,742	79.97	2,844	88.93	10,263	96.21
Vacant	20,650	8.23	1,291	16.39	937	20.03	354	11.07	404	3.79
Total	250,864	100.00	7,877	100.00	4,679	100.00	3,198	100.00	10,667	100.00
Status of Vacant Year-round Housing Units(% of total):										
For Sale	1,383	.55	132	1.68	39	.83	93	2.91	26	.24
For Rent	9,032	3.60	496	6.30	434	9.28	62	1.94	107	1.00
Held for Occasional Use	2,331	.93	426	5.41	274	5.86	152	4.75	8	.07
Other	7,904	3.15	237	3.01	190	4.06	47	1.47	263	2.47
Total Vacant Year-round Units	20,650	8.23	1,291	16.39	937	20.03	354	11.07	404	3.79

Source: 1980 Census of Population.

County's inventory of units held for occasional use. It reflects the Region's current and historical status as a location for second-homes and weekend retreats. Generally, these units are owned by affluent Oahu residents, and they are frequently rented on a short term basis to other residents or to visitors.

3.4.3 Housing Cost

The relatively low household incomes in the Region limits the affordability of housing among residents of the Region. Table 3.4-3 indicates that the median gross monthly rent for Oahu residents in 1980 ($315) was only slightly higher than in both the Koolauloa and the North Shore areas ($306 and $303 respectively). In Wahiawa, median gross monthly rents were substantially lower ($266).

On Oahu, the median monthly cost for non-condominium units with a mortgage ($494) was also slightly higher than in the Koolauloa area ($482). A relatively more significant difference is reflected in the median for the North Shore ($331) reflecting the area's older housing stock. The comparative difference in the Wahiawa area was not as great ($428) compared to Oahu ($494).

One perspective regarding housing affordability is the percentage of family income relative to either gross monthly rent or housing costs with a mortgage. As indicated in Table 3.4-3, relative to median family income, housing costs in the Region and the adjacent Wahiawa area were higher than the county according to the 1980 census data. The ratio of median monthly rent relative to median family income was 14.5 percent for the County, 15.9 percent in the Koolauloa area, 17.4 percent in the North Shore area, and 23.1 percent in the Wahiawa area. The ratio of median monthly housing costs with a mortgage relative to median family income was 21.7 percent for the County, 25.1 percent in the Koolauloa area, 19.1 percent in the North Shore area, and 32.1 percent in the Wahiawa area.

3.4.4 Turnover in Housing Occupancy

Table 3.4-4 presents census data that reflects the turnover in housing occupancy. Turnover in housing occupancy results from residents moving to other housing units in the area or leaving the area altogether. The following discusses the data in the table.

1) There was a moderately higher degree of turnover in the Region (31 percent) during the fifteen month period preceding the 1980 census compared to the County (27 percent). The turnover in the Region during the preceding four years, 1975 to 1978, was almost identical to that in the County (29 and 30 percent respectively).

TABLE 3.4-3

Housing Cost Data

	Oahu	Koolauloa	North Shore	Wahiawa
Gross Monthly Rent:				
Median	$315	306	303	266
As a Percentage of Median Family Income	14.5%	15.9	17.4	23.1
Selected Median Montly Costs For Owner Occupied Non-condominium Units:				
With a Mortgage	$494	482	331	428
As a Percentage of Median Family Income	21.7%	25.1	19.1	32.1
Median Value for Non-condominium Owner Occupied Units	$140,000	114,500	94,400	105,900
Median Household Income in 1979 For Occupied Housing Units:				
Total	$25,156	20,197	19,370	17,779
Renter	$16,710	14,692	15,660	13,518

Source: 1980 Census of Population and Housing.

TABLE 3.4-4

Occupied Housing Units by Year of Original Occupancy

ALL OCCUPIED HOUSING UNITS:	County	Koolauloa-North Shore Region	Koolauloa	North Shore	Wahiawa
1979 to March 1980	63,173	2,053	1,224	829	3,905
1975 to 1978	70,034	1,919	1,200	719	3,472
1970 to 1975	35,380	1,015	616	399	642
1960 to 1969	36,624	953	447	506	977
1950 to 1959	16,952	419	153	266	864
1949 or Earlier	8,051	227	102	125	403
TOTAL	230,214	6,586	3,742	2,844	10,263
1979 to March 1980	27.4	31.2	32.7	29.1	38.0
1975 to 1978	30.4	29.1	32.1	25.3	33.8
1970 to 1975	15.4	15.4	16.5	14.0	6.3
1960 to 1969	15.9	14.5	11.9	17.8	9.5
1950 to 1959	7.4	6.4	4.1	9.4	8.4
1949 or Earlier	3.5	3.4	2.7	4.4	3.9
TOTAL	100.0	100.0	100.0	100.0	100.0

RENTER OCCUPIED HOUSING UNITS:	County	Koolauloa-North Shore Region	Koolauloa	North Shore	Wahiawa
1979 to March 1980	48,256	1,786	1,047	739	3,764
1975 to 1978	42,128	1,223	720	503	3,040
1970 to 1975	12,968	455	227	228	327
1960 to 1969	8,254	369	210	159	215
1950 to 1959	2,465	106	57	49	137
1949 or Earlier	1,350	110	71	39	55
TOTAL	115,421	4,049	2,332	1,717	7,538
1979 to March 1980	41.8	44.1	44.9	43.0	49.9
1975 to 1978	36.5	30.2	30.9	29.3	40.3
1970 to 1975	11.2	11.2	9.7	13.3	4.3
1960 to 1969	7.2	9.1	9.0	9.3	2.9
1950 to 1959	2.1	2.6	2.4	2.9	1.8
1949 or Earlier	1.2	2.7	3.0	2.3	.7
TOTAL	100.0	100.0	100.0	100.0	100.0

(continued)

TABLE 3.4-4

(continued)

OWNER OCCUPIED HOUSING UNITS:	County	Koolauloa-North Shore Region	Koolauloa	North Shore	Wahiawa
1979 to March 1980	14,917	267	177	90	141
1975 to 1978	27,906	696	480	216	432
1970 to 1975	22,412	560	389	171	315
1960 to 1969	28,370	584	237	347	762
1950 to 1959	14,487	313	96	217	727
1949 or Earlier	6,701	117	31	86	348
TOTAL	114,793	2,537	1,410	1,127	2,725
1979 to March 1980	13.0	10.5	12.6	8.0	5.2
1975 to 1978	24.3	27.4	34.0	19.2	15.9
1970 to 1975	19.5	22.1	27.6	15.2	11.6
1960 to 1969	24.7	23.0	16.8	30.8	28.0
1950 to 1959	12.6	12.3	6.8	19.3	26.7
1949 or Earlier	5.8	4.6	2.2	7.6	12.8
TOTAL	100.0	100.0	100.0	100.0	100.0

2) Compared to the County, turnover in renter occupied units was also slightly higher in the Region during the fifteen month period preceding the census (44 and 42 percent respectively). However, the turnover was below that of the County during the four years period 1975 to 1978 (30 and 36 percent respectively).

3) Compared to both the County and the Region, the Wahiawa area had a higher turnover rate during the fifteen months preceding the 1980 census (38 percent) and during the four year period 1975 to 1978 (34 percent). The turnover for renter occupied dwelling units located in Wahiawa was even higher, with 50 percent of the units being occupied during the fifteen months preceding the census.

3.4.5 Other Descriptive Data

Table 3.4-5 presents descriptive data which compares housing in the study area with the County. The following describes the data:

1) The proportion of households comprised of families was relatively comparable on Oahu (77 percent) and the Koolauloa and North Shore areas (76 and 78 percent respectively). The Wahiawa area had a significantly higher percentage of households comprised of families (88 percent), reflecting in part the fact that the community is comprised of many young military personnel and their families.

2) In 1980, the County's occupied housing was approximately evenly distributed between owner- and renter-occupied units. In the Koolauloa and North Shore areas, owner-occupied housing comprised 39 and 40 percent, respectively, of the year-round housing units. In the Wahiawa area, they comprised 27 percent.

3) The average household On Oahu was 3.31 persons per household. In the Region, the average household size was larger. The Koolauloa, North Shore and Wahiawa areas, respectively, averaged 3.79, 3.46 and 4.05 persons per household.

4) The percentage of year-round housing units with no bathroom or a half bathroom was slightly higher in the study area (2.0 to 2.6 percent) compared to Oahu (1.9 percent).

5) The percentage of occupied housing units with 1.51 or more persons per room was significantly higher in the Koolauloa area (16 percent) than Oahu (four percent). In the Wahiawa area nine percent of the occupied housing units had 1.51 or more persons per room.

TABLE 3.4-5

Descriptive Housing Data

	Oahu	Koolauloa	North Shore	Wahiawa
Percent of Households Comprised of Families	77.3	76.3	78.1	88.4
Percent of Owner Occupied Year-round Housing Units	49.9	39.0	39.6	26.5
Average Household Size per Occupied Year-round Housing Unit	3.31	3.79	3.46	4.05
Percentage of Year-round Housing Units With No Bathroom or a Half Bathroom	1.9	2.6	2.0	2.5
Percentage of Occupied Housing Units With 1.51 or More Persons Per Room	4.2	15.9	7.2	4.9
Percentage of Renter Occ. Housing Units With 1.51 or More Persons Per Room	10.0	20.0	3.2	5.5
Percentage of Year-round Housing Units Built Prior to 1940	3.8	11.03	17.04	11.08
Percent of Occupied Housing Units With Heads of Households Over 65 years	13.2	13.7	18.1	9.1
Percent Of Renter Occupied Housing Units With Heads of Households Over 65 years	9.9	11.6	11.2	3.8
Single Person Households Over 65 Years	3.9	4.8	4.7	3.7

Source: 1980 Census of Population and Housing.

6) The proportion of renter occupied housing units with 1.51 or more persons per room was twice as high in the Koolauloa area (20 percent) than Oahu (ten percent). In Laie, 46 percent of the nearly 550 renter occupied units had 1.51 or more persons per room. In the Hauula area, 21 percent of the 389 renter occupied housing units had 1.51 persons per room. In the Wahiawa area less than six percent of the rental units were in this category.

7) Less than four percent of the housing units on Oahu in 1980 were built prior to 1940. This compares with 17 percent in the North Shore area, and 11 percent in both the Koolauloa and Wahiawa areas. The higher proportion of older homes in the study area reflects the relatively slower development patterns in these areas compared to the County as a whole.

8) The proportion of heads of households over the age of 65 years relative to all households was 13 percent in the County and the Koolauloa area, and 18 percent in the North Shore area. The proportion of heads of households over the age of 65 in renter occupied units relative to renter occupied units was ten percent in the County, 12 percent in the Koolauloa area, and 11 percent in the North Shore area.

9) The proportion of single person households over the age of 65 years relative to all households was almost four percent in the County and just under five percent in both the Koolauloa and North Shore areas.

3.4.6 Existing Housing Need Groups

There are presently several housing need groups in the study area. They include the elderly, low-income residents, and residents whose income qualify them for inclusion in the "gap group" residents. Additionally, immigrants residing in the Region and visitor industry employees are frequently regarded as a separate need groups for housing assistance. A final category of housing need would be related to the rehabilitation of older housing units. The following briefly described each of these.

Elderly Housing

Although the proportion of elderly persons 65 years and older is virtually the same in the Region as in the County, there are relatively higher concentrations in Kahuku and Waialua. However, the proportion of heads of households over 65 in rental units was slightly higher in the Region compared to the county. This in part reflects the concentration in the Kahuku area results from elderly residents remaining after the Kahuku plantation closed in 1971, and the concentration in Waialua is due in part to individuals

remaining in the area after retiring from employment at Waialua sugar plantation. In both cases, this is due to their long-term association with the community, but it is also believed to be due to relative lack of mobility with respect to changing employment and/or residence.

Generally, the housing needs of the elderly are for rental units, particularly with provision of health services. To date, elderly housing has been developed at Kahuku and at Haleiwa.

Low-income Housing

Low-income housing standards are based on both family size and income. Census data indicates that the Region, and particularly the Koolauloa area, have relatively high concentrations of individuals below the poverty standard compared to the rest of Oahu. Publicly assisted rental housing programs are directed towards serving the housing needs of low-income residents.

The relatively low household incomes in the Region effectively limits the demand for housing. Recent development activity in the Region at Haleiwa and Kahuku indicates that the demand for newly developed affordable income housing currently exceeds the supply. A representative of Oceanic Properties Inc., developer of the Paala Kai project near Haleiwa, estimates that there is presently sufficient demand to justify developing between 80 to 100 affordable housing units annually in the North Shore area.

Gap-group Needs

The "gap group" refers to households whose income is too high to qualify for low-income housing assistance and too low to qualify for conventional financing. The State's Hula Mae program is directed towards assisting the gap group.

Visitor Industry Employees

Visitor industry employees are generally perceived as a housing need group. Analysis of State Health Surveillance data indicates that families of hotel workers have incomes which are significantly below the average income for non-hotel employees on Oahu, Kauai and Hawaii but not on Maui (A. Lono Lyman, Inc. 1984). Visitor industry employees who qualify for housing assistance can benefit from existing public sector housing programs administered by the State and City. These include rental assistance programs as well as others that provide below market interest rates for home ownership.

Rehab-housing

"Rehab" housing refers to housing units in an area that are in need of being rehabilitated due to either their age or structural condition. Given that a relatively higher percentage of the housing units in both the Region and the adjacent Wahiawa area were built prior to 1940, a need for rehabilitation assistance would be likely to currently exist.

3.5 Other Local Land Uses

The discussion of other local land uses in the Region includes an overview of the State and County land use controls, followed by a discussion of the current land use patterns in the Region.

3.5.1 Overview of State and County Land Use Controls

The relative roles of the State and the Counties with respect to land use management are set forth in the State Land Use Law and administrative rules and regulations, and in the Standard Zoning Enabling Act.

The State Land Use Law, passed in 1961, stipulates that all the land in the State be classified under one of four land use districts: urban, rural, agricultural, and conservation. In the Urban District, counties have sole jurisdiction for land use planning and regulation through their general and community development plans, zoning codes, subdivision ordinances, and other land development related permit requirements. Joint State-County land management is found in the Rural and Agricultural Districts. The State has principal jurisdiction over the Conservation District.

Table 3.5-1 summarizes the distribution of acreage by State Land Use District. Although Oahu has 79% of the State's population, it has only 9.5% of the State's total acreage and 53% of the State's Urban District lands. Of Oahu's 385,300 acres, 87,006 are in the Urban District, 143,434 are in the Agricultural District and 154,860 are in the Conservation District.

According to the City and County of Honolulu Charter, all land use regulations, including zoning, must conform to existing development plans. The General Plan, which is adopted by resolution, has only advisory status. Specific zoning determines land use.

The City and County's population policies are interrelated with its land use management policies. These policies are embodied in the General Plan revisions approved in 1982 and the recently approved Development Plans. The two planning documents focus future development activity on Oahu in a "Primary" and a "Secondary" Urban Center. The Primary Urban Center encompasses the area Waialae-Kahala through Halawa-Aiea-Pearl City exclusive of census tract 83, the military controlled area between Ewa and West Loch. The Secondary Urban Center includes the Ewa-Makakilo and along with census tract 83.

In urban-fringe and rural areas, General Plan and the Development Plans limit development to maintaining these areas' 1980 proportion of the island-wide population. As a planning guideline, the most current population projections prepared by

TABLE 3.5-1
Acreage by State Land Use Districts
(January 1983)

Acreage:	Total Area	Urban & Rural	Agri-cultural	Conser-vation
City & County of Honolulu(1)	385,300	87,006	143,434	154,860
Hawaii County	2,573,400	36,175	1,227,894	1,309,332
Maui County:				
Maui	465,800	19,457	252,664	193,679
Lanai	90,500	5,058	47,239	38,203
Molokai	165,800	4,192	111,841	49,768
Sub Total	722,100	28,707	411,743	281,650
Kauai County				
Kauai	353,900	12,053	143,115	198,732
Niihau	45,700	_____	45,700	_____
Sub Total	399,600	12,053	188,815	198,732
State Total(2)	4,080,400	164,749	1,971,278	1,944,373
Percent Distribution:				
City & County of Honolulu(1)	9.5%	53.1%	7.4%	8.0%
County of Hawaii	63.8	22.1	63.8	67.3
Maui County	11.5	11.9	13.1	10.0
Kauai County	8.8	7.3	7.4	10.2
State Total(2)	100.0%	100.0%	100.0%	100.0%

(1) Excludes 888 acres of formerly submerged lands now used for the Reef Runway and South Ramp. The land was added to the State Land Use inventory and made a part of the Urban District in 1982. It should also be noted that Oahu does not have any land in the Rural District.

(2) Excludes Kahoolawe, Kaula and Lehua Islands and the Northwestern Hawaiian Islands, comprised of a total of 31,100 acres and no permanent residents.

Source: State Land Use data as of January, 1983.

the State's Department of Planning and Economic Development is to be used as a basis for defining future population allocations for the eight major Development Plan areas.

In July 1984, the State's Department of Planning and Economic Development (DPED) released its revised population projections, the M-F series which replace the II-F series prepared in 1978. DPED's M-F series is now used by the City's Department of General Planning as the population base for the allocation of population among the eight Development Plan areas. Table 3.5-2 shows the General Plan's population guidelines which are followed in allocating the population among the Development Plan areas. Based on the Department's present determination of the Development Plan capacities, shown in the second column, the Koolauloa areas' Development Plan capacity would be exceeded before the year 2000. The same column indicates that the North Shore area's Development Plan capacity would be exceeded sometime after the year 2000. The Koolauloa population allocation decreases between the years 2000 and 2005 from 14,811 to 14,318 due to a corresponding decrease in the area's pro rata share from 1.6% in 2000 to 1.5% in 2005.

Table 3.5-2 also indicates that the current Development Plan Capacity (956,700 residents) exceeds the DPED's M-F series projection for the year 2000 (925,700) by 21,000 residents or by only 2.3%. In 2005, Oahu's projected population of 954,500 is approximately the same as the current Development Plan capacity.

Table 3.5-3 presents alternative population allocations for Oahu based on DPED's "High" and "Low" population projections and the population distribution used by Department of General Planning in its year 2000 allocations. Based on DPED's "High" projection, Koolauloa's population allocation in 2000 would be 16,300 or approximately 1,500 more than the population based on the M-F series. The North Shore area's population would be 17,300 or approximately 1,600 more than the population based on the M-F series. The total population differential of 3,100 would justify over 1,000 additional units based on an average household size of 3 persons per unit.

Table 3.5-3 also presents historical population data, alternative scenarios based on the growth rates between 1970 and 1980, and the population per the Development Plan allocations. The following highlights the data presented in the table.

1) Historical census data indicates that the Koolauloa's population for the census district (which is not the same as the Development Plan area) has increased as a percentage of Oahu's total population since 1950. Further, the annual rate of increase in Koolauloa's population has exceeded Oahu's growth rate since 1950. The faster growth in the Koolauloa census district can be attributed to development that occurred in the Kaaawa-Punaluu area, and the growth in the Laie area resulting from the

TABLE 3.5-2

DISTRIBUTION OF POPULATION BY DEVELOPMENT PLAN AREA BASED ON THE GENERAL PLAN GUIDELINES AND DPED'S M-F ("Most Likely") PROJECTIONS

	1982 Estimated		Development Plan Capacity		Projected, 2000		Projected, 2005		General Plan Guidelines (%)
	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total	
Primary Urban Center.....	424,700	54.5	488,300	51.0	488,770	52.8	488,704	51.2	47.5 - 52.5
Ewa.................	36,000	4.6	81,800	8.6	81,462	8.8	82,087	8.6	9.0 - 10.0
Central Oahu........	104,800	13.5	127,900	13.4	127,747	13.8	127,903	13.4	12.8 - 14.2
East Honolulu.......	44,500	5.7	61,000	6.4	61,096	6.6	61,088	6.4	6.2 - 6.8
Koolaupoko..........	111,200	14.3	125,600	13.1	125,895	13.6	125,994	13.2	12.4 - 13.6
Koolauloa...........	11,900	1.5	14,500	1.5	14,811	1.6	14,318	1.5	1.3 - 1.5
North Shore.........	13,700	1.8	15,900	1.7	15,737	1.7	16,227	1.7	1.6 - 1.8
Waianae.............	31,900	4.1	41,700	4.4	41,657	4.5	41,998	4.4	4.2 - 4.6
TOTAL........	778,700	100.0	956,700	100.0	925,700	103.4	954,500	100.4	95.0- 105.0

Source: Based on Table 1, "Land Supply Review: Population Implications of the Development Plans," Department of General Planning, City and County of Honolulu, August 1984.

TABLE 3.5-3

Distribution of Population by Development Plan Area
Based on DPED's "High" "Most Likely" and "Low" Population Projections

	1982 Estimated		Development Plan Capacity		Based on DPED's High Projection for the year 2000		Most Likely Projection for the year 2000		Based on DPED's Low Projection for the year 2000	
	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total
Primary Urban Center.....	424,700	54.5	488,300	51.0	537,307	52.8	488,770	52.8	422,536	52.8
Ewa..................	36,000	4.6	81,800	8.6	89,551	8.8	81,462	8.8	70,423	8.8
Central Oahu........	104,800	13.5	127,900	13.4	140,433	13.8	127,747	13.8	110,436	13.8
East Honolulu.......	44,500	5.7	61,000	6.4	67,163	6.6	61,096	6.6	52,817	6.6
Koolaupoko..........	111,200	14.3	125,600	13.1	138,397	13.6	125,895	13.6	108,835	13.6
Koolauloa...........	11,900	1.5	14,500	1.5	16,282	1.6	14,811	1.6	12,804	1.6
North Shore.........	13,700	1.8	15,900	1.7	17,300	1.7	15,737	1.7	13,604	1.7
Waianae.............	31,900	4.1	41,700	4.4	45,793	4.5	41,657	4.5	36,012	4.5
TOTAL........	778,700	100.0	956,700	100.0	1,017,627	103.4	925,700	103.4	800,258	103.4

Source: Based on Department of General Planning, City and County of Honolulu, August 1984.

development of Brigham Young University and the expansion of the Laie Mormon community.

2) Contrasting the Koolauloa census district, the North Shore, or Waialua, census district has grown at a slower rate. This slower growth reflects the fact that a significant portion of the area's land in sugar production and is owned by a few large land owners, namely the Bishop Estate and Castle and Cooke. Land development by these land owners has been extremely limited.

3) The projected populations, shown in scenarios one and two, are based on the growth rates that occurred between 1970 and 1980. Scenario One, based on the 1970-80 growth rate, projects Oahu's population to be 1,227,000 in 2005, or 273,000 over the M-F projection. Scenario Two, based on 50% of the 1970-80 growth rate, projects Oahu's population to be 968,000 or approximately 14,000 more than the M-F projection. The combined Koolauloa-North Shore projected populations shown in Scenarios One and Two project that the regional population would be 41,400 and 31,300, respectively, in 2005. The Development Plan population allocation for the two areas based on the M-F projection indicates a population of 30,500. Based on the Development Plan population allocation, the regional growth rate would be reduced from the rates that occurred between 1960 and 1980.

The recently released M-F population series represents the State's third series of population projections in six years. Both the changes in the State's population projections and the changes in the population allocated by the County to the Koolauloa-North Shore area underscores the problems associated with using population projections as a criterion for policy decisions related either to land use or economic development.

It is important to remember that there are General Plan criteria other than population that would appropriately be considered in policy decisions regarding the Kuilima Resort's future development. These include objectives related to economic activity, jobs, and the provision of affordable housing.

3.5.2 Distribution of Land Uses

Table 3.5-4 presents the distribution of land uses on Oahu, based on the land use classifications used in 1983, the most recent date data is available, for real property tax assessment purposes. Approximately 136,750 acres of land are identified as being in agricultural uses, 75,300 acres in residential uses, 8,530 acres in industrial, 2,660 acres in commercial uses, and under 210 acres in hotel and resort uses.

TABLE 3.5-4

Distribution of Land Uses on Oahu
Based on the Land Use Classifications
Used for Real Property Tax Assessment Purposes
(March 1983)

	Acres	Dist.
Agriculture	136,751	36.9%
Conservation	146,987	39.7
Residential:		
Improved	38,068	10.3
Apartment	2,270	0.6
Unimproved	34,968	9.4
Subtotal	75,306	20.3
Industrial	8,532	2.3
Commercial	2,659	0.7
Hotel/Resort	210	0.1
TOTAL	370,445	100.0

Source: City and County of Honolulu, Department of Data Systems, unpublished tabulations as cited in "The State of Hawaii Data Book: 1983," Table 169.

The City's Department of General Planning indicates that there are 137 acres of residentially zoned land in the Koolauloa Development Plan area and 109 acres of similarly zoned land in the North Shore Development Plan area. The 246 acres of residentially zoned land in the Region is 5.4 percent of the County's residential zoned land. (City and County of Honolulu, Department of General Planning, August 1984. "Land Supply Review: Population Implications of the Development Plans.")

Commercial and retail uses in the Region are being analyzed by another consultant. It suffices to say that presently commercial-retail uses in the Region are limited with respect to both their variety and quantity. Existing sites include the commercial areas located in Haleiwa, Waialua, Laie, and Hauula. Additional development is located along the highway in isolated areas.

A review of the Department of General Planning's land use maps indicates that there is relatively little industrial zoned land in the Region. The largest industrial zoned site is occupied by the Waialua Sugar Plantation's mill. Smaller parcels of industrial zoned land are also located in Haleiwa and Laie. Additionally, there are non-conforming sites that have "grandfathered" industrial uses. The existing pattern of industrial land use in the Region is not uncommon. Typically, the need for industrial land in rural areas is minimal due to the limited variety of economic activities in the area. Additionally, except for sugar and pineapple processing, agricultural storage and production facilities can, under certain circumstances, be located on agricultural sites.

3.5.3 Implications of Limiting Land Supply

The scarcity and high price of developable land in Hawaii has been a subject of concern for many years. For example, in 1960, prior to the enactment of the Land Use Law, Hawaii's high land values was identified as one of the major concern related to housing. (Harland Bartholomew, 1960.) More recently, it has been noted that the high cost of housing on Oahu is basically the result of a long-standing and continuing imbalance between supply and demand. (Hitch, 1982.)

Economic theory suggests that if there is an ample supply of raw, unimproved land which can be converted from agricultural land and is reasonably near infrastructure, then, on the edge of an urban area, the prices and rents offered for such raw land zoned for an urban use should be about the same as prices for land zoned for an agricultural use. If this were not the case, and urban land prices and rents for raw land greatly exceeded those of agricultural prices and rents, then land owners and developers would seek to realize the profits to be gained by converting the agricultural lands to urban use, and this conversion would continue until the prices are brought into equilibrium. If

prices and rents for land in urban classifications greatly exceed prices and rents for land in agricultural uses, then this implies that the supply is restricted artificially by factors such as restrictive government policy and limited infrastructure development ostensibly designed to preserve prime agricultural land. In Hawaii, and particularly on Oahu, the evidence is that the supply of urban land available for single family residential development is severely restricted: prices and rents for urban land far exceed those for agricultural uses.

There are many factors which restrict the supply of land available for residential development in Hawaii. These include: (1) the fact that Hawaii is comprised of relatively small islands with mountainous interiors; (2) the use by the military of substantial acreage; (3) government land use regulations to conserve prime agricultural lands and encourage compact development which saves on government infrastructure and servicing costs; and (4) limited development of water, roads, sewers, and other infrastructure needed before housing development can proceed. With continuing economic and population growth and an increasing demand for a limited land supply, prices are bid up to increasingly higher levels, especially in central urban areas. Such increases are necessary for the efficient allocation of land, and are not "artificially inflated." (Plasch, 1983.)

The fact that the high land values preceded the enactment of the Land Use Law indicates that the law is not the sole--nor necessarily the major--cause of limitation on land supply relative to demand. However an empirical study of several metropolitan areas in Canada concluded that the most significant factor affecting the value of residential land was restrictions on land development. (Derkowski, 1976.)

No comparable analysis has been conducted to ascertain to what extent Hawaii's land use controls impact housing costs relative to other factors, nor has there been a comprehensive study quantifying the impact that limited residential land supply has on residential housing costs. However, several studies have offered evidence that limited supply has a significant impact on residential costs, particularly on Oahu. Federal Housing Administration (FHA) statistics are cited as reflecting this impact. The FHA statistics indicate that the difference has increased from roughly two and a half times in 1960 to five and half times in 1980. (First Hawaiian Bank, 1982.) The difference between residential lot values in Hilo and Honolulu has also been cited as evidence of the impact that limited land supply has had on Oahu residential land values. (Hitch, 1982.) Additional evidence is implied by the comparable trends for single-family homes on Oahu and San Francisco, an area which also has experienced rapid population growth and has a restricted land supply. (Plasch, 1983.)

3.6 Existing Resort and Relation to Community

This section describes (1) the historical and present development of Kuilima and (2) recent programs for involvement of the surrounding communities in the project.

3.6.1 Historical and Present Development

Kuilima Development Company (KDC), a subsidiary of Prudential Insurance, is currently the project's sole developer.

Originally, PIC Realty Corporation (a wholly-owned subsidiary of Prudential Insurance) and the Del E. Webb Corporation formed a joint venture in 1969 to undertake development of the 880-acre Kahuku property, which is partly owned by Prudential and partly leased from the Campbell Estate. In 1972, Del E. Webb's 487-room Kuilima Hotel opened and was managed by the Webb Hotels, a Las Vegas-based subsidiary of the Del E. Webb Corporation. Other on-site facilities included the golf course and club house, a riding stable, tennis courts, and the Kuilima Estates East and West condominiums.

Despite developer assurances that the new hotel would employ many former plantation workers, the initial hires disappointed the community. Hotel operators said the former workers lacked basic skills and qualifications. Although subsequent agreements led to the hiring of more ex-plantation workers, this experience generated a series of discussions among community leaders about the need to provide suitable training for Koolauloa/North Shore job-seeking residents. These discussions culminated in the 1978 establishment of the North Shore Career Training Corporation. The Corporation is primarily funded by Prudential and Campbell Estate but has also received substantial contracts and grants from both private and public funding sources to undertake various specific programs (North Shore Career Training Corporation, 1983).

In its first four years, the hotel experienced dismal occupancy rates, and Prudential assumed full control of the project in 1976 by purchasing the interest of its original joint venture partner. Prudential contracted the Hyatt Corporation of America to manage what then became the Kuilima Hyatt Resort Hotel, as well as the adjacent golf course. The year 1976 also saw the beginning of an effort by Prudential to win community and government approvals for development of the remainder of the property. It was felt that such additional development was needed in order to provide a sufficient amount and diversity of activities (i.e., a "critical mass" of facilities) to attract enough customers to make the operation profitable. In other words, the determination was that a single hotel would never constitute a viable resort "destination" by itself.

The Kuilima master plan has gone through several changes. The major proposal before the present one involved significantly

greater densities than envisioned under the current plan—i.e., seven hotel sites with 5,200 rooms; 2,070 condominium units; some 500 single-family homes and residential townhouses; and a 100,000-square-foot commercial development. (By contrast, the present proposed master plan involves four hotel or condo-hotel sites with 1,957 rooms; 2,063 resort condominium units, plus the residentially-designated Kuilima Estates; no single-family/town-house lots; and a 40,000-square-foot commercial area.) However, City approvals to date have only been for 2,000 visitor units. .

While occupancy rates at the existing hotel increased after 1970, the facility continued to operate without a profit. The hotel also suffered from frequent changes of its general manager under both of the first two operators, who employed a total of 15 general managers from 1972 through 1983.

Kuilima Development Company exercised an option in its contract with Hyatt, and Hilton Hotel Corporation was awarded the management contract in 1983. Hilton temporarily closed the hotel on July 31, 1983, to undertake renovations for the renamed "Turtle Bay Hilton and Country Club." At that time, 360 employees were terminated but assumed they would be rehired in time for the new hotel's opening scheduled for February 1984.

Interviews for job openings for the Turtle Bay hotel were conducted in mid-November 1983. More than 2,500 people applied for the openings. Approximately 400 people were hired, including 230 who were employees at the time of the Hyatt closing. This meant that 130 former employees were not rehired. The non-rehiring of these former employees became a major issue in the community. A group called the United Kuilima Workers formed and appealed to area government officials, certain unions, and the communities to assist them in getting their jobs back. On January 14, 1984, the United Kuilima Workers were joined by members of the Hawaii State Labor Council and several area legislators in protest of the non-rehiring of former employees.

A picket line was set up and continued until February 11, 1984. That date marked the signing of an agreement between the United Kuilima Workers, Turtle Bay Hilton, and Kuilima Development Company. All parties agreed to the establishment of a "Dislocated Workers Program," which was designed to create a pathway to full-time employment at the Hilton for the non-rehired former employees.

This program—which cleared the way for Hilton's opening—called for participants to be paid a salary comparable to that of their previous employment while performing various forms of community-oriented service work. The North Shore Career Training Corporation has administered the program, which is being funded by Prudential at an estimated cost in excess of $400,000.

For its part, the hotel agreed to rehire participating workers when a position opened, providing the workers were qualified. Of the 130 original non-rehired workers, 53 elected to participate in the Displaced Workers Program (with the remainder either not interested, often because they had already found other work, or not qualified because they had been just on-call or part-time in 1983). As of this writing (November 1984), all of the workers have either been rehired by Hilton, offered equivalent positions, or found satisfactory alternate work.

3.6.2 Community Interaction and Involvement

Kuilima Development Company and its predecessors have been significantly involved in community affairs, particularly in Kahuku, since the project began. The community interaction has had mixed results, however. In the key informant interview process carried out for this report (described in further detail in Section 3.7.5), residents of some communities praised the developer's efforts over the years, while others were sharply critical of "hired-gun" community liaison personnel and of a perceived pattern of "poor communications." This difference in viewpoint may largely reflect a basic underlying split both in philosophies and in economic interests which differentiates those who emphasize economic growth vs. those who wish to "keep the country country." However, other factors may also be at work. The developer's repeated series of permit applications to the City has necessitated a repeated series of community presentations, causing some residents to feel cynical about "still another plan" and still other residents to feel simply confused by the changes over time. Also, until last year, the developer's community interactions largely focused on presentations _to_ the community rather than obtaining early input _from_ the community.

In November 1983, the Kuilima Development Company took a new tack by establishing the "Kuilima/North Shore Strategy Plan Community Advisory Committee," or North Shore Strategy Committee for short. The committee's overall purpose is to formulate a self-help community economic development strategy for the Koolauloa/North Shore area by attempting to capture as much of the employment and spin-off business development from the Kuilima resort for the local region as is possible.

However, committee members have decided to direct much of their energy toward providing input for the new proposed master plan, which was not yet in existence at the time of the first meeting a year ago. Their original recommendations and reactions to initial proposals are responsible for much of the current development concept. The Committee continues to provide planning input on matters such as the proposed park at Kawela Bay, establishment of the marsh as a bird sanctuary, public access to the coast, traffic considerations, and design options.

The membership of about 40 persons include business representatives, government officials, and citizen delegates from the following communities and groups:

--_Kaaawa_ (three representatives, including the chairman of the Koolauloa Community Council and a member of the Koolauloa Neighborhood Board)

--_Punaluu_ (two representatives, including the chairman of the Koolauloa Neighborhood Board and the Punaluu Community Council)

--_Hauula_ (four representatives, including the chairman and another member of the Hauula Community Association, the chairman of Kunani-o-Hauula, and Committee member for the United Kuilima Workers)

--_Laie_ (two representatives, including the Laie representative on the Koolauloa Neighborhood Board)

--_Kahuku_ (four representatives, including a Koolauloa Neighborhood Board member and officers of the Kahuku Community Association, Kahuku Hospital, North Shore Career Training Coorporation, and Kahuku Housing Corporation)

--_Kuilima_ (three representatives, including presidents of the Kuilima Estates East and West Homeowners Association and a Koolauloa Neighborhood Board member)

--_West Kawela Bay_ (three representatives, all members of the West Kawela Bay Homeowners Association)

--_Sunset Beach/Pupukea_ (two representative, including the president of the Sunset Beach Community Association)

--_Haleiwa/Kawailoa_ (two representatives, including present and immediate past presidents of Haleiwa Community Association)

--_Waialua_ (two representatives, including chairperson of the Waialua Community Association)

--_Business Community_ (representatives of 16 businesses or institutions: Polynesian Cultural Center, Waimea Falls Park, Turtle Bay Hilton, Zions Securities, BYU-Hawaii, Kahuku Hospital, North Shore Realty, Campbell Estate, North Shore Career Training Corp., Marine Culture Enterprises, Kahuku Sugar Mill, Oceanic Properties, Kahuku Farmers Association, Hanohano Enterprises, Kaya's General Merchandise, and Bank of Hawaii)

--_Government Representatives_ (Sen. Charles Toguchi, Sen. Gerald Hagino, Rep. Joe Leong, Councilman Toraki Matsumoto, Councilman David Kahanu)

(NOTE: The above represents membership as of early 1984. In recent months, there have been informal additions, including the chairman of the North Shore Neighborhood Board.)

Beginning in December 1984, Kuilima Development Company plans to mail to each resident of the Region a monthly or bimonthly newsletter informing them of the project's status and providing answers to frequently encountered questions.

3.7 Community Needs, Values, and Issues

The purpose of this section is to provide a social context for the impact assessment of the following chapter through analysis of the current community's needs, values, and issues--both those which are independent of the proposed project and those which are more directly relevant. Sources for this analysis will include documented policy statements of government and of community groups; survey data; and results of recent key informant interviews.

3.7.1 Statewide/Islandwide Perspectives on Resort Development

While there were a number of studies in the 1970's about concerns and issues regarding tourism development, they are now primarily out of date and few contemporary studies are available. The most recent are the 1981 *State Tourism Plan Technical Reference Document* (State of Hawaii, Department of Planning and Economic Development, 1981a), the *Hawaii State Plan Survey* conducted the same year (State of Hawaii, Department of Planning and Economic Development, 1981b), and a University of Hawaii survey study on residents' perceptions of tourism impacts (Liu and Var, 1984).

The *Tourism Plan Technical Reference Document* identifies three "primary factors" by which tourism growth produces social impacts (State of Hawaii, DPED, 1981a, pp. 48-54):

- *Creation of Jobs*, with implications for reduced out-migration, lower unemployment costs, improved family stability from reduction of economic stress, but also the possibility of family disruptions when previously non-working wives enter the labor force.

- *In-Migration of New Workers*, with implications for increased population, need for new infrastructure, and cultural adjustments between residents and in-migrants.

- *Increased Visitor Population*, with implications for:

  --social interaction between residents and visitors;

  --perpetuation of local arts and handicrafts;

  --changes in lifestyle and standard of living;

  --erosion of "Aloha Spirit";

  --impaired resident access to coastal areas;

  --competition for public facilities and resources;

  --pressures on open space and agricultural lands;

--cost of living and property values;

--crime; and

--population increases, and need for employee housing.

Public perceptions on these issues were tested in a limited way in the last State Plan Survey. (NOTE: An updated State Plan survey is to be conducted in 1984.) In that 1981 statewide survey, respondents were first asked whether Hawaii should continue to promote tourism as the state's major industry or whether more effort should go into developing other industries to provide a more diversified economic base. Statewide, 41% favored continued emphasis on tourism, with 56% wanting to develop other industries instead; Oahu results were essentially identical (State of Hawaii, DPED, 1981b, pp. 48-49).

Respondents were then asked to select among limited options the three most important reasons for emphasizing tourism and the three most important reasons for wanting to develop other industries. As shown by Table 3.7-1, the primary reasons for public support were tourism's dollar and employment contributions to the local economy. In Table 3.7-2, it may be seen that primary reasons for developing other industries involved fears of over-dependence on tourism; resident concern with social costs such as crime, beach access, or low job quality were relatively low in this context.

The final recent study was a 1982 statewide mail-out survey (Liu and Var, 1984), results of which have been jointly published by the University of Hawaii School of Travel Industry Management and the Social Science Research Institute. (The same publication series contains a review of academic literature on perceived impacts of tourism throughout the world--see Kendall and Var, 1984). The sample size was 636, which represented a return of 21.2% of the 3,000 mailed to randomly-selected mailing addresses. Mail-out surveys are often subject to a strong bias in favor of better-educated people and others who are comfortable with written materials; the authors report such a bias was observed but claim that it does not affect validity of results due to the low relationship between demographic variables and perceptions of tourism impact in Hawaii.

Table 3.7-3 shows results for those questions which focused on perceived effects and impacts of tourism development in Hawaii. The major pattern of these results can be described as follows:

o Respondents strongly agreed that tourism provides important economic benefits in regards to jobs, infusion of cash into the economy, and increased standard of living.

TABLE 3.7-1

Public Opinion: Reasons to Emphasize Tourism -- 1981

"Here are some reasons people might have for wanting to continue to support tourism as Hawaii's major industry. Please select the three that you think are the best reasons."

	percent mentioning State	percent mentioning Oahu
tourism brings lots of money into the State	62	63
a lot of money has already been invested in tourism, and a lot of people have jobs there	55	57
tourism is the best hope for future jobs for Hawaii residents	49	46
because of its beauty and good climate, Hawaii is a natural place for tourism	49	51
because of tourism, private businesses will invest money in the State that they wouldn't otherwise	35	34
tourism provides residents not only with economic activity but with social activity as well	29	29
tourism does not pollute the air or water like some other industries might	19	19

Source: State of Hawaii, Department of Planning and Economic Development, 1981b, pp. 50-51.

TABLE 3.7-2

Public Opinion: Reasons to De-Emphasize Tourism — 1981

"Here are some reasons people might have for wanting to develop other major industries that might cut down our dependence on tourism. Please select the three that you think are the best reasons."

	percent mentioning state	percent mentioning Oahu
it's bad to depend on just one industry	69	71
tourism has too many ups and downs, which is bad for the State's economy	48	48
tourism promotes overdevelopment and takes too much land	37	35
over the long run, Hawaii may become less popular as a tourist spot	33	34
tourism promotes development that benefits non-residents rather than residents	32	31
tourism encourages crime	28	28
tourism development makes it difficult for residents to use an area for fishing, swimming, surfing, and so on	19	16
tourism provides fewer management or professional-level jobs	15	16
tourism provides lower paying jobs	10	10

Source: State of Hawaii, Department of Planning and Economic Development, 1981b, pp. 52-53.

TABLE 3.7-3

Hawaii Residents' Strength of Agreement with Various Statements About Perceived Tourism Impacts

Strong Agreement (75% + "agree")	Agreement (61%-75% "agree")	Equivocal Agreement (40%-60% "agree")	Lack of Agreement (25%-39% "agree")	Strong Lack of Agreement (0%-24% "agree")
economic effects				
--created more jobs --attracts investment, spending --increased standard of living in Hawaii	(none)	--increased prices for goods and services	(none)	
social/cultural effects				
--created great variety of entertainment --educational benefits from meeting tourists --encourages residents in a variety of cultural activities (crafts, arts, music, etc.)	--led to more prostitution	(none)	--increased crime --harder to get tickets for theater, concerts, sports --exploitation of native Hawaiians --increased drug use	--tourism detrimental to "cultural identity"
physical/environmental effects				
(none)	(none)	--tourists add to Honolulu traffic problems --more parks and other recreational areas for residents --roads and public facilities kept at higher standard --no tourist contribution to decline in ecological environment --more vandalism	--overcrowding of local beaches, parks, etc.	--public parks less peaceful, tranquil

Source: Liu and Var, 1984, selected findings

- However, there was less agreement as to whether tourism has contributed to an increased cost of living in Hawaii. To the extent that opinions are divided, this may be considered an "issue" in the public perception.

- In regard to socio-cultural impacts, there was strong agreement that tourism has made positive contributions in areas such as cross-cultural exposure and education, entertainment, promoting arts and crafts, and, on the negative side, prostitution. There was also general lack of agreement with most allegations of negative social impacts (other than prostitution)--e.g., overall crime, exploitation of native Hawaiians, etc.

- As for the physical/environmental effects listed in the questionnaire, there was split response over most items, both positive and negative--e.g., increased traffic or increased public facilities such as parks.

While the survey measured agreement with various propositions about tourism impact, it asked only in very general ways about the perceived importance of impacts. The few questions of this type indicated that the types of social benefits which won substantial agreement (exposure to the culture of visitors) were, however, rated less important than "social costs" from tourism, which in turn were rated less important than the economic benefits. However, protection of the environment was considered even more important than tourism's economic benefits (although respondents also said they would be unwilling to lower their standards of living to achieve environmental protection). These findings were based on very few questions, and the area of perceived significance of tourism impact is one which still needs further survey research.

Sample sizes for both the State Plan and the University of Hawaii surveys were not large enough to permit breakdown of results for smaller areas such as the North Shore or Koolauloa. Only one major survey research effort in the last six years permits a comparison answers from respondents in the Koolauloa/North Shore Region with results from the rest of the island--the 1978 City Development Plan surveys.

3.7.2 Development Plan Surveys

As part of its effort to prepare Oahu's Development Plans, the City and County Department of General Planning conducted in-person random-sample surveys (SMS Research, 1978a) to determine community attitudes and priorities on a number of issues directly addressed by the Development Plans. Survey results are now six years old; however, no more recent polling efforts offer the broad range of questions and comparability of results across different parts of Oahu which are provided by these surveys. In each of ten different Development Areas comprising the island of

Oahu, 400 respondents were asked (1) a series of questions which remained identical from area to area; and (2) a series of questions unique to each area, drawn up with the assistance of the area's Development Area Organization, citizen involvement committees drawn largely from Neighborhood Boards in the region.

Despite the advantages of using these data, results should be viewed with some caution, due both to their age and several other factors:

- Questions focused primarily on land use and dealt little or not at all with socio-economic issues such as crime or employment. For example, there were no direct questions about need for economic development, which may have reflected the relative economic prosperity of that year.

- The limited number of demographic items makes it difficult to check against Census data and evaluate the true representativeness of the sample.

None of the Development Plan Survey questions dealt specifically with Kuilima. However, a number of questions dealt with issues clearly linked to resort development in the area--e.g., housing, population, land use trade-offs, etc.

Islandwide Questions About "Important Problems": Table 3.7-4 presents major results from the questions asked in all parts of Oahu. To provide a context for evaluating the Koolauloa and North Shore results, the table also shows data for Waianae (another rural but noncontiguous part of the island) and total Oahu results. Some key conclusions from this table:

- The need to preserve agricultural land was a greater concern in all three rural areas than for the island as a whole. It was particularly important for Koolauloa, where it attained the highest priority among the sample respondents. In the rural areas, ag land preservation was clearly a greater concern than simply preserving scenic areas, whereas the two had equal weight for the islandwide sample.

- However, concern over population growth was then much lower in Koolauloa than most other places, including the North Shore. Similarly, traffic for Koolauloa residents was important, but not as important as for people elsewhere.

- The need for affordable housing was then somewhat less in the rural areas than other parts of Oahu, although it still ranked among the top three problems.

- Distance from jobs--the sole question in the series pertaining to economics--was then less of a problem for respondents in Koolauloa or the North Shore than in Waianae.

TABLE 3.7-4

Development Plan Survey Results on Top Community Problems

Following are percentages naming each problem as one of the three "most important" facing respondents' own local areas. After reviewing 41 cards containing possible problem and rating the importance of each, respondents were asked to look at those they had named "very important" and select the three "most important." This table reproduces items which ranked (according to percentage frequency) either in the "Top Ten" for one of the three rural areas or in the "Top Seven" for the total Oahu sample.

	Total Oahu		Koolauloa		North Shore		Waianae	
	percent	(rank)	percent	(rank)	percent	(rank)	percent	(rank)
not enough affordable housing	33	(1)	27	(2)	19	(3)	29	(2)
too much traffic	24	(2)	19	(3)	25	(1)	13	(6)
too many high-rises	14	(3)	6	(13)	8	(11)	6	(13)
population of area growing too fast	13	(4)	7	(12)	14	(5)	11	(10)
need to save agricultural land	12	(5)	28	(1)	20	(2)	20	(3)
need to protect scenic, natural areas	11	(6)	18	(4)	17	(4)	13	(6)
more bus service	11	(6)	9	(9)	11	(9)	12	(8)
streets need paving, repair	10	(8)	12	(5)	8	(11)	14	(5)
hospitals, doctors too far away	9	(9)	11	(6)	13	(6)	38	(1)
pollution in streams, ocean	9	(9)	9	(9)	7	(15)	3	(22)
jobs are too far away	5	(14)	9	(9)	8	(11)	20	(3)
bad drainage, flooding problems	5	(14)	10	(7)	8	(11)	12	(8)
need to save historic buildings, places	4	(18)	5	(16)	12	(7)	4	(21)
need to save views of the ocean	4	(18)	6	(13)	9	(10)	6	(13)
need for sewer improvements	3	(27)	10	(7)	12	(7)	6	(13)

Sources: SMS Research, 1978a, 1978b, 1978c, 1978d

Questions Unique to Study Areas: A difficulty with the area-specific questions devised by community groups is that most (except for a few on the North Shore survey) featured response formats of "very important," "important," or "not important," rather than "agree" or "disagree." This was problematic because most of these questions were about possible _policy positions or actions_ (as opposed to the _needs_ addressed in the islandwide list), and the response format did not explicitly allow people to express _disagreement_ with any proposal. (If an "opposite view" was volunteered, this was recorded, but no more than four percent ever volunteered such opposite views.) This means that responses of "not important" _could_ be interpreted as "disagreement," and that responses of just "important" (as opposed to "very important") _could_ be interpreted as "no strong feelings."

With this very strong caveat about the meaning of results, the questions and responses of most apparent relevance to Kuilima included the following:

- Of 10 questions unique to the Koolauloa survey, the one which received the highest number of "very important" responses (56%) was the item, "Preserve the rural way of life in this area."

  However, the items which received the highest number of "not important" responses were:

  --"put a limit on development of tourist attractions" (30% not important plus 4% opposite view, vs. 28% very important);

  --"limit the growth of population in this area" (30% not important plus 2% opposite view, vs. 31% very important).

  Thus, Koolauloa residents as of 1978 were fairly united about wanting to preserve a rural lifestyle, but were much more divided about specific anti-development actions such as limiting tourism or imposing population caps.

- North Shore residents, on the other hand, voiced only 11% agreement and 85% disagreement with the proppsal "build more hotels in the North Shore area."

  Of 10 questions posed in the "very important/not important" format, the most popular proposal was the item, "control development in the North Shore area" (55% saying very important). Second was "keep the North Shore mainly rural with agriculture and recreation" (49% very important). However, the importance of agriculture was apparently based more on open space than economics, since there was less enthusiasm for the proposal "have more agriculture in this area" (30% _not_ important vs. 28% very important).

3.7.3 Neighborhood Board Mail-Out Surveys:

General Topics and Concerns: In 1979, the Koolauloa Neighborhood Board mailed out a survey which simply repeated a number of the Development Plan Survey questions. Only 67 responses were obtained, rendering results of little value. This Neighborhood Board did another mail-out survey in 1983, but again received very few returns (about 130 out of 3,520 mailed) with no demographic items to measure sample validity.

In 1982, the North Shore Neighborhood Board conducted a "mini-survey" consisting of six items. Since all of these dealt with reactions to specific development proposals, including a previous Kuilima expansion plan, discussion will be deferred to the next paragraphs. The North Shore Board also sponsored a very lengthy 1984 mail-out survey with numerous questions about community needs. However, results had not yet been compiled at the time of this writing.

Questions About the Kuilima Project: The North Shore Board's April 1982 "mini-survey" posed a question about attitudes toward a previous proposal for expanding the Kuilima project (to an extent greater than in the present proposal), although the wording suggested that the "hotel" alone was to be expanded. This survey was sent to approximately 5,000 area households, with a fairly respectable return rate of about 19%. No questions were asked about demographic characteristics, so the representativeness of the results cannot be evaluated.

Results for the Kuilima question are reproduced in Table 3.7-5, in the context of results for the other five questions on the survey.

Table 3.7-5 indicates only one of the six proposals won majority support from the sample. The Kuilima proposal of that time, as worded for the survey, was opposed by a plurality. Of the six items, the Kuilima question had the highest proportion of respondents saying neither "for" nor "against," but indicating either apathy or uncertainty.

The 1984 North Shore Neighborhood Board survey also contained a question on Kuilima (confusing the hotel with the overall resort complex), as follows:

> The Turtle Bay Hilton (formerly Prudential/Kuilima) project is planning to expand its number of rooms by approximately 500 to 2000 units over the next twenty years. Are you in favor of this expansion. YES ____ NO ____

Note that the question apparently applies more to attitudes about expansion already allowed under the present Development

TABLE 3.7-5

Results of 1982 North Shore Neighborhood Board "Mini-Survey"

"What is your position on..."	number answering	FOR %	AGAINST %	DON'T CARE %	NOT SURE %
a four lane Kamehameha Highway for Wahiawa to Haleiwa?	(823)	51	38	2	9
the proposed 4700 room expansion of the Kuilima Hotel?	(807)	33	45	10	13
fast foods and 7/11 stores in Haleiwa?	(804)	30	60	8	3
the subdivision of agricultural land into 2 acre farm lots at the old Dillingham Ranch (Mokuleia Homesteads)?	(836)	25	57	5	14
the proposed general aviation airport at Poamoho?	(817)	20	65	5	10
Sullivan's Cultural Park at Pupukea?	(840)	18	70	5	7

Source: Percentages computed by Community Resurces, Inc., based on original numbers supplied by Neighborhood Commission, City and County of Honolulu.

Plan than to the proposed additional expansion. Again, results have not yet been compiled as of this writing. It should be noted that this survey (unlike the 1982 questionnaire) contained some questions about respondents' demographic characteristics, so it may be possible to evaluate the validity of the survey's results, when available, by comparing the sample characteristics with known demographic traits of the overall population obtained from the U.S. Census.

3.7.4 Community Group Issues and Positions

General Issues Being Discussed in Area Neighborhood Boards: Because of the large number of community groups in the Region, analysis is limited to the two Neighborhood Boards (No. 28, Koolauloa, and No. 27, North Shore). The socio-economic consultants reviewed minutes of meetings held during the past year (September 1983 through August 1984) by both Boards to provide a flavor of the topics of recent concern. The following list of topics is not intended to be a complete enumeration of all subjects of discussion, but rather an overview of those issues which give a sense of the major concerns (as indicated by lengthy or repeated discussion).

In this past year's activity, it may be observed that the Koolauloa Board dealt more with general land use issues, in part because there were more proposed changes. The North Shore Board has focused more on specific commercial and residential proposals in the context of the new Haleiwa Scenic Design District.

Koolauloa Neighborhood Board No. 28 Topics

- Kahana Valley: Implementation by the State of the long-planned "living cultural park" and participation by the Neighborhood Board on a State Advisory Board.
- Displacement of Kuilima Workers: Discussion on non-hiring of some former employees in transition from Hyatt to Hilton; exploration of hotel's application for Honolulu Job Training Program funds and subsequent City denial.
- Zoning Code Violations at Texas Paniolo Restaurant and luau activities at Hale Kamala in Kaaawa.
- Development Plan annual review package.
- Kakela Beach proposal to build 115 homes in $200,000 range on present private park land.
- Malaekahana Park: proposal to redesignate some land from Park to Residential.

- Water Issues, including:

  --proposed State Water Code;
  --Kaluanui Wells in Kaliuwaa State Park and proposed redistribution of water;
  --modification of Kahawai Nui Stream.

- Proposed Kahuku Shrimp Farm and possible impacts of discharge of chemicals.

- Maintenance of Public Parks, particularly the Hauula Beach Park pavilion which was scheduled for improvement and subsequently collapsed.

North Shore Neighborhood Board No. 27 Topics

- Haleiwa Theater Demolition and its legality.

- Haleiwa Scenic Design District: implementation of recent ordinance to assure control of architectural character.

- Proposed McDonald's for location on old theater site.

- Convenience Store (7-11) Construction on old theater site without notice to Neighborhood Board.

- Redesignation of "Holt Property" at Puaena Point from Agricultural to Residential.

- Oceanic Properties Proposal to build 300 affordable homes on 65 acres near Ranch Camp in Waialua.

- New Waialua Church on agricultural land.

- "High Tech" Training Facility proposed for Sunset Beach by Pacific Electrical Contractors Association and International Brotherhood of Electrical Workers.

- Traffic Problems, particularly at Wilson Crossing, located on Kamehameha Highway and used for crossing of cane haul trucks.

Positions Taken on the Kuilima Proposal: Support for the project has been voiced by the associations of most communities near to the project site. Opposition has come from the Kaaawa and Punaluu community associations. The Koolauloa Neighborhood Board takes a mixed position, and the North Shore Neighborhood Board as of this writing has yet to take a position on the current proposal.

The Koolauloa Neighborhood Board in its September 13, 1984 meeting voted to support the proposed 90-foot height limit (up from 70 feet); the redesignation from Residential to Resort for the Kawela Bay hotel sites; and to allow construction of the golf course and the establishment of the marsh as a bird sanctuary. The Board opposed a blanket change of the beach setback from 300 feet to 100 feet, but indicated the 100-foot setback would be permissible for Kawela Bay. The Board has also taken the position that 2,000 resort units are sufficient and that the proposed apartment units are unnecessary since they will generate little employment.

In December of 1983, the North Shore Neighborhood Board took positions essentially in opposition to the old, higher-density proposed plan still being discussed at that time. Since the new proposal has emerged, the Board has maintained liaison with the North Shore Strategy Committee but had yet to take any formal position as of November 1984.

Based on correspondence to the City Department of General Planning, these are known positions taken by other groups:

Organization	Position	Other Comments
Haleiwa Community Assn.	Support	
Hauula Community Assn.	Support	
Kaaawa Community Assn.	Oppose	
Kahuku Community Assn.	Support	
Kahuku Hospital	Support	
Kahuku Housing Corp.	Support	
Koolauloa Lions Club	Support	
Kuilima Estates East	Support	
Kuilima Estates West	Support	
Kunani-O-Hauula	Support	
Laie Community Assn.	Support	With condition that development supports Laie recreation, education, and job training.
North Shore Career Training Program	Support	

Punaluu Community Assn.	Oppose	
United Kuilima Workers	Support	
West Kawela Bay Home-owners Assn.	Support	With recommendation that proposed Kawela Park be located away from West Kawela Bay and between two East Kawela hotels.

3.7.5 Key Informant Interviews

In addition to the somewhat limited and dated survey data, as well as the evidence about Neighborhood Board and other community group positions, it was considered desirable to have a more up-to-date picture of concerns held by a wider spectrum of Region residents. Because time constraints ruled out an updated sample survey for inclusion in this EIS, the socio-economic consulting team interviewed approximately 35 "key informants"--i.e., persons believed to have a particularly good grasp of community issues, either because they were leaders of area organizations or because they held positions enabling them to develop particularly good understandings of community dynamics (e.g., school principals, police, area social workers). Initial contacts were selected on the basis of variety--choosing known leaders from different communities, different ethnic groups, and different value orientations in regard to growth vs. no-growth. Subsequent contacts were based on a "chain" technique of referrals, by which earlier informants recommended additional informants.

The principal disadvantages of the key informant technique are perhaps obvious: the views obtained are not necessarily representative of wider community attitudes, and informants may tend to make referrals to other persons who hold similar views. At the same time, the technique has some significant advantages: it allows much more thorough exploration of the chain of logic which underlies attitudes; there is time for a more complete explanation of views and concerns; and the resulting aggregate information allows for a fairly good understanding of issues as perceived by community leaders (if not necessarily the wider public).

Some informants expressed great concern over the confidentiality of their identities (primarily in regard to questions about community dynamics and views on the proposed Kuilima expansion). Therefore, assurances were made that informants would be anonymous, both for purposes of this report and in terms of nondisclosure of identity to the developer.

Needs and Issues Not Directly Tied to Kuilima: Following are the major themes which turned up in numerous key informant responses to questions about general community needs and issues:

- Overview of General Value Differences: Strong differences emerged in overall attitudes toward the need for economic development vs. the need to "keep the country country." Although a few leaders attempt to mediate and bridge the gap, the general feeling from the interviews was one of sharp polarization rather than polite disagreement; spokesmen for each camp tended to speak bitterly and disparagingly of the opposing view (and sometimes the opposing personalities). Such comments are carefully controlled in public settings, but they were a strong theme in these one-on-one interviews.

  There was a tendency for the divisions of philosophy to be correlated to divisions in geography and ethnicity. Support for economic growth was strongest among leaders of settlements which were most hard hit by the Kahuku Plantation closing--Kahuku (particularly the old portion), Laie, and Hauula. Communities which are composed less of settlements and more of scattered rural homes (farms, kuleanas, beach homes, cottages, etc.) are most likely to oppose further development--e.g., Kaaawa, Punaluu, and the Sunset/Waimea area. The leadership of Haleiwa and Waialua are more divided, with Haleiwa people listing in the direction of <u>controlling</u> (but not necessarily stopping) growth and Waialua people being most concerned about ensuring that new development supports rather than harms the existing plantation economy.

  The ethnic divisions in opinion tend to match the geographical distinctions, since many ethnic groups tend to be found more in some communities than others. Enthusiastic pro-growth orientations are perhaps strongest among Filipino and South Pacific peoples; more cautious pro-growth feelings, among the Oriental leaders; and anti-growth sentiments, among Caucasians. Native Hawaiians tend to be sharply split, depending to some extent upon whether they are part of a settled community or lead a more isolated and self-sufficient rural lifestyle.

  In fact, much of the division seemed to have to do with whether people felt a historic sense of "community" which they fear is being threatened through economic decay, or whether their ultimate attachments had more to do with self, family, and direct contact with nature. Pro-growth leaders often bitterly allege that the split boils down to the "Have's" versus the "Have-Not's." Our fieldwork would suggest, however, that a more appropriate distinction is between those "Contented" with the lack of further economic development (including both the "Have's" whose livelihood is more rooted in the overall islandwide economy and also those

"Have-not's" who are happy with a more independent and subsistence-type lifestyle) versus those "Threatened" by limited economic opportunities (largely people who identify with a community and whose history of gradual socio-economic progress within that community is now at stake).

Both groups have formed strong social ties in the area, although those of the Threatened have more to do with some sense of historical identity. And both groups emphasize that they have made, and are willing to continue to make, economic sacrifices in order to live in the "country" (as the Contented are more likely to call it) or in "this community" (as the Threatened are more likely to say). The difference is that the level of localized economic activity is uncomfortably low for the Threatened, while it is an appropriate deterrent to overpopulation from the perspective of the Contented.

- Outmigration of Youth: This is one of the major sub-issues contributing to the overall difference just discussed. Pro-growth leaders believe that much youth outmigration is tied to the lack of local employment opportunities. They acknowledge that some young people would move away for personal reasons whether or not there are many local jobs, but they said many of those who have gone have expressed an interest in returning but cannot. Anti-growth leaders believe that it is natural for the great majority of young people to outmigrate. They feel that people who are climbing the socio-economic ladder will find more opportunities in Honolulu or on the Mainland, and they are unwilling to sacrifice the "country" ambience to provide job opportunities which they doubt will go to local-born youths. The latter viewpoint is a particularly threatening one to pro-growth leaders, for whom the continuity of family and the continuity of community are very intertwined.

- Recreational Facilities and Youth Programs: Both pro-growth and anti-growth spokesmen tend to agree there is a need in the Region for more youth programs and recreational facilities. The lack of City active-use parks and playing fields is a particular issue in the communities of Kahuku, Laie, and Hauula, where the adult population is also deeply involved in baseball, soccer, rugby, etc. The planned Kahuku District Park will someday be of value, but Laie and Hauula also want their own facilities.

- Schools/Vocational Training: Particularly in Koolauloa, there is concern about the quality of public education and the need for additional training to prepare young people for jobs. There is a feeling that many youths, especially males, emerge from school still lacking basic social and language skills which may be required in almost any form of employment.

- Traffic: Throughout the entire Region, the Kamehameha Highway is a two-lane arterial, and many of the houses in the strip-development communities are close to the highway. Buses--particularly the evening peak-hour cavalcade of tour buses through Koolauloa to or from the Polynesian Cultural Center--have created noise, interference with television reception, and frustratingly slow driving conditions.

- Housing: The housing supply is a problem throughout the area, but most particularly in Koolauloa (where the Development Plans have clamped tight lids on further housing development) and even more particularly in Laie (where large extended families increasingly must share units rather than spread over several nearby houses).

- Water: Community leaders are apprehensive about what they perceive to be the City's plans to transport water to leeward Oahu to support the future Ewa/West Beach development. Anti-growth leaders do not mind the water loss in terms of its deterrence to population growth, but they are concerned about implications for agriculture and aquaculture.

- Historical Preservation: Two settlements--Haleiwa and Kahuku--are particularly concerned with preserving the ambience of their respective communities, and Haleiwa has been successful in getting the City to enact a Special Design District to ensure that future development is architecturally compatible with buildings of the past and present. Similarly, Kahuku's future housing is being planned to match the "plantation feeling" of the existing old town, and there is strong community interest in finding some use to ensure preservation of the old mill. (The move for a "living park" in Kahana Valley might also be viewed from this preservationist perspective, although other cultural considerations are also present there.)

- Power Structure: As is often the case in any community, various groups feel they have less power than other groups. People who live in the less urbanized areas tend to feel the reins of power are held by the major landowners and employers in the urbanized areas (the Mormon Church in Laie, Campbell Estate and Kuilima in Kahuku, Castle and Cooke in the Waialua area). In turn, many people in these communities feel that areawide community groups such as the Neighborhood Boards have been "taken over" by articulate newcomers whose interests and views are not those of the longtime local residents. Another dimension to the power issue involves younger vs. older people. For example, in Kahuku a number of younger people (both in the old and the new parts of town) expressed some restlessness that community leadership positions have remained in essentially the same hands for as long as they can recall.

Additionally, there is sometimes a perception by community groups that the North Shore and Koolauloa areas as a whole lack political power in comparison to the more populous areas comprising most of the remainder of Oahu.

Needs and Issues Directly Related to Kuilima Expansion: The major themes which emerged in response to questions about the proposed expansion--and perceived opportunities or problems--were naturally similar in many respects to the background issues and concerns just described. It is important to note that those who tend to favor the proposed expansion emphasize a relative few concerns--generally having to do with community preservation through economic opportunities--while those who tend to oppose raise a wide variety of issues. Thus, the following list of issues and concerns is weighted toward a negative view, because the people who are inclined to be negative toward the project cite more questions and issues. This is particularly important to keep in mind in light of the positions in favor of the project taken by most community groups (Section 3.7.4).

- **Overview of General Value Differences:** Particularly among anti-Kuilima informants, there was a feeling that the project has polarized the community. An alternative, and not necessarily incompatible interpretation, would be that the proposed expansion activates the basic background value differences described in the previous section--i.e., the conflict which has existed since the plantation closing between pro-growth and anti-growth, between the "Threatened" and the "Contented," between those who emphasize "country" and those who emphasize "community." (Again, "community" is used here to indicate a historic sense of belonging and/or a strong desire to keep the next generation in the same physical community. Those who value "country" also value the current community, but there is somewhat more tendency to assume the next generation will naturally outmigrate.)

  Not all pro-growth informants necessarily favored the Kuilima expansion; some were concerned that resort employment is not an ideal economic base. Not all anti-growth informants necessarily opposed the expansion; a few saw a carefully planned and secluded resort complex as more compatible with "country" than gradual local outmigration and turnover of housing stock to affluent second-home owners. <u>On the whole</u>, however, the split between project proponents and opponents closely followed the underlying value split about the need for economic development vs. the need to keep the country country.

  Many of the following specific issues reflect this overall value difference, but other topics represent additional issues which may have been raised by either or both groups. The first two specific issues below may be regarded as

"mega-concerns," for which the individual sub-topics are as important as any of the others that follow.

- **Compatibility with "Country":** This complex of issues is generally raised by persons who tend to oppose the project, although the answers are also of interest to proponents.

  --Population/Housing Growth: Several community leaders recalled a previous environmental impact statement for an earlier Kuilima proposal; the EIS suggested that this earlier project proposal (larger than the one now being proposed) would increase residential population in the Region by an additional 11,200 to 12,500 persons by the year 2000, with approximately half that number to be housed in the area from Kuilima to Laie (Belt, Collins & Associates, 1979, pp. IV-163 to IV-189). Few key informants seemed aware (or, if aware, much impressed by) the City Development Plan limits on population growth which have been imposed on Koolauloa and the North Shore since preparation of this 1979 EIS.

  --Pressure for Off-Site Development: Some informants believed the Kuilima expansion would result in the "urbanization" of the Koolauloa/North Shore area by leading to pressures for development outside Kuilima, either for (1) the assumed new residential population just discussed, and/or (2) additional resort or affluent "second-home"/investor real estate development. Based on previous development proposals by the Campbell Estate (most of which were not approved by the City), some people believed the Kuilima complex would be just a "foot in the door" for extensive development proposals from that land-owner in particular.

  --Traffic: Fears about increased traffic on Kamehameha Highway, particularly on the Koolauloa side, were among the most common and most significant concerns.

  --Water/Sewer/Other Infrastructure: There was strong awareness of future limitations of water supply for Oahu, and there were many questions about whether the project would have enough water without penalizing either area residents or nearby agriculture and aquaculture operations. Additionally, and usually based on the assumption of major population growth, some informants questioned whether all forms of infrastructure would be capable of meeting the demands imposed by the project. Some further believed that significant taxpayer expenditures would be required to provide such infrastructure.

  --Compatibility with Aquaculture/Agriculture: In addition to the water concern, some informants suggested a resort operation in the area would be incompatible with agriculture or aquaculture because tourists would not want to see or smell such operations. (Other informants, however, believed area farms are an excellent backdrop for tourism.) A separate fear was that Campbell Estate might use the resort as an excuse to increase lease rents for nearby agricultural lands.

--"Noise and Pollution": Anti-growth informants sometimes made general references to increased "noise and pollution," although the basis for such concern appeared to be linked more to the assumed overall urbanization of the area than to any direct effects of the resort itself.

--Planned vs. Unplanned Development at Kuilima: At present, only a few informants indicated they had given much thought to the possibility that a failure to attain successful "critical mass" at Kuilima could lead to ending plans for hotel development and subsequent unplanned condominium development of currently zoned land (whether by Kuilima Development Company or a subsequent owner). However, the few who did consider the prospect of unplanned development--including people otherwise opposed to further growth at Kuilima--expressed strong feelings that a planned area offering many jobs would be much preferable to the alternative of a "mini-Kihei" on the North Shore.

o Employment Opportunities: These represented the major reason for support by project proponents, who were frankly willing to see some population growth and development of the "country" to have them. However, a number of questions were raised by opponents and some proponents as well.

--Need for Jobs/Labor Availability: While proponents argue there is a major need for jobs in the area, some opponents believe there is little or no such need. They ask if the assumed lack of local labor supply will not lead to the sort of major population increase previously discussed or to greatly increased commuter traffic from people driving to work from outside the area. Thus, this issue is at the heart of disagreement between opponents and proponents.

--Desirability of Resort Jobs: Opponents point to presumed low wages, seasonal lay-offs, limited opportunity for advancement, and shift work as reasons for believing that tourism provides "dead-end" jobs which local communities should not depend upon for primary employment.

--Alternatives for Employment: Project proponents dispute some of the foregoing allegations, but are even more likely to argue there is no alternative in sight for other major sources of employment. Opponents encourage development of more agriculture and aquaculture, but resort proponents believe these industries are not sufficiently labor-intensive.

--Local Youth Interest in Tourism Employment: Some informants question whether tourism work--either because of the presumed poor working conditions previously described or because of its "servant" nature--would appeal to the young local people whose parents support the project. Proponents believe youth interest can be heightened by training and that it is preferable at least to provide young people with the choice.

--Youth Qualifications for Tourism Work: A related but separate issue is whether many young local people have the basic language and social skills to qualify even for entry-level resort jobs. Pertinent to this discussion are training prospects and also the availability of resort-related jobs which do not require extensive social interaction with guests.

--Importation of "Transients": Largely flowing from the assumption of limited youth and/or other local labor supply is a concern about increased influx of young Mainlanders who might work the resorts for a few years and then leave. There is a belief that such "transients" now dominate the Kona and Kaanapali rural resort workforces and a fear that a similar pattern would emerge at Kuilima.

o Assurances of Community Benefit: Even among project proponents, historical experience with frequent changes in ownership and management at what is now the Turtle Bay Hilton (see Section 3.6) have made residents somewhat cynical about promises that future development will benefit current area residents. There is strong awareness that few promises made by developers are binding upon subsequent hotel or retail operators. There are three particular areas in which more firm assurances are sought.

--Hiring Preference for Local Residents: Community residents want some guarantees that they, not outsiders, will get first crack at new jobs. They also are concerned about preference in rehiring situations after a change in ownership (e.g., the recent changeover from Hyatt to Hilton and subsequent nonhiring of some residents).

--Wage Equality with Waikiki Resorts: There is a fear that Kuilima hotels might consider their employees to be a "captive" labor supply and offer wages below the Waikiki standard, as the current Hilton contract is now interpreted. Some informants are willing to accept a small differential, if it is essentially equal to savings derived from not having to commute to work.

--Hotel Policy Flexibility to Accommodate Local Conditions: Among the displaced workers from Hilton, there is currently some resentment that one person was dropped because of a policy against two family members working in the same department. The feeling is that such a policy is not sensitive to the realities of small communities with large extended families. Additional objections have been voiced to the standard hotel policy forbidding employees to be customers in their off-duty hours at hotel bars, restaurants, or shops. Reasons for the policy involve opportunities for collusion to avoid payment and the possibility of negative interactions with guests; however, area residents feel it denies a substantial portion of the population (i.e., Kuilima workers) access to some of the few restaurant and entertainment amenities in the region.

- Potential for Off-Site Resort-Related Economic Development: A major topic of interest is the true potential of the resort for stimulating off-site economic development of types felt by some to be more compatible with the existing social fabric and/or aspirations of residents. Even some strongly anti-resort informants expressed interest in learning more about prospects for such off-site economic activities as Hawaiian-food restaurants, arts and crafts stores, or strengthened agricultural activities. (The term "off-site" is used loosely here, since some of the potential commercial activities might take place either inside or outside the resort complex.)

- Kuilima's Economic Feasibility: Many people cannot understand why more hotels should be built if the present one is not profitable. Those who understand the "critical mass" argument (i.e., that prospects for profitability are increased when there is more to do at the resort) have several other concerns. They point to the area's reputation for strong winds and rough waters.

- Need for Condominium Development: Some community leaders who have been involved in debate over the project for many years support hotel development but oppose condominium development because of the relatively few jobs provided by condominiums. The issue is further intensified if condominium construction at Kuilima will consume the limited amount of additional residential capacity for the area under the Development Plan population allocations; there is a desire to use this capacity for housing affordable for local residents.

- Developer Commitment to Quality Hotel Construction/Desire for Interim Review: Particularly among those who are apprehensive about condominiums, there is concern that a "blanket yes" to all developer requests could result in a development that is not of the exact nature now being proposed--i.e., lower-class hotels or condominiums in place of job-providing hotels. This leads to a feeling of conceptual support for the project as proposed, but a preference for some form of deferred review to ensure performance.

- Coastal Access: Hilton's current policy of charging for parking is interpreted by many as a deliberate effort to

restrict public access to the coastline. It is, at present, a very sensitive issue in the community, and there are firm questions about provisions for access in any future development.

- Beach Setbacks: Kuilima's present request to reduce the 300-foot beach setback to 100 feet is a matter of controversy between project opponents and proponents. As noted previously, the Koolauloa Neighborhood Board took a middle course by endorsing the reduced setback for Kawela Bay hotel sites but requesting the opportunity to review proposals on a case-by-case basis for the remainder of the project shoreline.

- Kawela Park/Access to Kawela Bay: West Kawela residents are strongly opposed to the planned park at Kawela, fearing noise, intrusion into their property, and lack of maintenance and security if it is a City park.

  By contrast, the proposed park and consequent access to Kawela Bay is an extremely desirable feature to many residents in other communities. There is a deep-seated resentment against perceived exclusion from the Kawela fishing grounds and swimming area, since it is among the few calm-water spots in the Kahuku area. The key informant interviews turned up numerous anecdotes about Kawela residents calling the police or setting dogs upon non-Kawela local residents trying to swim or fish in the bay over the years. Many longtime local residents felt Kawela residents, perceived to be largely Caucasians, were exhibiting racial prejudice. However, even Caucasians living at the Kuilima condominiums said they do not feel welcome going into Kawela because of the profusion of "Keep Out" signs.

- Displacement: Questions are frequently asked about the project's impacts on (1) East Kawela lessees now on month-to-terms; and (2) the limited number of farmers now operating on agricultural leases within the project site. The greatest concern among the informants was for the farmers.

- Impacts on West Kawela Residents, Other "Neighbors": Other than relocatees, the individuals likely to be most affected by the resort development would be West Kawela residents, who currently enjoy near-total seclusion on one of Oahu's most beautiful bays. It is expected their property values would rise, but many say this is not as important to them as the visual impact of hotels across the bay and the potential intrusions from hotel guests, employees, and park users. On the eastern side of the property is an aquaculture operation, a scattering of old beach cottages, and a nudist camp about a mile down the beach.

- Off-Site Property Values/Land and Housing Costs: Kuilima condominium owners look forward to a desired increase in their property values from the proposed expansion. However, off-site residents of communities as distant as Hauula or Kaaawa have expressed some concern about the possibility of undesired increases in property value--resulting in higher taxes for persons on fixed incomes and/or higher housing costs for area residents. Some of this concern is based on anticipated residential population pressures, and some is based on anticipation of "spillover" in property values from Kuilima.

- **Investment Opportunities for Residents:** There is an interest among some community residents in the feasibility of resident huis becoming investors in Kuilima real estate.

- **Social Integration of Part-Time Condominium Residents:** Some informants saw the potential for social problems in having many part-time condominium residents with few opportunities to become integrated into the full-time residential community.

- **Crime:** The prediction of dramatically increased crime was one of the most common themes among anti-Kuilima informants. During the course of this fieldwork, a highly publicized armed robbery of hikers (primarily tourists) occurred at Sacred Falls. Several of those who foresaw crime problems predicted such events would become an "everyday occurrence" if the Kuilima resort expands to the proposed size.

- **Negative Resident-Visitor Interaction, Attitudes:** A less dramatic concern was simply that the expanded resort would lead to social friction between residents and tourists, with displays of rudeness rather than wholesale violence.

- **Negative Impacts on Youth:** Youth alienation was assumed to underlie much of both the preceding two points, as well as resistance to youth employment. Additionally, some informants are concerned about youth perceiving a major income gap between themselves and resort guests, and perhaps attempting to emulate the expensive lifestyle of affluent persons on vacation. Somewhat related concerns are the ideas that the resort might be an attractive nuisance for youth, luring them away from school or families, or that the sophistication of a major resort would affect their "rural" philosophies by exposing them to urban influences.

- **Social Problems in Local Resort Workforce:** The most common concerns about social problems felt to be associated with tourism employment involve marital disruptions, impaired supervision of children, and self-image or other mental health problems.

- **Hawaiian Names at Resort:** A number of community informants strongly dislike the name "Turtle Bay" and have even suggested deed covenants requiring hotel operators to use Hawaiian names for the hotels.

- **Power Structure:** Possibly underlying much of the apprehension about any major socio-economic change in the area is concern over implications for control and influence. There are split feelings in the community about the appropriate responsibilities and levels of power for the resort developers and operators as it expands. On the one hand, there is a sense that the major employer for the area properly should make substantial contributions to community causes and events; on the other, there is a fear of a return to a paternalistic plantation situation in which residents would assume an undesired position of subservience.

- **Economic Domination:** Economic as well as political control is at the heart of concerns that the Koolauloa/North Shore Region ideally should have a diversified economic base, not a single major employer. Some informants believe agriculture or aquaculture can be expanded to provide counterbalancing jobs; others would simply oppose any major new development unless and until other forms of simultaneous economic development are also carried out. It will be recalled that concerns about overdependence on tourism form one of the major statewide public concerns (Section 3.7.1), and the following chapter will explore the prospects for alternative economic futures in the Region.

4.0 CONTEXT FOR IMPACT ASSESSMENT

The preceding chapter profiled existing conditions and issues in the Region, while the chapter after this will analyze likely future conditions with and without the proposed project. The purpose of this intermediary chapter is to establish the logical framework for the impact assessment to come. Such a framework requires consideration of three things: (1) the meaning of the idea "future without the proposed project"; (2) an overview of those off-site forces for change which are expected to occur or continue with or without the project; and (3) an assessment of the general types of economic opportunities available for the Region.

4.1 The "Without-Project" Alternative

The standard model for socio-economic impact assessment is to make two separate forecasts of likely future conditions--with the proposed project and without it--and then compare the differences between the two scenarios.

The present situation is more complex, however, because of uncertainties about what would or would not occur at the Kuilima site if the requested additional land use approvals are denied.

The Resort now has approval for a total of 2,000 visitor units (including the existing 487 units at the Turtle Bay Hilton but excluding the residentially-designated 368 Kuilima Estates condominium units), a 40,000-square-foot commercial center, and--subject to some site-specific permits--a second 18-hole golf course. The present Development Plan imposes a 300-foot coastal setback and strip of Residential-designated land between hotel sites and both the eastern part of Kawela Bay and the western part of Turtle Bay. Theoretically, this might be considered the "without-project" future scenario.

However, the developer believes the present approval situation does not provide the "critical mass" needed for an economically successful resort complex. There are serious questions as to whether the developer would attempt to build the additional approved 1,513 units believing that they will not be profitable. The present developer is more likely to sell the property to one or more new owners, who would in turn probably create higher-density and less labor-intensive hotel or condominium facilities than are currently envisioned. (It should be noted that some governmental approvals would still be required before such scenarios could come to pass.) Conceivably, however, the economic and political situation might even dictate no further development for an indefinite period of time.

Thus, the "without-project" alternative future (without regard to the identity of the final developer) cannot be clearly seen, but could involve any of a range of possibilities:

(1) no further development (i.e., continuation only of the existing hotel--assuming it attains profitability without the development of other on-site attractions);

(2) development of the additional approved 1,513 units as full-service hotels (a particularly unlikely scenario); or

(3) partial or complete development of the currently approved additional 1,513 units, but as condominiums or lower-quality hotels, probably by separate developers not coordinating on any common site plans.

Future number (3) is perhaps the most likely, followed (on a temporary basis) by future number (1). Future number (2), despite its economic unlikelihood, represents the probable intent of the current Development Plan approvals.

Under these conditions, the socio-economic impact assessment cannot always be clear-cut. For quantifiable impact variables flowing directly from the projected unit count (i.e., employment and, to some extent, population and housing), the foregoing "without-project" future number (3) will generally be used as the basis of comparison. For less quantifiable impact variables (e.g., crime or community character), a more conservative approach will be taken: use of some version of future (1), either with consideration of likely non-resort changes in the future (see following section) or a simple comparison with the present situation.

Thus, only partial solutions are possible to the problem of determining the "without-project" future, and it will be necessary occasionally to remind the reader of these complexities in the upcoming impact assessment chapter.

4.2 Other Forces for Socio-Economic Change

This section is intended to provide an overview of basic off-site forces for socio-economic change in Koolauloa and the North Shore--i.e., changes which are expected to occur (or, for those changes already occurring, to continue) whether or not further development takes place at Kuilima. To the extent that it is possible to foresee them at this time, these changes are expected to be relatively minimal due to City and County policies restricting substantial further growth in the area.

4.2.1 Development Plan Constraints on Population/Housing

As was discussed at considerably more length in Section 3.5.1 of the preceding chapter, the City and County Development Plans limit land use approvals for the Region to provide only enough additional residential capacity to accommodate approximately 1.4 percent of the estimated year 2000 population for Koolauloa and approximately 1.7 percent of the 2000 population for North Shore. (It will be recalled that the City's definition of the two areas places the Sunset/Waimea/Pupukea communities with the North Shore.)

At present, the City Department of General Planning (DGP) estimates that currently-approved residential capacity is enough to accommodate virtually all the projected year 2000 population:

	1982 est. population	year 2000 target population	est. capacity w/ current approvals
Koolauloa	11,900	14,811	14,500
North Shore	13,700	15,737	15,900

If these policies (based upon City General Plan guidelines on future population distribution) remain in place, the Region--and particularly the Koolauloa area--will grow at a rate much less than its historic growth rate (see Section 5.2), and few if any new residential lands will be developed other than those already designated.

Consequently, whether or not further development takes place at Kuilima, population growth would be extremely limited over the next 15 to 20 years, and pressures on area housing can be expected to intensify greatly.

4.2.2 Approved Land Use Changes Awaiting Implementation

Approved (but not yet implemented) land use changes can be of two general types: residential/commercial or public facilities. The former is more difficult to discuss than the latter.

A representative of the Department of Land Utilization (personal communication, 1984) stated that specific permit requests have been declining in the past five years for the Region and that no new subdivisions or significant zoning changes are currently before the department. Unfortunately, due to a lack of funding, the department's only monitoring position has been eliminated, making it extremely difficult to track the current status of past permits issued.

The only significant change in land use designations in the previous Annual Review was the designation of a 19-acre parcel in Hauula for development as a private school for autistic children, along with creation of 114 rental housing units. There is current uncertainty whether or when this development will occur. Regarding public facilities, Table 4.2-1 shows both the projects already on the public facilities map for the Development Plan and the proposed additions in the 1984-85 Development Plan Annual Review. It should be noted that no proposed public facility on the Development Plan is certain to be constructed unless its timing is "one year," meaning that funding is actually included in the next year's City budget. None of the North Shore/Koolauloa projects have attained that level of certainty.

4.2.3 Other 1984-85 Proposed Development Plan Amendments

Other than the proposed Kuilima project, this year's Annual Review of the Development Plans is relatively devoid of any large-scale changes proposed for either the North Shore or Koolauloa areas. One substantial request introduced by the City Council is to change 44 acres of agricultural land controlled by Oceanic Properties to residential designation in the Waialua area to yield up to 28 single-family units. The Council's justification for this request is to convert existing homes on agricultural land to a residential designation and to allow for some infilling. In addition, a previously-denied proposal for the development of an 81-acre agricultural subdivision for residential estates has been re-introduced for the Mokuleia area. Finally, the Pacific Electrical Contractors Association and the International Brotherhood of Electrical Workers are seeking approval for a training facility on a six-acre parcel mauka of the highway at the southwestern end of Sunset Beach.

With regards to public facilities, DGP planners indicated that no new projects of any significance have been proposed. For the two areas, North Shore and Koolauloa, a total of six amendments have been introduced, all related to new park development. Significant roadway expansion or by-pass routes have not been updated to a newer development timetable, indicating the unlikelihood that there will be any sudden undertakings.

Table 4.2-1

Major Public Facility Projects Proposed for the North Shore and Koolauloa

Facility	Proposed Timing for Implementation
(Koolauloa)	
Hauula-Punaluu Wastewater Treatment Plant	7+ years
Kaaawa Wastewater Treatment Plant	7+ years
Kuilima Wastewater Treatment Plant	7+ years
Kahuku Beach (Regional) Park	7+ years
Kahuku District Park	2-6 years
Kahuku Golf Course (relocation)	7+ years
Kakela Beach Park	2-6 years*
Laie Beach Park (Bluff)	2-6 years*
Kaaawa Fire Station	7+ years
Kawela Bay Fire Station	7+ years
Laie Fire Station	7+ years
Hauula 180' Reservoir	2-6 years
(North Shore)	
Kamehameha Highway between Weed Junction and Kamehameha Realignment	7+ years
Haleiwa Wastewater Treatment Plant	2-6 years
Pupukea-Sunset Wastewater Treatment Plant	7+ years
Waialua Wastewater Treatment Plant	2-6 years
Ehukai Beach Park	7+ years
Haleiwa Regional Park	7+ years
Haleiwa Rehabilitation Facility	2-6 years*
Kawailoa Beach Park	7+ years
Makaleha Beach Park	7+ years*
Puuiki Beach Park	7+ years
Waialee Beach Park	7+ years
Sunset Beach Fire Station (Relocation)	7+ years
Helemano Agricultural Training Center	7+ years

*proposed amendments to Fiscal Year 84/85 Annual Review.

Source: Department of General Planning, September 1984

4.2.4 Long-Term Plans of Major Landowners

While the foregoing suggests little likelihood under current City policies of significant land use changes, it may still be useful to consider the proposals of major landowners to determine possible changes as recommended by influential economic forces in the area. There are five major landholders in the region:

o **Bishop Estate:** Bishop Estate owns large tracts of land northeast of Haleiwa and in the Waialua area (much of it sugar-cane land under lease to the Waialua plantation). No tentative development plans for any substantial portions of these lands has been announced by the Estate.

o **Mokuleia Homesteads:** This subsidiary of Northwestern Insurance has unsuccessfully pursued for several years City approval for development of about 700 acres in the Mokuleia area. Other than the previously-noted 81-acre request, however, the developers have not reapplied for approval and have indicated that plans are being revised.

o **Oceanic Properties/Castle and Cooke:** Oceanic is the development arm for Castle and Cooke, parent company of the Waialua Plantation. To date, Oceanic's development activities in the North Shore area have been focused on affordable housing, either directly or indirectly for plantation employees--e.g., the 44-acre proposal in this year's Development Plan Annual Review (Section 4.2.3). The company has not indicated it has any other specific plans or proposals to make at this time. However, in the event of a significant cutback of lands by Waialua Sugar Plantation, Oceanic would have corporate responsibility for any development of lands taken out of agricultural production.

o **Zions Securities Corp.:** Zions is the development arm of the Mormon Church, which has substantial land holdings from Laie to Punaluu. Despite the City's proposal to condemn the privately-owned Kakela Park in Laie for public park development, Zions has indicated it will proceed with an application to build a 115-unit luxury housing development on the 11-acre beach parcel. The company says it will use profits from that development to subsidize a proposed 385-unit low- and moderate-income housing project on 65 acres directly across Kamehameha Highway. Zions is also reportedly preparing an application for a 17-acre light industrial park mauka of Malaekahana (*Pacific Business News*, Oct. 1, 1984). These proposals are contingent on City approvals; however, Zions has most needed land use approvals for another project it has discussed: replacing the current 46-unit Laniloa Lodge Hotel with a larger structure of approximately 300 units.

o **Campbell Estate:** In the past, Campbell Estate had proposed an ambitious urban development plan for lands mauka of Malaekahana between Laie and Kahuku. These plans were rejected by the City and have not been re-submitted. A more recent tentative concept for a 469-acre "gentleman's estate" agricultural subdivision has also failed to win immediate favor with the City and is not being further pursued at the present time. However, this year's Development Plan amendment requests do include one proposal by Campbell to revise zoning boundaries in Kahuku to pave the way for a strip commercial development of some 50,000 square feet along the highway.

Campbell's other announced proposals for the Kahuku area include sandmining of the present Kahuku golf course (with eventual construction of 600 to 700 housing units after the mining has been completed) and provision of land mauka of Malaekahana for the City to construct a new municipal golf course.

More immediately, Campbell is working with Kahuku residents to provide additional housing in the old plantation style on ten acres mauka of the highway and 62.5 acres makai (including the land containing existing housing in the old portion of Kahuku). The current residents have spoken for 220 existing lots--on which some houses would be rehabilitated and others replaced--and about 190 new units would be constructed as infill or an adjacent property.

4.2.5 Other Major Socio-Economic Possibilities or Trends

Cutbacks or Shutdown at Waialua Sugar: Perhaps the major area of uncertainty in the North Shore's economic future is the viability of the Waialua plantation. Conditions on the world sugar market and decisions by the U.S. Congress about continuation of sugar subsidies could result in sudden changes in the health of many Hawaii plantations, including Waialua, either for the better or the worse. It is difficult at this time to predict the plantation's future for even one more year. If the plantation should close or require significant cutbacks in land and/or workforce, there could be serious implications for both land use planning and socio-economic conditions in the area.

o Demographic Trends and Population Turnover: It was reported in Section 3.2.1 that the residential mobility of Region residents in 1980 was similar to that for Oahu as a whole-- i.e., only about half the population had lived in the same house five years previously, and one-quarter of the residents had been living somewhere other than Oahu (primarily the Mainland). This suggests there will continue to be a substantial turnover in population in the future, even if (and perhaps especially if) new economic development does not occur. Certain other demographic and/or socio-economic trends are expected to keep occurring in the Region regardless of development patterns, primarily because they are occurring in the population as a whole--e.g., increased average age and level of education.

o Economic Alternatives: Because of the complexity and significance of this topic, it is given detailed attention in the following section.

4.3 <u>Assessment of Other Regional Economic Opportunities</u>

4.3.1 Overview of Regional Economic Trends

The economic development in the Region has been much more limited then in the rest of the County. The limitations are reflected in lower average income, higher rates of unemployment, and relatively fewer residents participating in the civilian labor force. While income and employment were discussed in section 3.3, it is worth noting the factors related to economic development and demographics that have affected the levels of income and employment attained in the Region. These include:

1) The limited economic base in the Region which in turn limit employment opportunities located within the Region.

2) The physical distance between the Region and major concentrations of employment. On the East these include Kaneohe, and on the West the Campbell Industrial Park, Waipahu, Pearl Harbor, and Honolulu. The Region's relative distance from these areas have effectively reduced the employment opportunities available to its residents.

3) The relatively younger median age of the Region's residents contributes to the unemployment levels, since a youthful population has fewer job-related skills. As would be expected, unemployment is most significant among the residents between the ages of 18 and 25 years.

4) Many of the Region's residents have relatively lower level of education. This place them at a disadvantage in competing for employment.

Unless an economic base such as tourism is developed in the Region, the area's future economic development should continue to lag behind that of the County as a whole. The following is a synopsis of economic opportunities in the Region.

4.3.2 Light Industrial Uses

The potential for light industrial uses in the Region is limited by the area's distance from the Honolulu harbor, airport, and commercial areas. Largely because of the transportation time required to reach the Region and the relatively smaller population base in the Region, it is not an advantageous location for most light industrial operations. Light industrial sites that are at a competitive advantage include the Gentry Waipio Business Park, the Campbell Industrial Park and industrial sites in Waipahu and Kaneohe.

4.3.3 Diversified Agriculture

Diversified agriculture is currently a major component of the Region's economy and should be expected to be a vaiable contributior to the Regional economy. There are, however, limitations to the impact that agriculture will have on the Regional economy. One basic factor is the limited employment provided by agriculture, measured either in terms of jobs per acre or per unit of output. Another more basic factor is the limited growth that Hawaii's agriculture has experienced over the past fifty years.

Agricultural production data indicates that crop production has declined since the mid-1930s. Since the mid-1960s, crop production has decreased on Oahu primarily due to reduced pineapple and sugar production. Crop acreage used for crops other than sugar and pineapple is below the acreage cultivated in the 1930s on Oahu as well as the neighbor islands. Since the mid-1960s, crop acreage other than pineapple and sugar has increased at a significantly slower rate on Oahu compared to the neighbor islands.

One factor reflected in the trends is that Hawaii's crop production competes with products grown outside Hawaii. Although Hawaii.has the soil and climatic conditions required for a variety of agricultural activities, other locales have a greater competitive advantage. This advantage is derived from a combination of variables, including lower production costs, closer proximity to major markets, and economies of scale that are not realized in Hawaii.

Finally, several factors have influenced agricultural production historically locating on the neighbor islands rather than on Oahu. One is that there is a significantly greater supply of land on the neighbor islands. Another factor that has become increasingly important, is the value/cost differential for land located on Oahu's and the neighbor islands. This results primarily from factors related to Oahu having a disproportionately large share of Hawaii's population and a relatively small share of its total land area.

An assessment of the impact of residential encroachment in the Waianae region notes that agricultural production, measured in terms of the value of production after adjustment for inflation, actually increased in the region between the late-1940s and early-1970s. (Miklius, 1976.) To the extent that agricultural land preservation and the expansion of population in rural areas are not mutually exclusive, it is concluded that carefully planned development in rural areas can potentially reinforce and even expand agricultural production.

To date, the State and counties have used land use controls as a "stick" to very effectively prevent agricultural lands from being converted to non-agricultural uses. It is apparent that expansion of agriculture throughout the state could potentially

result from the public sector's using land use controls as both a "carrot and stick." If the State and/or counties used land use controls as both a "carrot and stick," the public could derive potential benefit from increased agricultural production and either lower or stabilized costs for urban land uses. The former could provide employment benefits, and the latter has the potential to stabilize and perhaps even lower housing costs, particularly on Oahu.

4.3.4 Aquaculture

Presently, the Region has the State and County's most significant concentration of aquaculture development. Development of aquaculture in the Region has been encouraged by the policies of the Campbell Estate and the availability of an adequate supply of fresh water.

Aquaculture has become a vaiable element in the Regional economy and can be expected to remain so in the future. As an economic activity, aqualcultre is an intensive user of land and water, and requires relatively little labor per acre of production. Consequently, the economic impact that agriculture has on the Regional economy, in terms of labor and income, is relatively modest compared to other activities, such as tourism.

4.3.5 Commercial Fishing

Fishing pursued by residents of the Region may be characterized as both a means of supplementing family incomes and a recreational past time. Most of the fishing is from boats that are launched from trailers at either the Haleiwa or Heeia State small boat harbors. Boats launched out of Haleiwa can potentially fish the waters off the Waianae area which is Oahu's richest fisheries for tuna, mahimahi and marlin. Bottom fishing closer to the coast is also noted as being of significance.

The expansion of commercial fishing based in the Region is encouraged by the State's expectation of significant growth in commercial fishing through the 1990s. However, the commercial aspects of fishing based in the Region have been hampered by the lack of berths for commercial fishing vessels, and the lack of ice-house facilities at the Haleiwa and Heeia small boat harbors.

4.3.6 Tourism

Tourism is generally acknowledged as being the driving force in the economic growth experienced by both the State and County since the mid-1960s. Presently, Region's tourism-related development is concentrated at the Kuilima Resort opened in the early 1970s and at the nearby Polynesian Cultural Center. The Kuilima Resort has a single hotel with 487 rooms, presently operated by Hilton, a 18-hole golf courses, and a total of 368 condominium town-house units. (The latter are technically not a part of the "Resort" in that their land use designation is Apartment rather than Resort.) Additional condominium development has occurred along the Region's coastline, particularly in the Punaluu area.

5.0 IMPACTS AND MITIGATIONS/ENHANCEMENTS

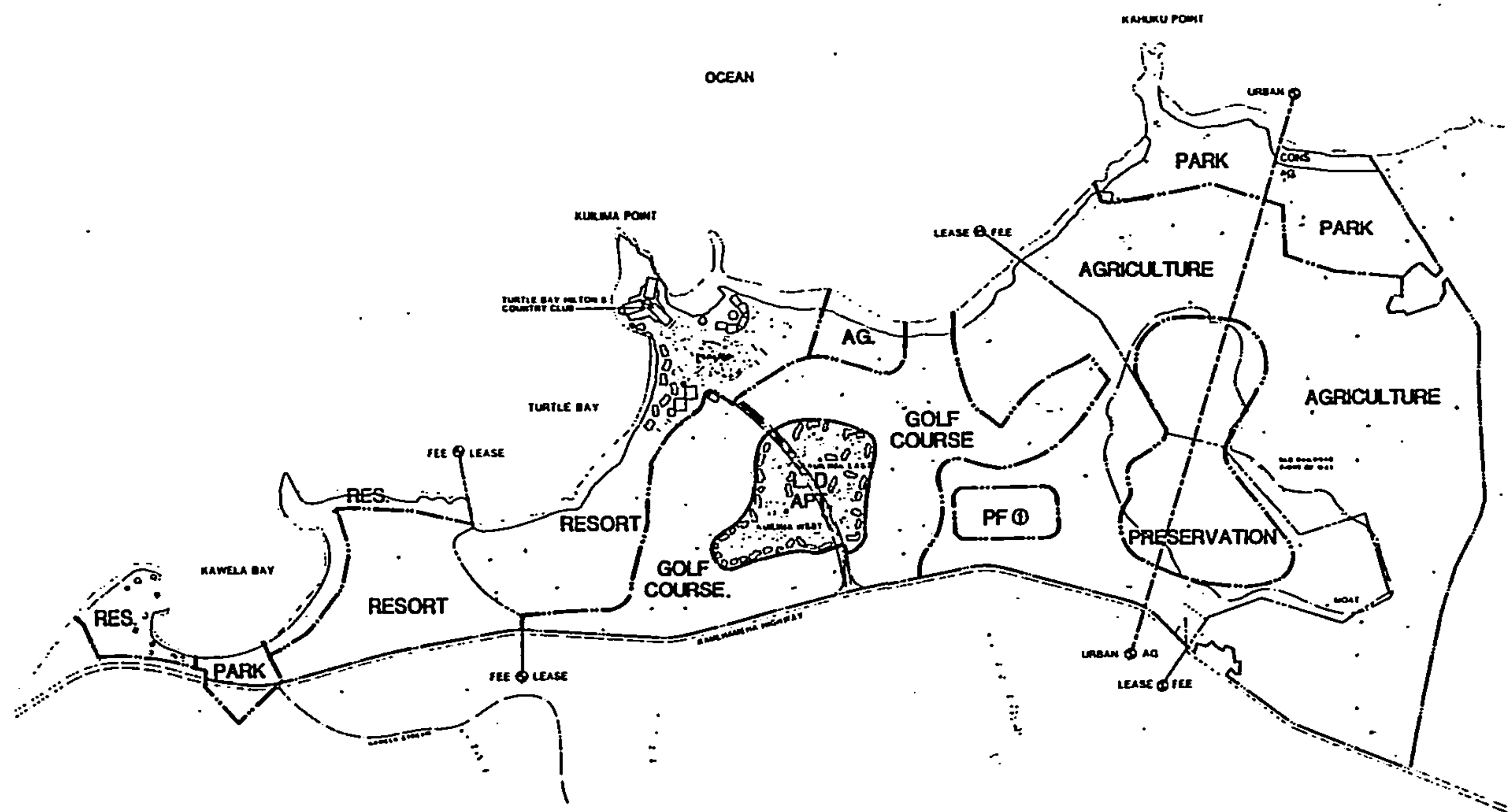
5.1 Employment Impacts

5.1.1 Overview of Approved and Proposed Development

Figures 5.1-1 and -2, respectively, depict the development permitted under the current land use approvals for the Kuilima Resort, and the development as proposed by Kuilima Development Company. Table 5.1-1 summarizes the development as approved and as proposed. References to sites are based on the proposed development, and the allocation of the development presently allowed represents estimates provided by the project's planners, Group 70. The following discusses the quantitative and qualitative differences between the development as approved and as proposed.

Development Based on Existing Approvals: As of late 1984, the development at the Kuilima Resort included 487 hotel rooms, an 18-hole golf course and club house, a stable facility, and other ancillary facilities. (The existing 368 condominium units are designated Apartment rather than Resort.) Based on the existing County and State development approvals, the additional development permitted at the Resort includes 1,513 visitor units (hotel and/or condominium), a 40,000-square-foot retail shopping center, and an 18-hole expansion to the golf course. Under current approvals, the extent of development would be dictated by the County's Development Plan and zoning, and the location of development would be determined by the same County approvals as well as the State's Land Use Boundary designations. As depicted in Figure 5.1-1, the development under the current approvals would be concentrated between Kawela Bay and the site of the existing Turtle Bay Hilton Hotel. The area that would be developed is encompassed by Kawela Bay on the West, Kamehameha Highway on the South, the existing golf course on the East, and the shoreline on the North. The County's Development Plan imposes several limitations on the extent of development including a 300 foot shoreline setback and building height limitations.

Development as Proposed: The Kuilima Development Company is presently seeking an amendment to the County's Development Plan and the State's Land Use Boundary in order to develop an additional 2,000 visitor units. This would result in a total of 3,513 units more than now exists on the property. According to the Kuilima Master Plan (Figure 5.1-2), these additional 3,513 units would be comprised of 1,450 hotel rooms and 2,063 resort condominium units. The proposed amendment would also reduce the shoreline setback from 300 to 100 feet, and increase the permitted building height limits. As depicted in Figure 5.1-2, if the proposed amendments are approved, development would not be concentrated on the western portion of the Resort, but would also encompass the eastern portion. The proposed development would still include the 40,000-square-foot retail shopping center.

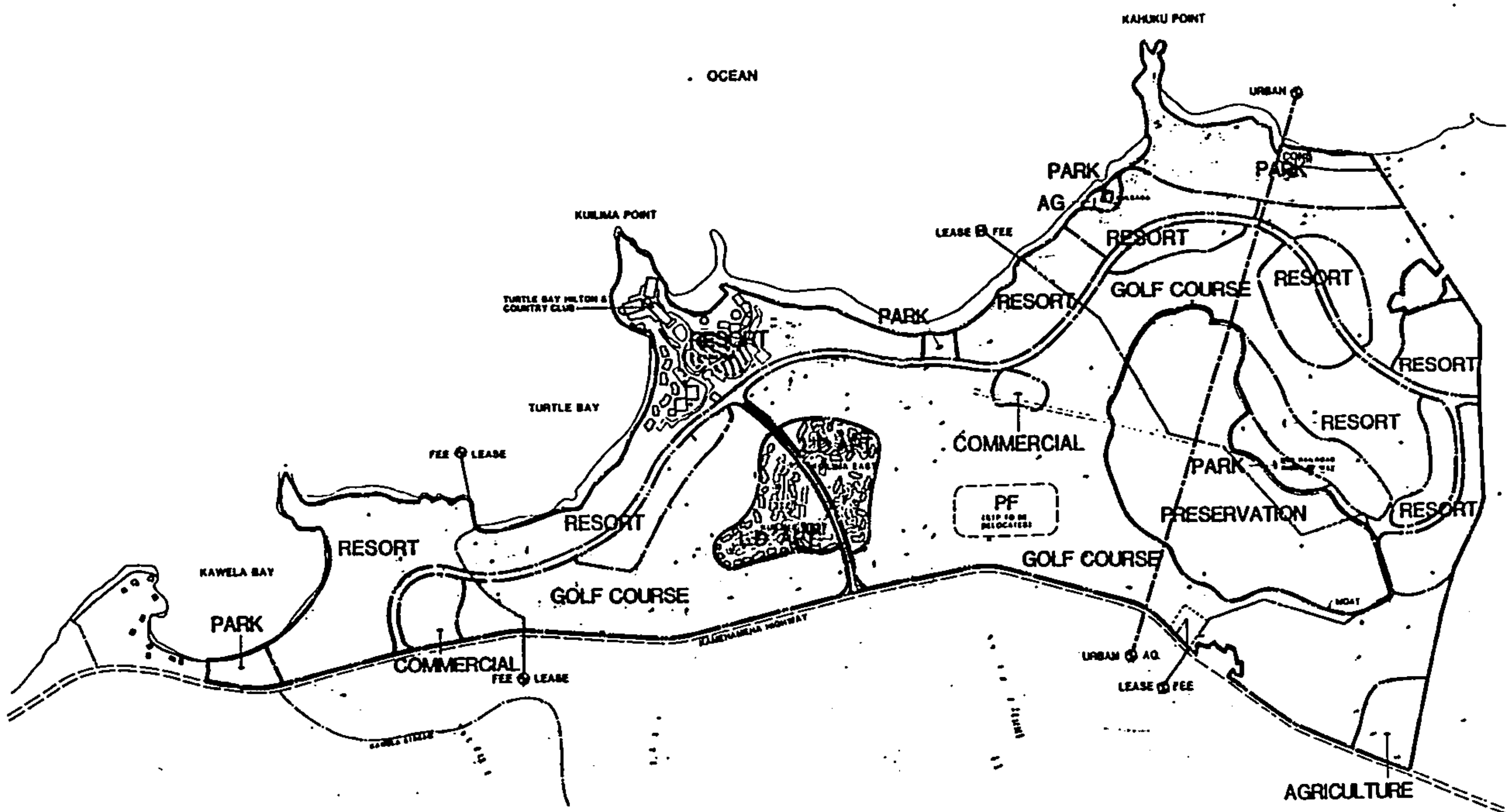


KUILIMA RESORT • BASE MAP • EXISTING DEVELOPMENT PLAN

GROUP 70 ARCHITECTS AND PLANNERS

NORTH

FIG. 5.1-1 MAP DEPICTING EXISTING DEVELOPMENT APPROVALS AT THE KUILIMA RESORT



KUILIMA RESORT

• BASE MAP • PROPOSED DEVELOPMENT PLAN

GROUP 70
ARCHITECTS AND PLANNERS

FIG. 5.1-2 MAP DEPICTING PROPOSED DEVELOPMENT APPROVALS AT THE KUILIMA RESORT

TABLE 5.1-1

Summary of Additional Development Proposed at the Kuilima Resort

RESORT SITES	UNITS
H-1	500
H-2	500
H-3	350
H-4	100
A-1	565
A-2(a)	210
A-2(b)	108
A-3	315 (1)
A-4	180 (1)
A-5	205 (1)
A-6	300 (1)
A-7	180
Total	3,513

(1) Requires both Development Plan and State Land Use amendments. All others require only a Development Plan amendment.

Source: Group 70, 1984.

5.1.2 Factors Determining Total Employment Impacts

Several factors will determine the employment impact that would arise from further development at the Kuilima Resort during both the construction and operating phases. These factors are related primarily to the quality of development and the labor intensity of the resort operations. The following discusses these factors with respect to the development that is currently approved and the additional development that is proposed.

The Development as Approved concentrates new facilities in the western portion of the Resort with a required setback 300 feet from the shoreline. These development parameters are expected to make the overall quality of development competitive with other facilities serving the middle range of the visitor market. The average cost of construction is expected to be lower than it would be if the project catered to the upper end of the visitor market. Consequently, construction phase employment is expected to be less labor intensive than it would be if the project served the upper end of the visitor market.

The ambiance of concentrated development does not lend itself to competing for the visitor market that pay higher than average room rates and seeks higher quality services. During the operating phase, services are expected to be less labor intensive than they would be for facilities that cater to the upper end of the visitor market, reflecting a lower quality of services being offered. An example of a less labor intensive service is the substitution of buffet food service for table service, which requires more labor. Facilities are expected to include fewer food and beverage service facilities and banquet and meeting facilities. Housekeeping services are expected to be reduced reflecting both the ability to achieve greater efficiencies due to rooms being in closer proximity to each other, and the reduction of services such as cleaning rooms on a less frequent basis. The hotels developed would be less likely to have banquet and meeting facilities, thus reducing the employment required.

As discussed in Section 4.1, it is likely that the present developer would hesitate to proceed with development under present approvals, so that full build-out under present approvals--if it does occur--would be on a piecemeal basis by a variety of new owners. This increases the likelihood that such development would consist primarily of resort condominiums and that any hotels would be of lower quality. For purposes of this analysis, it will be assumed that less than half of the units (650 of the 1,513) would be hotel rooms, with the remainder being resort condominium units.

Development As Proposed by KDC would increase the total number of units developed and reduce the relative concentration of development. New development would be set back 100 feet rather than the 300 feet presently stipulated. Hotel and resort condominium sites would also extend beyond the existing Turtle Bay Hilton hotel site up towards the western portion of the property, thus further reducing the concentration of development. The less concentrated lower density development is expected to make the Resort comparable to the Wailea Resort on Maui. As such, the Kuilima Resort is expected to be positioned to compete for the upper-end of the visitor market. Typically, these visitors seek higher quality facilities offering more labor intensive services. The higher quality of facilities is represented by higher construction costs on a per room basis, resulting in higher labor to room ratios during both the construction and operating phases.

The higher quality of services would be represented by increased food and beverage services, and the provision of additional guest services, such as night-time maid services and increased beach and other recreational services. The hotels developed would be more likely to have banquet and meeting facilities, thus creating additional employment opportunities.

5.1.3 Employment Impacts Defined

The employment impact during the construction and operation period are projected in terms of the direct, indirect, induced, and total demand for labor. The employment impact is also discussed in terms of its probable location: at the resort, elsewhere in the North Shore-Koolauloa Region, and elsewhere on Oahu. Finally, the employment impact is presented based on the development that has been approved and the development proposed by KDC.

"Direct", "indirect", "induced", and "total demand" for labor are defined as follows:

(1) "Direct demand". for labor is that which occurs as a result of the direct expenditures of persons staying at the resort. At the resort, it includes labor needs of the hotels, non-hotel condominium units, golf course, tennis courts, restaurants, bars, beauty shops, retail stores, and other resort facilities. Direct demand may also occur outside of the resort, when visitors to staying at the resort purchase goods and services from outside. For instance, an increase in visitors at the Kuilima would probably lead to increased business at existing or new retail establishments in the Region, producing additional jobs in the Region. Likewise, increased tourism to Oahu resulting from new development at the Kuilima would have other direct job impacts on the island, due to increased traffic at the airport or increases in ground transportation services.

(2) "Indirect demand" for labor is that which occurs in businesses that supply goods and services to the establishments directly affected by new expenditures. For instance, new restaurant trade at the resort may

support further development of the Region's aquaculture and agriculture industries.

(3) "Induced demand" for labor is that which occurs as a result of the respending of direct and indirect expenditures throughout the state's economy.

(4) "Total demand" for labor is the sum of "direct", "indirect", and "induced" demands for labor.

5.1.4 Construction Employment

While it is not possible to project the timing of construction employment, it is possible to estimate the total employment impact of development. Table 5.1-2 presents the assumptions used to estimate the construction employment impact of the project. The estimate of direct construction employment is based on building technologies and labor requirements observed at similar developments in recent years. The quality of the units and retail space to be constructed will also have great bearing on amounts of labor required. As indicated in a previous section, the approvals that have been obtained would support development that serving the middle of the visitor market, while the proposed amendments would serve the upper end of the visitor market.

The projected construction impact is stated in terms of equivalent annual jobs or "person-years" through the period of development. Based on published data concerning the distribution of construction labor in managerial positions, it is expected that 80% of the direct demand will be on-site at the Resort, and the remaining 20% outside the Region. The multiplier used to derive the total employment impact is based on the State's econometric model of the construction industry in Hawaii. (State of Hawaii, Department of Planning and Economic Development 1980. "An Econometric Model of the Hawaii Construction Industry.") The model indicates that over a period of five years, each permanent construction job supports approximately 1.6 workers elsewhere in the economy, reflecting a multiplier of 2.6 (1.0 plus 1.6). A multiplier of 2.35 is used to reflect the fact that development of the Kuilima Resort would occur over a period of time with actual development activity fluctuating. Indirect employment generated elsewhere in the Region during the construction phase is projected based the on 0.2 jobs for every 1.0 job generated at the Resort. (Anderson et al, 1974).

Based on the current approvals, Table 5.1-3 indicates that construction employment is estimated to generate 915 equivalent annual jobs in the Region and another 1,325 outside the Region. Construction of the project as proposed is estimated to generate 3,466 equivalent annual jobs in the Region and another 5,018 outside the Region. Approval of the proposed amendments is estimated to increase employment by 2,551 equivalent annual jobs in the Region and another 3,694 outside the Region, or a total of 6,244 equivalent annual jobs islandwide.

TABLE 5.1-2

Assumptions Used to Estimate Labor Demand
for Construction of Approved and Proposed Developments

	Approved for Development	Additional Proposed for Development
Direct Employment:		
Hotel Construction Employment Per Unit..........	.50	.90
Resort Condominium Construction Employment Per Unit.....	.70	1.10
Retail Construction Employment Per 1,000 sq.ft.........	.60	.90
Distribution of Direct Employment:		
In the Region.................	80.0%	80.0%
Outside the Region............	20.0%	20.0%
Total Employment Multiplier.......	2.35	2.35
Regional Indirect Employment As a Percentage of Regional Direct Employment..............	20.0%	20.0%

Source: A. Lono Lyman, Inc.

TABLE 5.1-3

Labor Demand for Construction of Approved and Proposed Developments, Kuilima Resort (1)

	Approved for Development	Total Proposed for Development	Employment from Additional Development
Direct Jobs at the Resort	762	2,888	2,126
Other Direct Jobs In the Region	0	0	0
Indirect and Induced Jobs In the Region	152	578	425
Subtotal, Jobs In the Region	915	3,466	2,551
Jobs outside the Region:			
Direct Jobs	191	722	531
Indirect and Induced	1,134	4,296	3,162
Subtotal, Jobs Outside the Region	1,325	5,018	3,694
Total, All Jobs	2,240	8,484	6,244

(1) Construction employment attributable to the 1,000 resort condominium units that require State Land Use approval is as follows:

Direct employment:	
In the Region	880
Outside the Region	220
Subtotal	1,100
Indirect and Induced Employment:	
In the Region	176
Outside the Region	1,309
Subtotal	1,485
Total	2,585

Source: A. Lono Lyman, Inc.

5.1.5 Operational Labor Demand Projections

While it is not possible to project the timing of operational employment, it is possible to estimate the total employment impact of development. Table 5.1-4 presents the assumptions used to estimate the operating employment impacts of the project, and the following discusses the assumptions.

Hotel Employment is projected based on the expected quality of development and the employment ratios of similar hotels. As indicated previously, the approved development is expected to be comparable to the Keauhou Resort in Kailua Kona, Hawaii. The Resort and its facilities would compete for the middle range of the visitor market. Likewise, construction and operating phase employment is expected to be less labor intensive. As proposed, development would be less concentrated and would be expected to make the Resort comparable to the Wailea Resort on Maui. As such, the Kuilima Resort is expected to compete for the upper-end of the visitor market. Typically, these visitors seek higher quality facilities offering more labor intensive services.

Table 5.1-5 describes selected hotels and summarizes their employment ratio, inclusive of part-time employees, and the estimated full-time equivalent employment ratios. The ratios range between 2.1 employees for a luxury hotel to less than 0.4 employees for hotels and resort condominiums with minimal services.

Other direct demands: For calculation of direct employment to be generated elsewhere in the Region and the state, the following assumptions were used:

(1) employment will be generated elsewhere in the region at the rate of 0.2 jobs for every 1.0 job generated at the resort (Anderson et. al., 1974);

(2) direct hotel, condominium, and retail employment represent 75% of total in-state direct employment attributable to visitor industry development (State of Hawaii, Department of Planning and Economic Development, 1984. State Data Book, p. 215);

(3) all hotel visitors and condominium users come from out of state.

TABLE 5.1-4

Assumptions Used to Estimate Labor Demand
for Operation of Approved and Proposed Developments

	Approved for Development	Proposed for Development
Hotel Employment Per Unit.........	.50	1.00
Resort Condominium Employment Per Unit............	.50	.50
Retail Employment Per 200 Sq. Ft.	.80	1.00
Hotel, Condominium, and Retail As a Percentage of Total Direct Visitor-Created Employment.............	75%	75%
Indirect Employment As a Percentage of Total Direct Visitor Created Employment.....................	80%	80%

Sources: The employment ratios are derived from A. Lono Lyman, Inc.'s survey of selected hotels. The adjustment for part-time employees is based on the State Tourism Study finding that 14% of visitor industry employees hold more than one job (State of Hawaii, Department of Planning and Economic Development 1978. Tourism Manpower, P. 206). The estimate of full-time equivalents is derived by multiplying the employment ratio by 93 percent (100 percent less half of 14 percent).

TABLE 5.1-5

Jobs Per Room For Selected Hotels and Resort Condominiums

	Unadjusted For Part-Time Employees	Adjusted For Part-Time Employees
Luxury Hotel	2.10	1.95
Secondary Luxury Hotel	1.50	1.40
First Class Resort Hotel	1.10	1.00
Low Density Resort Hotel	0.82	0.76
Medium Density Resort Hotel	0.50	0.47
Off-Waikiki Beach Hotel	0.48	0.45
Off-Waikiki Beach Hotel With Minimal Food Service	0.39	0.36
Resort Condominium Hotel	0.32	0.30
Off-Resort Condominium Hotel	0.22	0.20

Source: A. Lono Lyman, Inc.

Indirect and induced demand: Estimation of indirect and induced demand impacts are based on the following findings and assumptions:

(1) the State's Input-Output Model estimates that indirect and induced employment in 1982 was generated at a rate of approximately 80% of total direct employment supported by visitor expenditures (State of Hawaii, Department of Planning and Economic Development, 1984, p. 215);

(2) the Regional share of total indirect and induced employment is less than that for direct employment, and is estimated to be 15 percent of the total indirect and induced employment.

The second assumption is made because induced and indirect spending are less likely to be captured by the Region than is direct off-site spending. Unlike direct spending, indirect spending frequently occurs in wholesaling, warehousing, transportation, and production industries. On Oahu, such industries tend to be centralized. Similarly, induced spending, defined as the recirculation of dollars in the state economy, tends to escape regional economies.

Summary of projected employment demand impacts. Table 5.1-6 indicates that the projected operating employment based on the present approvals is 1,155 jobs in the Region and 883 outside the Region, or a total of 2,038 islandwide. The projected employment based on the proposed plans is 3,555 jobs in the Region and 2,719 outside the Region, or a total of 6,274 island wide. Without the proposed amendments to the land use controls determining the development permitted at the Resort, the lost employment opportunities in the Region would be 2,400 and 4,236 islandwide.

5.1.6 Characteristics of Direct Labor Demanded

The State Tourism Manpower Simulation Model provides a preliminary basis for estimating the distribution of projected employment by both industry and occupational characteristics. (State of Hawaii, Department of Planning and Economic Development, 1978. Manpower, State Tourism Study). Based on the Manpower Simulation Model, Tables 5.1-7 and 5.1-8 present estimates of the distribution of total employment (direct, indirect and induced) and hotel jobs generated by development at the Kuilima Resort.

The distribution of total employment by industry, Table 5.1-7, indicates that 31 percent of all jobs that are generated could potentially be in eating and drinking establishments, and another

<u>TABLE 5.1-6</u>

Projected Operating Employment Impact of Approved and Proposed Development at the Kuilima Resort(1)

Jobs in the Region:	Approved for Development	Total Proposed for Development	Employment from Additional Development
Direct Jobs at the Resort..........................	849	2,614	1,765
Other Direct Jobs In the Region......................	170	523	353
Indirect and Induced Jobs In the Region................	136	418	282
Subtotal, Jobs In the Region..................	1,155	3,555	2,400
Jobs outside the Region:			
Direct Jobs	113	349	235
Indirect and Induced	770	2,370	1,600
Subtotal, Jobs Outside the Region.............	883	2,719	1,836
Total, All Jobs	2,038	6,274	4,236

(1) Operating period employment attributable to the 1,000 resort condominium units that require State Land Use approval is as follows:

Direct employment:	
In the Region	827
Outside the Region	92
Subtotal	919
Indirect and Induced Employment:	
In the Region	110
Outside the Region	625
Subtotal	735
Total	1,654

Source: A. Lono Lyman, Inc.

TABLE 5.1-7

Projected Distribution by Industry and Occupation of Direct, Indirect and Induced Employment Generated by The Proposed Expansion of the Kuilima Resort

Transportation Services	5.47 %
Air Transportation	10.76
Ground Transportation	5.54
Retail Trade	5.45
Eating and Drinking Establishments	31.36
Resort and Hotels	27.78
Personal Services	3.30
Auto and Miscellaneous Repairs	3.98
Amusement Services	6.34
TOTAL	100.00 %

Source: Percent distribution from Manpower Simulation Model, Department of Planning & Economic Development, 1978, State Tourism Study: Manpower, p. 138.

TABLE 5.1-8

Projected Occupational Distribution of Resort Jobs Generated

Distribution of Resort Jobs:	Percent Distribution	Approved for Development	Proposed for Development
Professional, Technical, and Kindred	3.73	32	98
Manager, Official	8.00	68	209
Sales Worker	.46	4	12
Clerical Worker:			
Stenographer, Typist	2.18	19	57
Other Clerical	14.11	120	369
Subtotal, Clerical	16.29	138	426
Craft Kindred	2.83	24	74
Operative	3.21	27	84
Service Workers:			
Cleaning	23.71	201	620
Food	25.92	220	678
Personal	13.19	112	345
Protective	1.11	9	29
Subtotal, Service Workers	63.93	543	1,671
Laborers	1.55	13	41
TOTAL	100.00	849	2,614

Sources: Percent distribution from Manpower Simulation Model, Department of Planning & Economic Development, 1978, State Tourism Study: Manpower, p. 89. Employment projections prepared by A. Lono Lyman, Inc.

28 percent in resort and hotel facilities. Transportation related sectors could potentially account for approximately 22 percent of all jobs, and the service sectors another 14 percent. Retail trade could potentially account for 5 percent of total employment generated by the Resort's development.

Table 5.1-8 indicates that the greatest share of hotel/resort employment will be generated in food service occupations. Other service positions (principally housekeeping and other cleaning), will constitute the next most prevalent job opportunities directly generated, followed by clerical and sales positions, and professional, managerial, technical, and related positions.

Relative to the employment that could be generated by the development as approved, the development as proposed could potentially more than double the available positions in all occupational categories. As indicated in Table 5.1-8, if the development proposed by KDC is approved, the potential hotel/resort employment could be distributed as follows:

About 300 new professional, managerial, technical, and related positions are expected to be created.

Nearly 440 other jobs are projected to be generated in clerical, sales, and service positions other than food.

Nearly 1,340 service jobs are projected to be generated as a direct result of new visitor expenditures. About 600 of those could potentially be cleaning jobs, nearly 680 could be food service jobs, 345 personal service jobs, and 30 security and protective jobs.

About 75 new crafts and operative positions are expected to be generated.

About 40 general labor positions are expected to be generated within the Region.

5.1.7 Operational Labor Sources

The major components of labor supply for the resort's expansion during the operating phase are:

1) formerly unemployed persons,

2) new labor market entrants in the form of greater civilian labor force participation,

3) new labor market entrants in the form of high school graduates,

4) formerly underemployed persons, primarily those in the Region,

5) residents of the Region who commute to work outside of the Region.

Labor supply is most likely to come from within the North Shore and Koolauloa Region. A secondary source of employees is expected to be the adjacent Wahiawa District. Labor is considered less likely to come from the Koolaupoko District due to the area's relatively high employment participation rate and low unemployment rate reflecting its proximity to the major employment centers in Honolulu.

If there is not sufficient labor available in the Region, or if there is inadequate employment training, the adjacent Wahiawa District is a potential secondary source of labor because of its proximity, high civilian unemployment, and low rates of labor force participation. According to representatives of the Waipahu Employment Services Office, many of their applicants are civilian dependents of armed forces personnel. In the Wahiawa area, such persons typically experience difficulty in the labor market because of their distance from major employment centers, and because their short lengths of stay in the islands (generally three years with an option to renew) are perceived by themselves and by employers as a handicap. Military personnel who choose to settle on Oahu frequently remain in the Wahiawa vicinity because of its relatively lower housing costs.

The hotel industry is characterized by a relatively large proportion of jobs requiring minimal skills. Such a labor market situation could benefit from the development of a program that seeks to increase the basic skills of residents, in order that the may potentially qualify for jobs at the Kuilima Resort. Conducted in conjunction with a pre-employment training program, Regional residents should have a higher probability of attaining employment.

5.1.8 Potential Labor Supply

This section discusses the potential for the Region and the adjacent Wahiawa area to supply the labor force that would be required by development at the Kuilima Resort.

Employing the Unemployed: Decreased unemployment has limited potential for increasing the Regional labor supply, but has relatively greater potential for increasing the labor supply in the adjacent Wahiawa area. In 1980, the Koolauloa-North Shore Region's unemployment was 4.8% of the civilian labor force, not significantly higher than the prevailing county rate of 4.6%. By contrast, civilian unemployment in the Wahiawa district was 8.5% in 1980, with 822 civilian labor force members listed as unemployed (U.S. Bureau of the Census, 1980). Unemployment in the county has risen since 1980. In 1984 it was 5.8 for the county. (State of Hawaii, Department of Labor, October 1984. Personal Communication). The current unemployment rate in the Region is estimated to be 6.0 percent and in Wahiawa 7.8 percent.

Increasing the labor force participation rate may be expected to result in a moderate increase in the Regional labor supply and a more significant increase in the labor supply in the Wahiawa area. The labor force participation among civilians 16 years and older is lower in both the primary and secondary market areas than in the county as a whole. At the last census, 61.4% of eligible civilians in the Region, and 56.7% in the Wahiawa area were in the labor force, compared to 65.8% throughout the county (U.S. Bureau of the Census, 1980).

Increased Labor Force Participation: Increased labor force participation is expected to result in relatively more women entering the job market than men. The majority of civilians not in the labor force are women, and Table 3.3-8 noted their characteristics. Among such women, those living in both the Region and the Wahiawa area are more likely to have young (less than six years old) children than are such women in the county as a whole. However, Table 3.3-8 also showed that women in both the Region and the Wahiawa area without children under 18 years of age were much less likely to participate in the labor force than were their counterparts throughout the island. Among women without their own children under 18, 55.1% in the Wahiawa District, 57.8% in the North Shore District and 46.9% in the Koolauloa District did not participate in the labor force. Island-wide, only 44.0% of comparable women were not a part of the labor market.

Although some of this non-participation is due to "rural life styles," Employment Services workers find that a great deal is attributable to the lack of regional employment opportunities, and (in Wahiawa) the perceived futility of job-hunting among persons who are uncertain of where they will live in three years.

An indication of the potential for increasing employment while maintaining the existing levels of population is reflected in Table 5.1-9. Even at 1980 population levels, reasonable changes in unemployment and labor market participation levels imply the potential to fill approximately 3,000 additional jobs from within the Region and the adjacent Wahiawa area. This would be potentially possible without an increase over the 1980 population and with both a decrease in unemployment to the county average and an increase in labor force participation. Our estimates indicate that had the Region and Wahiawa area realized the labor force participation rate that prevailed in the county in 1980 and the county's current unemployment rate, there could be 325 fewer unemployed persons and 2,650 more labor market participants without any growth in the total number of civilians residing in the primary and secondary regions.

TABLE 5.1-9

Potential Changes In the Civilian Labor Force (1)

	Koolauloa-North, Shore Region	Wahiawa	Total
Increased Employment	750	1,900	2,650
Decreased Unemployment	25	300	325
Total	775	2,200	2,975
Other Potential Employees:			
Persons Employed on a Part-time Basis in 1979 (2)	1,600	1,850	3,450
Employed Persons who Commuted More Than 45 Minutes in 1979	2,400	2,050	4,450

(1) Assumes that the Region and the Wahiawa area would have a labor force participation rate and an unemployment rate comparable to the County.

(2) Persons who worked less than 40 weeks and less than 35 hours per week in 1979.

Source: U.S. Census.

High school graduates: In the 1983-84 school year, 707 persons were graduated from Kahuku, Waialua, and Leilehua High Schools (State of Hawaii, Department of Education, Student Information Services, 1984. Personal communication). The most recent available data, presented in Table 5.1-10, indicates that in both the Region and the Wahiawa area, considerable numbers of persons enter the labor market soon after graduating from high school. Statewide, 8.2% of 1977 graduates worked full-time, and 33.7% worked part-time within eight months of leaving high school. Data for the Central school district (including Leilehua High School) were comparable, but in the Windward school district (which includes both schools of the primary labor market region), full-time work soon after graduation was much more prevalent, at 13.5% of the survey respondents. Furthermore, more than one out of five recent graduates in all areas shown were not employed, but indicated that they wanted work.

The Department of Education expects moderate but slowing growth in enrollments at Kahuku and Waialua High Schools through 1990 (Kahuku averaging 2.4% annual growth between 1984-85 and 1989-90, Waialua 2.0%), and slight and slowing growth at Leilehua (averaging 0.5% over the period). Enrollments at all three regional high schools are expected to grow more rapidly after 1990. (State of Hawaii, Department of Education, Student Information Services, 1984. Personal communication).

Table 5.1-11 projects numbers of regional high school graduates to the year 2015, using the average rates of growth observed between 1984 and 1990. Because of this assumption, projections should be conservative in the long run. The projections suggest that graduating seniors in the region should increase from about 700 per year in 1984, to about 900 per year in the year 2000, and more than 1100 per year by the year 2015. Estimating (see Table 5.1-10) that 35% of the projected graduates will seek employment on Oahu on a part-time or full-time basis soon after graduating, it is expected that high schools in the Region and Wahiawa area will supply approximately 300 labor market entrants per year by the year 2000, and approximately 400 per year by the year 2015.

Underemployed persons: The last census enumeration suggests that underemployment was more prevalent in both the Region and the Wahiawa area than in the county as a whole, and may be particularly high among women. Table 3.3-9 indicated that 41 percent of the workers in the Region worked fewer than 40 weeks and/or averaged less than 35 hours per week worked. Within the Region in 1979, a total of 3,300 men and women (27 percent of the Regional employment) worked less than 35 hours per week, and of these 1,600 (13 percent of the total Regional employment) worked less than 40 weeks in that year.

TABLE 5.1-10

Work Status of Persons Following High School Graduation in 1977: Selected School Districts (1)

	Working: Full-time	Working: Part-time	Desire Work (2)
Statewide	8.2%	33.7%	20.9%
Windward district	13.5%	32.9%	22.2%
Central district	8.4%	39.3%	21.7%

(1) Surveys completed between November 1977 and February 1978.

(2) Persons not employed but indicating desire for work, including persons enrolled in school.

Source: State of Hawaii, Department of Education, 1977, Graduate Follow-up Survey."

TABLE 5.1-11

Projected Regional High School Graduates, 1984 - 2015

	Kahuku High	Waialua High	Leilehua High	Total
Graduating class, 1984........	212	171	324	707
Projections (1):				
1985........	217	174	326	717
1990........	244	193	334	771
1995........	275	213	342	830
2000........	310	235	351	896
2005........	349	259	360	968
2010........	392	286	369	1,047
2015........	442	316	378	1,136
Total Projected, 1985-2015	9,560	7,200	10,500	27,200
Graduates Seeking Full or Part-time Employment after upon Graduation (35%)	3,325	2,520	3,675	9,520

(1) Annual compound growth projected at 2.4% at Kahuku, 2.0% at Waialua, 0.5% at Leilehua.

Source: A. Lono Lyman, Inc.

Rates for the Wahiawa District tend to be low because of the generally full employment experienced by its military personnel. However, the breakdown by sex shows that this full-employment is limited to the male portion of the labor market. Female under-employment is nearly 20% of working women in all regional districts, compared to only 14.7% in the county.

If 10% of the 1,600 workers defined as being underemployed in 1979 (those working less than 40 weeks in 1979 and fewer than 35 hours per week) Region had been able to obtain additional work at the Kuilima resort, then the 1979 North Shore and Koolauloa Region's labor forces would have been able to supply 160 additional workers through reduction of under-employment.

Commuters: The last component of labor supply consists of persons resident in the primary region who presently commute long distances to work outside of the region. As indicated in a previous chapter (see section 3.3 and Table 3.3-10) approximately 2,400 persons representing 25 percent of the employed residents of the Region spent more than 45 minutes traveling to work. By comparison, only 12 percent of the county's work force spent a similar amount of time traveling to work. Assuming that 10% of long distance commuters would be able and willing to relocate their employment to Kuilima, the commuting component could supply about 240 workers from persons already resident in the primary region.

Although the analysis has shown that there is a potential for the labor demand by the Resort within the Region being met without significantly impacting population, its realization would depend on the enactment of a number of mitigating factors. In particular, job training, day care services, knowledge of the new employment opportunities, rates of pay, and transportation assistance become key issues. These are discussed in section 5.13 of this report.

5.1.9 Employment Training Programs Presently Available

Presently, Kuilima Development Company, the North Shore Career Training Center, and the North Shore Strategy Committee are seeking to determine the sources, types and extent of training programs appropriate to enhance the number and type of jobs acquired by residents of the Region and to alleviate population impacts. Preliminary results of this effort are expected to be completed after the preparation of this report.

It is appropriate to note that there are several education and training for hotel-related employment in Hawaii, provided by five major groups: (1) the State Department of Education, (2) community colleges, (3) state and county recipients of federal Job Training Partnership Act funds, (4) the University of Hawaii at Manoa and (5) private schools and colleges.

The Department of Education (through the public high schools) and community college system offer vocational education, that is, career-oriented courses leading to degrees less than a Bachelor's. JTPA programs offer job training, that is, classroom and other training directed at the teaching of specific skills for specific jobs. The UHM offers Bachelor's and Master's Degrees, and hence constitutes neither a provider of vocational education nor of job training. The various private schools and colleges in the state offer vocational education and job training, as well as four-year and graduate degree programs.

Output of major providers is summarized in Table 5.1-12. Providers are discussed in the sections that follow.

State Department of Education (DOE): Vocational education in the public high schools is funded primarily by the state, although the DOE receives substantial federal assistance. About half of federal monies for vocational education in Hawaii go to the DOE.

The DOE offers the earliest formal vocational education that a person growing up in Hawaii might encounter. Vocational courses are taken as electives to supplement a regular school program, or as special curricula for disadvantaged or handicapped students. DOE programs reach a large share of public high school students.

Students are limited to the programs offered at their school, however "district exceptions" for one's entire school attendance may be granted on the basis of the availability of vocational programs. McKinley High is presently the center for business-related vocational education on Oahu. The DOE is considering making it an area vocational center, to which students from other high schools could come for specialized training in areas such as computer skills.

There are three types of vocational education programs offered by the DOE:

1) "Pre-Industrial Preparation (PIP)," is limited to academically disadvantaged students. This program offers basic education along with job skills in a work setting. Instruction is by DOE staff members.

2) "Occupational Skills (OS)," is for students with "handicapping conditions," including physical, mental, and emotional disablements. Training is generally intensive and oriented to preparation for a particular job. Instructors are hired from industry.

TABLE 5.1-12

Output of Hotel-Related Educational and Training Programs, Hawaii, Fiscal Year 1983 (Summer 1982 - Spring 1983)

Institution or Sector	State Total	Honolulu County	Hawaii County	Kauai County	Maui County
All Sectors	18,059	NA	NA	NA	NA
High schools (1)	10,615	7,847	1,279	402	1,087
Community Colleges(2)	2,831	2,176	310	117	228
UH Manoa (3)	107	107	0	0	0
State and County (4)	2,971	1,917	491	180	383
Pvt. Bus. and Tr. (5)	885	NA	NA	NA	NA
Pvt. Coll. & Univ.(6)	650	650	0	0	0

(1) Seniors who took vocational education in 1982-83 school year. Multiple counted where student took more than one course. (State of Hawaii, Department of Education, unpublished data.)

(2) Associate degrees or Certificates granted, Summer 1982 - Spring 1983, including Hilo Community College. (UH, Office of Institutional Research & Analysis, 1983.)

(3) Travel Industry Management School graduates. (Ibid.)

(4) Enrollments: classroom training, work experience, and on-job training programs funded with state and/or CETA money. Classroom training enrollments include some non-hotel related courses. (State of Hawaii, Department of Labor & Industrial Relations, unpublished data.)

(5) Incomplete estimate of 1980 - 1981 graduates from private schools accredited or licensed by Hawaii State Department of Education. (State Director for Vocational Education, 1981.)

(6) Graduates of Brigham Young University-Hawaii, Chaminade University, Hawaii Pacific College, and Wayland Baptist University in hotel-relevant programs; Masters in Science & Administration graduates of Central Michigan University (Respective registrars, unpublished data).

3) "Introduction to Vocations (IV)," is open to all students, and hence has the greatest participation. Courses provide information and experience in clusters of occupational types. Instruction is by DOE staff.

Curricula within these programs are organized in occupational clusters. These are: Agriculture, Distributive Education (sales and marketing), Home Economics (including food services), Office Education (including clerical, secretarial, and computer skills), Technology (engineering skills), and Trade and Industry (including carpentry, construction, repair, and maintenance skills.) Hotel-relevant courses within these clusters offered at the three regional schools include Grounds Maintenance, General Office, General Distributive, General Mechanical, Homemaking/Housekeeping, Supervised Food Service, Building Construction, and Ornamental Horticulture.

The OS course offerings vary from year to year with with student interest and the availability of instructors. Because they are taught by DOE staff, offerings in PIP and IV programs are more stable from year to year within a school. However, these curricula are flexible, and can be adapted to meet student interests and community opportunities.

Besides the PIP, OS, and IV programs, public high school students may participate in "Co-operative Education Programs," and "Career Opportunities Programs." The former involves on-job training in a position deemed relevant to a student's studies. Work is supervised by a DOE instructor, and minimum wages are paid entirely by the employer.

"Career Opportunities Programs" are full- and half-day, 20- to 35-week programs offered by the community college system's Employment & Training Office for "problem" high school students. (See the following subsection on the Employment & Training Office, community colleges.)

Although the figures given in Table 5.1-12 indicate enrollment of public high school seniors in all vocational courses, and not completion of hotel-related programs, it is evident that the DOE is one of the major providers of vocational education in the state. Enrollment among seniors in the 1982-83 school year (multiply counted where a student took more than one vocational education course in the year) was more than 10,000 statewide, and nearly 8,000 on Oahu.

Community Colleges: The community colleges are funded primarily by the state, but receive approximately half of federal funds for vocational education that come to the state.

There are four community colleges on Oahu, (Windward, Honolulu, Kapiolani and Leeward Community Colleges), and one in each neighbor island county (Kauai, Maui, and Hilo Community Colleges). Windward Community College is located in Kaneohe, and serves the North Shore and Koolauloa communities.

The community colleges offer specialized education and training through accredited classroom work. They offer Certificates of Achievement (generally one-year programs), and Associate degrees (2 year programs). The latter include an Associate of Arts in Vocational Education with programs in Business Technologies, Food Service, and Sales & Management (including Hotel Operations and Visitor Industry Management).

Through Continuing Education programs, the community colleges reach a broad spectrum of island communities. Continuing education offers instruction for apprentices, skill and knowledge upgrading for employed persons, and training for persons who are unemployed and/or considering switching jobs.

The output figures presented in Table 5.1-12 under state the importance of the community college system. Figures indicate persons completing Associate degrees or Certificates of Achievement, but a great many more take vocationally-related courses without embarking on any degree program.

The majority of for-credit community college education occurs on Oahu, particularly at Honolulu, Leeward, and Kapiolani Community Colleges. Of the 2,831 graduates shown for Honolulu County in Table 5.1-12, 156 graduated from Windward Community College. Next to Leeward, Windward Community College awarded the largest number of Associate in Arts degrees (124 in 1982-83). (University of Hawaii, Office of Institutional Research and Analysis, 1983, p. 5.)

University of Hawaii at Manoa (UHM): The primary source of funding for UHM is the state, although various federal and private grants and endowments may support particular chairs and research projects. The UHM is a four-year university offering professional level education in a number of programs applicable to hotel-related work. Related fields of study include Hawaiian Studies, Business Administration, Travel Industry Management, Food Services and Human Nutrition, and Home Economics.

The School of Travel Industry Management (TIM) is the University of Hawaii Manoa's most directly related program in this field, with a strong orientation to managerial and supervisory level employment. The TIM school offers Bachelor's degrees only. All TIM programs require substantial on-job internship training in the student's particular field.

The College of Business Administration is the largest hotel-relevant program at UHM. It awarded 647 Bachelor's and 96 Master's degrees in 1982-83. However, many of these students are likely to have entered non-hotel related fields of business employment following graduation.

In 1983, 107 students received Bachelor's degrees from TIM. Although graduates of many other UHM programs also enter the hotel-related job market in Hawaii, the figures given for UHM in Table 5.1-12 reflect only TIM graduates.

Federally supported state and county programs: This section deals with state and county programs supported by the federal Job Training and Partnership Act (JTPA), which replaced the Comprehensive Employment and Training Act (CETA) in 1983. Details of funding are given for each particular agency. It should be noted that many of the agencies also receive financial support form the state.

JTPA's Title IIA funds are limited to programs for economically disadvantaged persons, defined as persons out of work for at least 14 weeks, on welfare, receiving food stamps, or from a family below a designated poverty status. Title IIA-202-B2 funds are for economically disadvantaged persons older than 55.

Title IIB JTPA funds are for the Summer Youth Employment and Training programs, limited to economically disadvantaged persons between 14 and 21 years of age.

Title III JTPA funds are for employment relocation assistance to dislocated workers. No economic disadvantage is required for participation.

The agencies involved in the programs are:

1) State of Hawaii, Department of Labor & Industrial Relations, Employment & Training Administration (OETA): Under the Job Training Partnership Act (JTPA), all JTPA funds go to the governor. In Hawaii, the governor directs JTPA funds to the State Department of Labor and Industrial Relations' (DLIR) Office of Employment & Training Administration. Each Service Delivery Area (county) through its Private Industry Council (PIC) and Local Elected Official (LEO: in Hawaii, the mayor) designates who will operate JTPA funded programs, and DLIR's OETA routes funds to them. Choice of the operating entity is re-negotiated each year by the PIC-LEO.

On Oahu, funds go to the City & County's Honolulu Job Training Program (see below); on Kauai, to Kauai Community College; in Maui County and on the Big Island, to local Employment Services Office (offices of DLIR). These groups may in turn subcontract to others to provide training programs. Maui and Hawaii often contract with the Employment & Training Office of Community College System (see below.)

JTPA funds may also go directly to providers (community colleges and private vendors) for purchase of materials and/or "slots", or to private industry groups offering their own training programs.

In summary, OETA does not offer courses itself, but rather funds three types of training: (1) classroom training (through community colleges and private schools), (2) on-job training, and (3) work experience. Work experience programs are designed for first time labor market entrants, and many restrictions exist. Eligible persons may participate in all three types of training. For instance, it is not uncommon for a person to participate in classroom training, then on-job training, and then participate in work experience programs. Hence data shown in Table 5.1-12 incorporate multiple counting of persons.

2) City & County of Honolulu, Office of Human Resources, Employment & Training Division (also known as "Honolulu Job Training Program" (HJTPA)): The HJTPA is presently the prime administrative agency receiving Title II and III JTPA funds in Honolulu County. HJTPA also receives federal funds in the form of Community Development Block Grants money (through the City & County), and in the form of Refugee funding (through the State Department of Social Services & Housing).

For classroom programs, the agency puts out requests for proposals to providers of job training, and funds accepted programs. Classroom programs themselves may be provided by community colleges (either through the for-credit curricula or through the community college's Employment & Training Office, see below), private schools, or private industry groups. A hotel, for instance, could submit a proposal for training for its employees, and receive JTPA funds from the HJTP.

HJTP also funds on-job training, paying up to 50% of a disadvantaged employee's wages for up to six months. Summer youth programs are funded with Title IIB JTPA funds. Employment Services Offices on Oahu are used extensively for intake referrals to this program.

3) Employment & Training Office, community college system (ETO): The ETO is a non-profit arm of the community college system. The ETO is the major recipient of JTPA funds from the counties, and the major provider of instructional services funded by JTPA. Its own operating budget, however, (for office staff), is supplied primarily by the state.

The ETO offers non-credit classes and specialized short term training or re-training programs geared to specific projects and work sites. It does not offer work experience or on-job training. It has a teaching pool of about 40 persons on renewable one-year contracts. Classes may be offered at its own training centers (two in Honolulu, one in Waianae), at job sites, in community college facilities, or elsewhere. The ETO contracts with groups such as the military, Alu Like, State Departments of Health, Transportation, Personnel Services, Labor & Industrial Relations, Education, and with City and County of Honolulu (HJTP), who contribute the costs of rooms, teachers, and/or supplies.

The ETO also offers half- and full-day "Career Opportunities Programs" (ranging from 20 to 35 weeks) for high school students who show problems with the conventional school system. Hotel-related programs include Food Preparation and Baking, Clerical Occupations, and remedial education. Participation in these programs can lead to credit towards high school graduation.

The most current data compiled by the ETO coordinator indicates that during the period 1971 through 1981, 1,077 recipients participated in ETO sponsored hotel courses. Of these, 1,030 completed the courses, reflecting a 96% completion rate. Placement figures are incomplete, as the data is available only for individuals employed at the time the course was completed.

Private colleges and universities: The major private colleges and universities offering hotel-related curricula in the state are located on Oahu. They are Brigham Young University-Hawaii, Chaminade University, Hawaii Pacific College, Central Michigan University Extension, Wayland Baptist University, and Antioch Extension. Antioch, offers self-designed work-study curricula but is reportedly phasing out its programs in Hawaii.

Brigham Young University-Hawaii (BYU) offers Associate (two-year) and Bachelor's (four-year) degrees in Hotel Management, Travel Management, and Restaurant Management; many students combine two in a double major. Certificates of Achievement (one-year), Associate degrees, and Bachelor's degrees are also offered in Travel, Secretarial Science, Office Management, Business Management, and Accounting. In the 1981-82 and 1982-83 school years combined, 260 persons received Associate or Bachelor's degrees in these fields; 63 of these graduates were students from Hawaii. About 60% of BYU students are foreign, and

must return to their home countries. However, many foreign students are allowed to remain in Hawaii for a one-year work internship following graduation. Although more than 90% of BYU students are members of the Church of the Latter Day Saints, enrollment is not limited to persons of this faith.

In hotel-related fields, Chaminade University offers an Associate degree in Management, and Bachelor's and Master's in Business Administration. Chaminade graduated 109 persons in these fields in 1982-83, of a total of 379 graduates in that school year.

Hotel-relevant degrees at Hawaii Pacific College include a Bachelor of Science in Business Administration and an Associate degree in Management. Hawaii Pacific graduated 223 persons in these fields in 1982-83. The Business Administration curriculum includes a major in Travel Industry Management; however, most Business Administration students at Hawaii Pacific College major in computer sciences.

Wayland Baptist University offers an Associate of Applied Science degree and a Bachelor of Science in Occupational Education. Hotel-relevant majors in Occupational Education include Business Management, Business Administration, or Occupational Technology. The school graduated 45 persons in these majors in 1982-83. The Occupational Technology major awards extensive credits for work experience, and is utilized primarily by military personnel.

Central Michigan University offers a Masters in Science & Administration. Relevant areas of concentration for this degree are the program in General Administration, and in Human Resources Administration. However, completion figures are not available by concentration areas (other areas are Health Care and Public Administration.) In all four concentration areas combined, Central Michigan University graduated 143 persons in the 1982-83 school year. The university extension has five campuses in Hawaii, all located on military bases. Although most students are active military personnel, enrollment is not so limited.

Private business and trade schools: A number of private schools offer training in hotel-related fields, and most are located on Oahu. Major private schools providing hotel-related curricula are Cannon's International Business College of Honolulu, Hawaii School of Business, the Travel Institute of the Pacific, Kottner Travel Institute, Travelers Choice, and the Bartender Training Institute.

Hawaii Hotel and Restaurant Industry Employment and Training Trust (HHRIET): HHRIET is an independent training fund controlled jointly by labor (Hotel and Restaurant Workers Local 5) and management (hotels belonging to the Council of Hawaii Hotels and signatory to the Local 5 master hotel agreement). Whenever the trust fund dips below $300,000, member hotels are asked to contribute $0.01 for each employee hour worked. (In 1984, funds had not been collected for over 14 years.) The trust fund is used in conjunction with community college monies to provide on-job and /or classroom training for employees working at member hotels.

Training programs range from 30 to 600 hours in length, and may take as long as four years to complete. Most courses are held at Honolulu Community College because of its appropriate facilities. Currently none are held at Windward Community College. The location of courses appears to have been a problem in the participation of employees from Kuilima Resort. (In late-1984, the Turtle Bay Hilton has only one participant.)

Visitor Industry Education Council (VIEC): The VIEC has prepared three curricula that are available for use in primary and secondary schools. Their curricula are aimed at Kindergarten, 4th grade, 11th grade students. The Visitor Industry Education Council, recently produced the videotape "Tourism, What's In It For Me?".

Educational Institute of the American Hotel and Motel Association (HMA): The HMA is a non-profit educational foundation of the American Hotel & Motel Association, accredited by the U.S. Department of Education and by the National Home Study Council. Curricula are aimed at middle and upper managerial positions. Curricula are sold three ways: (1) to two- and four-year degree-granting institutions; (2) to local educational institute chapters (self-appointed associations of hotel personnel in one locale); and (3) to individuals for at-home self-teaching. The HMA also offers a few one-day skill development programs for non-managerial positions.

The largest user in Hawaii was formerly Kapiolani Community College. Kapiolani offered HMA certificates for completion of a series of HMA courses. Hotels frequently paid for persons taking HMA courses at Kapiolani, but withdrew such funding around 1980 and 1981. Kapiolani uses fewer of HMA materials now and sees less interest in the Educational Institute's certificates of achievement.

Hawaii Visitors Bureau (HVB): Under the directorship of Dr. Thomas Hamilton, the HVB began offering a short course in "Hawaiiana" for tour bus drivers. That was later expanded to a 40-hour course resulting in a certificate of completion. Employers paid the costs of employee participation. Since 1975, the 40-hour curriculum has been condensed to a 3-hour session which is available to supplement training given by other groups. The present session covers "Hawaiiana," origins of the visitor industry, and hospitality. The HVB occasionally provides speakers (generally with a 1-hour slide show and presentation) to supplement the Department of Education's vocational education courses.

5.2 Population and Housing Impacts

5.2.1 Overview

What can be said about population and housing impacts has changed greatly from the situation of a few years ago. For one thing, the development reflected in the Kuilima master plan has been greatly reduced. Even more importantly, however, the County is now operating under a more stringent set of population management policies, incorporated into the County's General Plan and Development Plans and discussed in the next section. It is sufficient to state at this point that these policies have important implications for population and housing development. Finally, Kuilima Development Company (KDC) is initiating some action planning for local employment which will also have important implications for population and housing pressures. These include job training and other mitigating actions which are discussed in Section 5.13.

5.2.2 Public Policy Limits Regional Population Impact

As noted in Section 3.5, the County's General Plan and Development Plans include, among other things, policies related to population management. The growth management policies limit the present and future population growth that may occur in any of the Development Plan areas. The adoption of the County's Development Plans for the two Plan Districts encompassed by the Region (Koolauloa and North Shore) have been accompanied by large-scale down-zoning which has reduced residential capacity in the Region. New residents in the Region would be able to move into the Region primarily as the result of others leaving the Region. To the extent that individuals working in the Region could not find housing within the Region, they would have to commute into the Region. Inmigration into the Region would be limited by the availability of housing, which is in turn limited by public policy.

An important factor that is expected to alleviate competition for housing is the existing turnover in Regional housing and the out- and inmigration of Regional residents. The 1980 census (see Section 3.4.4) indicates that the turnover in Regional housing was 31 percent between 1979 and mid-1980, and that the gross migration patterns (see Table 3.2-3a) indicate that 52 percent of the Region's residents moved into the Region five years prior to the census.

5.2.3 Alternative Futures for Population and Housing Impacts

The following describes four alternative futures for population and housing impacts in the Region resulting from development at the Kuilima Resort.

FUTURE #1: No Development Plan limits; "unmitigated" Kuilima development.

Impacts: Major increase in Koolauloa/North Shore population and housing inventory, through reduced outmigration and increased inmigration.

Comment: The Belt, Collins draft environmental impact statement prepared for a proposed larger scale development at the Kuilima Resort forecast total future population 11,200 to 12,500 greater with Kuilima than without. This included people who would otherwise have outmigrated; their analysis did not attempt to forecast how much of this population was due to new inmigrants. They foresaw much of the population growth occurring in new developments from Kahuku to Laie. (Belt, Collins & Associates, 1979. Proposed Expansion of the Kuilima Resort Community: Environmental Impact Statement.)

FUTURE #2: Current Development Plan policies; no Kuilima expansion.

Impacts: Future new housing only for additional 2,600 people in Koolauloa and 2,200 in North Shore by year 2000. Practical implications include strong pressure on housing (more congestions, higher rents and housing costs).

Comment: The Development Plans for Koolauloa and the North Shore areas imply both reduced inmigration and increased outmigration. The Region would probably experience more crowded households in future, so actual population will possibly be in excess of the Development Plans' limits.

FUTURE #3: Current Development Plan policies; "unmitigated" Kuilima expansion.

Impacts: Population still held to same totals by Development Plan. However, even stronger housing pressures.

Comment: It is difficult to say how how much stronger the housing pressure will be with Kuilima expansion, because it will be there anyway. Much of the Kuilima expansion has already been approved on the Development Plans, and total combined development spread over some 30 years. Also, the additional proposed expansion includes 1,200 resort condominium units and no residential units.

FUTURE #4: Current Development Plan policies; "mitigated" Kuilima expansion.

Impacts: Population still held to same totals if Development Plans unchanged. However, housing pressure relatively reduced by actions to assure maximum number of jobs for residents of Koolauloa, North Shore, and nearby areas.

Comments: The major "mitigations" for population and housing involve doing something that is also considered important in and of itself--seeking to provide current and future residents (who are already housed) as many of the jobs as possible and/or as they want. Mitigations are discussed in Section 5.13.

5.2.4 Construction Period Impacts

Both the state and Oahu have a large pool of skilled and experienced construction labor. In 1983, the State's Labor Department data indicates that the total construction employment for the state was 18,000 and 14,800 on Oahu. Oahu's 1983 construction employment represents 82 percent of the state's total construction jobs, indicates that at least on an islandwide basis, there are sufficient construction workers to satisfy projected construction labor demand attributable to the proposed development at the Kuilima Resort. Given that construction activity and employment is currently lower than what it was in the early- to mid-1970s, it is not unreasonable to anticipate that the supply of construction worker on Oahu could expand if the level of construction activity increased.

Current data is not available for the number of construction workers living in the Koolauloa-North Shore Region in 1983. However, the 1980 census indicated that approximately 760 construction workers resided in the Region, representing 3.5 percent of Oahu's construction workers. By comparison, the 1970 census indicated that 1,080 construction workers resided in the Region representing almost five percent of Oahu's construction workers. The decline in construction workers living in the Region reflects an overall decline in construction activity on Oahu and throughout the State. In light of this decline, it is likely that former construction workers who are now either employed in other industries or unemployed probably reside in the Region. A discussion with the director of the North Shore Career Training Center confirms that this is the case.

The existing supply of construction labor in both the Region and the County indicates that there is adequate labor to minimize the impact that the construction activity would have on population growth, both in the Region and the County. To the extent that construction workers who do not presently live in the Region move into the Region, the 30 percent turnover in rental housing observed in 1980 (see Table 3.4-4) should provide sufficient housing to accommodate these new residents. Construction workers who do not reside in the Region are expected to commute to their job site at the Resort.

5.2.5 De Facto Population Impacts

Table 5.2-1 summarizes the effects of the approved and proposed developments on de facto visitor population at the resort. The proposed expansion of the Kuilima Resort's impact on population and housing would be limited by existing County population management policies (discussed previously in Section 5.2.2) and by mitigating actions (to be discussed in Section 5.13). Thus, the net total regional population effects may be limited to those occurring at the resort.

Approved Developments: Using typical Hawaii resort occupancy and party-size assumptions (80% occupancy and 1.9 persons per unit for hotels; 50% occupancy and 2.5 persons per unit for resort condominiums), the currently approved plans would result in an average daily de facto Resort population of 2,807 persons (existing 740 plus 2,067 from additional approved units). This is based on the earlier assumption that 650 of the additional units would be hotels. However, the latter assumption is not a strong determinant of population outcome; if all the additional 1,513 units were developed as hotels, average population would increase only to 3,500, and it would drop only to 3,091 if all the units are resort condominiums.

Proposed Developments: As indicated in Table 5.2-1, the proposed total development would result in an estimated average daily de facto Resort population of 5,523 (2,944 in hotels and 2,579 in resort condominiums), which is 2,716 more persons than would be there if development occurs only as currently approved. (Again, these figures include the estimated existing de facto population of about 740). Thus, it is estimated that the increase in de facto population would essentially be proportionate to the increase in unit count (i.e., about double).

TABLE 5.2-1

Projected De Facto Population Impacts of Approved and Proposed Developments at the Kuilima Resort

	Approved for Development PLUS Existing (3)		Total Proposed for Development (WITH Existing) (3)		Population from Additional Development	
	# Units	Avg. Pop.	# Units	Avg. Pop.	# Units	Avg. Pop.
Hotel Rooms (1)...............	1,137	1,728	1,937	2,944	800	1,216
Resort Condominium Units (2)..........	863	1,079	2,063	2,579	1,200	1,500
Total....................	2,000	2,807	4,000	5,523	2,000	2,716

(1) De facto hotel population calculated at 80% occupancy, 1.9 persons per occupied unit.

(2) De facto condominium population calculated at 50% occupancy, 2.5 persons per unit.

(3) Existing 368 condominium units omitted from analysis because they are not part of the Resort -- i.e., they are designated Apartment and their population is considered residential by the City and County Department of General Planning.

(4) Existing 487 hotel units estimated to have population of 740; hence, DFW population would be 2,067 under current approvals vs. total 4,783 under proposed expansion.

Source: A. Lono Lyman, Inc.; Community Resources, Inc.

5.2.6 Off-Site Housing Availability and Costs

Presently and in the future, the limitations placed on residential housing development in the Region by the County's population management policies and by the State's land use policies will adversely impact both the availability and cost of housing in the Region. This impact is expected to be more significant than the impact that additional development at the Kuilima Resort could potentially have on the availability and cost of housing in the Region.

In the four years that have passed since the 1980 census enumeration, there is no evidence that the Regional housing situation has improved with respect to either availability or cost. Discussions with residents indicate that the availability of housing has probably worsened, due in part to military housing allowances which have provided recipients the opportunity to compete for the available housing supply. Although additional publicly subsidized housing has become available in the Region, state and county policies severely limits residential housing development, particularly on Oahu and in rural areas such as the Region. As indicated in Section 3.4.3, housing costs in the Region and the adjacent Wahiawa area were higher than the county according to the 1980 census data. The ratio of median monthly rent relative to median family income was 14.5 percent for the County, 15.9 percent in the Koolauloa area, 17.4 percent in the North Shore area, and 23.1 percent in the Waniawa area. The ratio of median monthly housing costs with a mortgage relative to median family income was 21.7 percent for the County, 25.1 percent in the Koolauloa area, 19.1 percent in the North Shore area, and 32.1 percent in the Wahiawa area.

A limited survey of rental housing in the Region indicates that a significant proportion of the rentals in the Region are kept available for short-term vacation rentals. Indeed the 1980 census reflected over 5 percent of the Region's inventory of year-round housing units being held for occasional use by owners. In 1980, the Regional inventory of units held for occasional use comprised 18 percent of the County's total in this category.

Development at the Resort is expected to add to an already existing pent-up demand for residential housing in the Region. The existing pent-up demand results primarily from County and State policies which effectively limit the supply of housing, particularly in rural areas such as the Region. The additional demand for residential housing that may be attributable to development at the Resort will be derived from employees' requiring housing. To the extent that housing is limited in the Region, employees can compete for the limited supply and bid-up rental rates, or they can seek less costly housing outside the Region, such as in Wahiawa.

Development at the Resort could reduce the demand for off-resort vacation rentals in the Region, and by doing so make these units available for residential use. This would occur as a

result of the Resort's vacation rental units having amenities that are not available at off-resort vacation rentals. To what extent this may occur is not possible to determine.

As discussed in Section 5.13.3, mitigation actions that may be taken would also alleviate the impact on housing. These mitigation actions include development of housing for employees, and establishing a rental information service in order to match employees with rental housing. These actions are expected to alleviate, to some extent, the possible impact that the Resort's development could have on the demand for housing attributable to employees and the possible impact on rents attributable primarily to County population management policies and secondarily to development at the Resort.

5.3 Other Economic Development

Further development at the Kuilima Resort would stimulate other economic activities, both inside and outside the Region. One perspective of the overall economic activity that may potentially be attributable to further development at the Resort is the distribution of sales or output, presented in Table 5.3-1. The table indicates that sales and output is relatively concentrated in hotel services and real estate, 36 percent; eating and drinking places, 23 percent; other retail trade, 10 percent; and the transportation sectors, 17 percent. This suggests that the other economic activities that would be attributable to further development of the Resort would also be concentrated in eating and drinking and in retail establishments, and transportation services. Although the relative distribution of sales is smaller, the visitor industry also stimulates the agricultural, manufacturing, wholesaling and service sectors.

Another perspective of the other economic activity is the indirect and induced employment, summarized in Table 5.3-2 and based on estimates discussed in Section 5.1. As indicated, exclusive of direct construction and operating jobs, the impact resulting from the construction period is expected to be greater than the impact resulting from the operating period. This reflects the relatively high pay rates earned by construction workers compared to hotel employees. Within the Region, the construction period employment impact is estimated to be 170 persons if the Resort is developed based on existing approvals, and 600 if it is developed as proposed by KDC. The operating period impact, exclusive of direct employment, is estimated to be 140 persons if the Resort is developed based on existing approvals, and 340 if it is developed as proposed by KDC.

TABLE 5.3-1

Distribution of Total Sales and Output
Generated by Visitor Related Expenditures in 1982
($ million)

	Sales/ Output	Distri- bution
Agriculture..................	$73.5	1.0%
Textile and Apparel Mfg................	63.0	0.9
Other Manufacturing..........	219.9	3.0
Air Transportation...........	878.2	12.0
Other Transportation.........	337.5	4.6
Wholesale Trade..............	204.2	2.8
Eating and Drinking Places......................	1,653.7	22.6
Other Retail Trade...........	768.8	10.4
Hotel Services and Real Estate................	2,598.4	35.5
Other Services...............	513.5	7.0
Imports......................	- -	- -

Source: State of Hawaii, Department of Planning and Economic Development. Data Book: 1983, Table 195.

TABLE 5.3-2

Employment, Exclusive of Direct Construction and Operating Jobs

	(A) Approved for Development	(B) Total Proposed for Development	(C) Employment from Additional Development
INSIDE THE REGION			
Construction Period: (1) Indirect and Induced...........	152	578	426
Operating Related: (2) Indirect and Induced...........	136	418	282
OUTSIDE THE REGION			
Construction Period: (1) Indirect and Induced...........	1,134	4,296	3,162
Operating Related: (2) Indirect and Induced...........	770	2,370	1,600

(1) See Table 5.1-3 and accompanying text.

(2) See Table 5.1-6 and accompanying text.

Source: A. Lono Lyman, Inc.

5.4 Other Regional Land Use Impacts

Land use impacts, other than at the Resort or the off-resort housing impacts (which were discussed previously), would include increased demand for retail and commercial land, and limited additional demand for industrial zoned land. Land values for ocean-front properties would also be likely to appreciate at a faster rate. The value of other urban (residential, commercial, retail, and industrial) land uses would be impacted to a lesser extent with the impact being determined ultimately by the supply permitted by public policy. Finally, individuals who are on fixed incomes and who own land that is rapidly appreciating in value may have their real property taxes increase at a faster rate then their fixed incomes allow them to afford.

The extent of the potential increased demand for additional retail, commercial and industrial land is being analyzed in a separate report being prepared by another consultant. Ultimately, the supply of retail, commercial and industrial land will depend on County land use policies. If public policy does not provide for sufficient commercial and retail land in the Region, users would tend to bid up the value of the available supply, and the pent-up or unsatisfied demand would be directed to areas outside the Region.

Further development at the Resort is expected to intensify the already existing demand for ocean-front property, such as along Kawela Bay. Since the demand for such uniquely located property is finite, than the values of such properties has tended to be higher and to appreciate at a faster rate then most other land. The rate of future appreciation is a function of many variables, and is generally regarded as being speculative. Therefore, we make no attempt to guess what the extent of the appreciation would be for ocean-front land.

The appreciation of residential land that is not located on ocean-front sites is expected to be most significantly impacted by public policy restricting the supply of such land. The impact that the development at the Resort has on such land values would be indirect, in that public policy would be the factor limiting supply. Increased demand attributable to the Resort's development is expected to be derived almost entirely from potential employees, and to a negligible to very limited extent by non-employees attracted to the Region by the Resort.

Individuals who own land that is rapidly appreciating in value and who are on fixed incomes may have their real property taxes increase at a faster rate then their fixed incomes allow them to afford. The proportion of existing land owners with fixed incomes could not be determined, therefore the extent of such an impact could not be ascertained.

5.5 Personal Incomes

In 1979, 23 percent of the Region's families had incomes below 125 percent of the poverty level standard set by the United State's Department of Housing and Urban Development. (For example, the poverty threshold for a four-person family was $7,412 in 1979.)

During the construction and operating phases, respectively, Tables 5.5-1 and 5.5-2 shows the effects on personal income of the direct, regional and total in-state employment estimated to be generated by the Resort's development based on the existing approvals and the amendments proposed by KDC. Income is shown in 1983 dollars, and average annual wages are based on wage information by industry.

Stated in 1983 dollars, the <u>total</u> direct income attributable to construction activity is expected to generate $39.1 million based on existing approvals and $148.3 million based on proposed development. Once the Resort is fully developed, the Resort is projected to generate an annual earnings of $24.3 million based on existing approvals and $ 74.8 million based on proposed development.

TABLE 5.5-1

Total Projected Earnings Derived from Labor Generated by Construction of Approved and Proposed Developments, Kuilima Resort ($million - 1983 dollars)

	(A) Approved for Development	(B) Total Proposed for Development	(C) Employment from Additional Development
Jobs in the Region........................	$22.5	85.4	62.9
Jobs Outside the Region..................	16.6	62.9	46.3
Total, All Jobs...........................	39.1	148.3	109.2

Source: A. Lono Lyman, Inc.

TABLE 5.5-2

Projected Annual Earnings Derived from Operating Employment Impact of Approved and Proposed Development at the Kuilima Resort ($million - 1983 dollars)

	(A) Approved for Development	(B) Total Proposed for Development	(C) Employment from Additional Development
Jobs in the Region........................	$15.5	47.6	32.1
Jobs Outside the Region..................	8.8	27.2	18.4
Total, All Jobs...........................	$24.3	74.8	50.5

Source: A. Lono Lyman, Inc.

5.6 Tax Revenues

State and local tax revenues generated by the visitor industry ranged between 16.8 percent and 17.7 percent of household income between 1980 and 1982, the most recent year data is available. (State of Hawaii, Department of Planning and Economic Development, 1983.) The following estimate is based on a 17 percent rate of tax generation for state and local taxes, stated in terms of 1984 dollars.

- o State and local taxes from construction wages is estimated to be $6.6 million based on existing approvals and $25.2 million based on proposed development.
- o Once the Resort is completed, annual state and local taxes from operating wages are estimated to be $4.1 million based on existing approvals and $12.7 million based on proposed development.

The impact that development at the Resort would have on real property taxes, which is one the several taxes include in the foregoing discussion, may be of particular interest to the City and County of Honolulu. Development at the Resort would impact real property tax revenues to the City and County of Honolulu by increasing the total units developed, the average value of those units, and the land values at the Resort. Since these values are not presently know, only a very crude estimate of the increased real property tax can be made.

Because of the uncertainties inherent in determining future land values, we have not made any estimate of the tax revenue that may arise from added land values. An illustrative estimate of the real property tax impact on improvements can be made based on some rough assumptions.

Assuming that the average value per unit of the improvements for the development that is approved were $150,000, than the real property tax on the improvements would be $2.2 million. Assuming that the average value per unit of the improvements for the development that is proposed were $200,000, than the real property tax on the improvements would be $4.8 million. Exclusive of the real property tax on the land value, the assumptions indicate that the additional real property taxes from the improvements alone could be over 100 percent of the taxes that could be derived from the development based on the existing improvements. Since the land value would also be greater with the development as proposed relative to the development as currently approved, there would also be additional real property taxes derived from higher land values at the Resort.

5.7 Political Ramifications

Rural resort development in Hawaii can have at least three types of political ramifications: (1) electoral; (2) union representation; and (3) community-based vs. absentee decision-making.

Electoral: An earlier assessment of the likely impact of a previous Kuilima master plan (Belt, Collins and Associates, 1979) suggested that major population growth would be generated in the Kahuku-Laie area, implying more voter power in those communities than others. Subsequent passage of the City Development Plans would prohibit or dampen such growth. However, a very long-term effect of resort condominium construction at Kuilima could be eventual retirement there by affluent older residents, most of them probably not now living in the Region. This could lend a slightly more conservative tinge to the Kahuku-area electorate, which is now fairly liberal in its voting patterns.

Union Representation: Historically, the ILWU--the union which represented Hawaii sugar workers--wielded great political power in the Koolauloa area, as it still does in and around Waialua. Today the ILWU represents Kuilima groundskeeper and golf course employees, while the AFL-CIO Local 5 represents indoor Hilton employees. As more facilities are constructed, a major political element in workers' lives will be union representation elections among these two unions and the new Independent Service and Culinary Workers organization (presently lodged in the Teamsters offices). Should one union win all or most hotel elections, electoral politics would also be affected.

Community-Based vs. Absentee Decision-Making: This has to do with the perception that hotel owners or management firms based outside the community will have decision-making power which can strongly influence the local economy or even political decisions (e.g., choice of sites for public facilities). Because this is also an element in resident-visitor interaction, discussion is deferred to Section 5.10 and to the "Mitigations" section (particularly Section 5.13.6).

5.8 Dislocation

Implementation of the proposed Kuilima master plan would require the removal or relocation of two groups:

- residential/vacation home lessees of houses along the eastern part of Kawela Bay and the western part of Turtle Bay;
- agricultural lessees of larger interior parcels used for farming.

5.8.1 Lessees of Residential Parcels on Kawela Bay

Prudential currently leases out approximately 20 acres (cumulative total) of residential property on 39 separate parcels located from the middle (southern shore) of Kawela Bay to the Kahuku end of the bay and extending east for approximately half a mile along the western part of Turtle Bay. There are a total of only 37 lessees, since one individual leases three parcels. Most of these parcels front Kawela Bay or are just inland from Kawela Bay, and all contain residential structures.

According to information provided by the property management company contracted by Prudential, about half the homes are occupied on a full-time basis (personal communication, L. Alexander, Chaney Brooks and Company):

Type of Occupancy	Number	Percent
full-time occupied	19	49%
held for occasional use--frequently occupied (e.g., weekend use)	5	13%
held for occasional use--infrequently occupied (e.g., vacation use)	10	26%
unoccupied	5	13%

No detailed information is available on the overall characteristics of tenants, although the list of names includes a number of families prominent in Island business, government, and entertainment circles. The current lease rent is $280 a month, not including real property tax and utilities.

All tenants have been on a month-to-month basis since 1980, when they were informed by Prudential of the planned eventual termination of leases because of the resort expansion.

Displacement impacts will vary among the lessees, depending to some extent on the degree to which they now depend on the parcels as residences. The 19 full-time families or individuals (including one sub-lessee renting from the tenant of record) would be most impacted. Along with the effort and time required to search for another residence and then move, these people will need to leave what many consider a desirable setting and low rental situation. Even though many of the existing houses are old and in need of repair, the East Kawela Bay setting is one of seclusion and private beach frontage. Additionally, there will be probable financial impacts, since the current lease rentals are considerably below market rates. A house in good condition and in a comparable setting could easily rent for three to four times the amount now being paid. A final type of impact involves psychological apprehension and anxiety about the future, which is as much a function of current uncertainties as of the eventual move itself.

Lessees who are part-time occupants will experience similar impacts, although they will not need to find a full-time residence. They will, however, need to move away from what may be an ideal vacation home or weekend hideaway, and they may find it difficult to rent another house for similar purposes.

However, in one sense these lease terminations would not be an "impact" of the currently requested land use approvals, because the terminations are likely to take place even if the applications are denied. The Kawela Bay residential leaseholds are on property owned by Kuilima Development Company. In the event of disapproval of the current requests, the developer would probably sell this property along with the other Kuilima holdings. Any purchaser would be highly likely to terminate the present leases in order to make use of the land and might even require Kuilima Development Company to terminate the leases first as a condition to the sale. The dislocation would not occur as rapidly, but it would still take place.

5.8.2 Lessees of Agricultural Parcels

Six lessees lease eight agricultural parcels totalling approximately 153 acres (of which about 20 acres is used for actual crop production, with the remainder for structures, roads, and livestock grazing). Most of this land is on the Kahuku side of the project site. The uses are intended to be strictly agricultural, and tenants now engage in activities ranging from growing crops (watermelon, papayas, and vegetables) to raising cattle. The lease rent is currently $2.00 per month per acre, not including water, utilities, or real property taxes. Like the residential lessees, the farmers have been leasing on a month-to-month basis since 1980, having been told that the leases will eventually be terminated.

The biggest impact of the proposed project on the farm lessees would involve the task of finding other farm lots which are affordable, considering that the lessees are currently paying nominal rent. Other impacts related to relocation center around the timing and actual activities involved in moving a farm operation. Crop growers need sufficient planning time to schedule planting and harvest before any relocation. Further, in the case of those who overlap different crops, it may be necessary to clear, prepare, and plant the new farm lot, while awaiting final harvest of the currents crops on the old land. Consideration must also be given to the actual relocation activities, which may include transport of animals, equipment, and supplies.

Again, the actual dislocation "impact" of the proposed resort expansion would be primarily to establish a definite termination date. Project disapproval would delay the termination of these leases for an unknown period of time, but subsequent sale of the lands would also also likely lead to the eventual termination of these leases. Alternatively, since the lands would remain designated for agriculture, the new owners might be willing to negotiate long-term leases with at least some of the present lessees, but the monthly lease rentals would almost certainly be far in excess of the present low rates.

5.9 Outdoor Recreation and Food Gathering

Outdoor recreational and food gathering resources play a major role in the lives of Hawaii residents, primarily because the natural resources are readily available and conducive to year-round enjoyment. This is especially true in rural areas.

This section discusses the potential impact of the proposed development on existing recreational and food gathering resources within the project boundaries, with consideration for the importance of these resources to residents of surrounding communities. Also discussed are the potential impacts of the project's visitor population on off-site recreational areas.

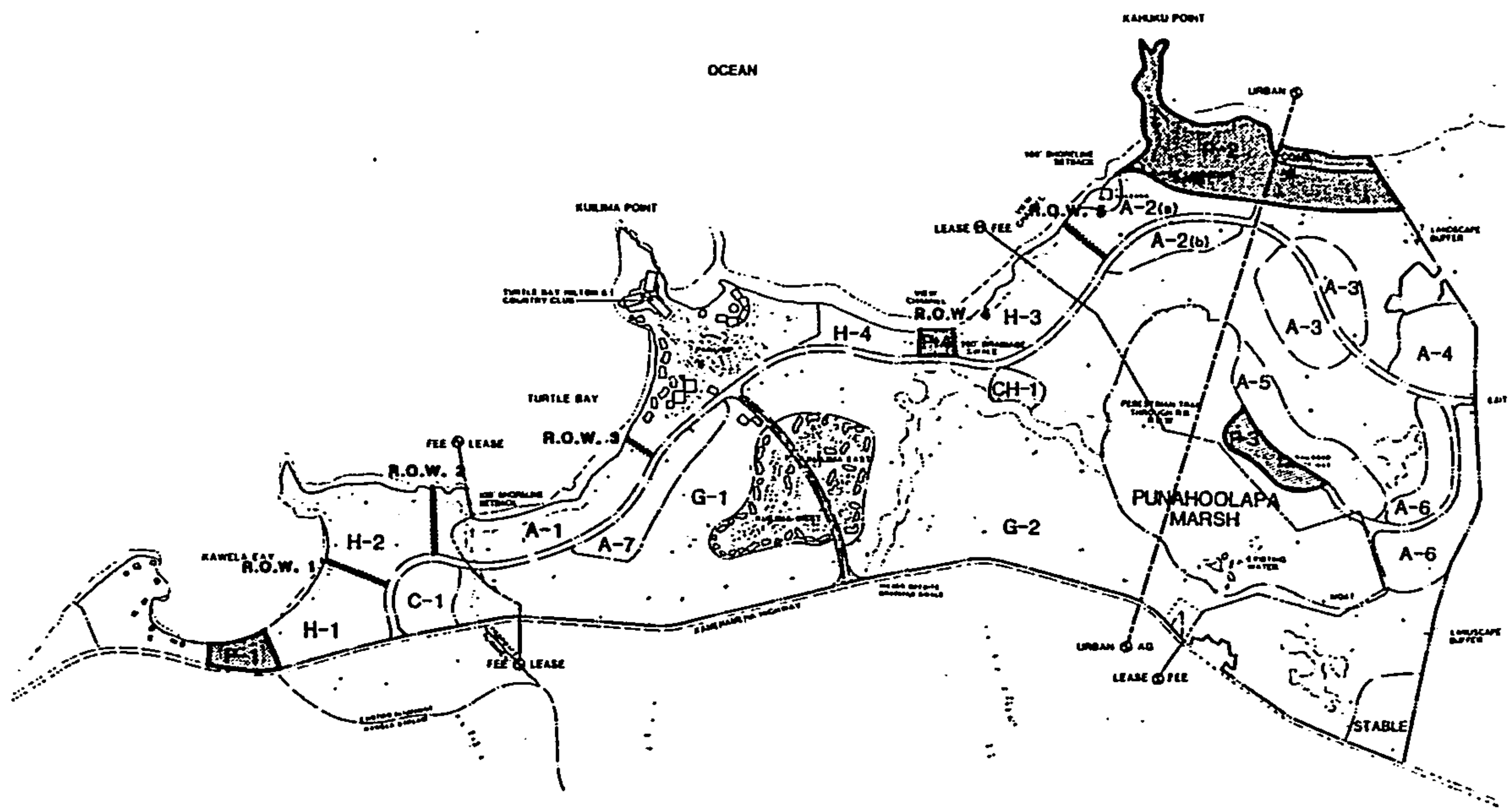
5.9.1 On-Site Outdoor Recreational and Food-Gathering Resources

Current recreational (and/or food-gathering) on-site resources for area residents may be categorized into two types: land-oriented and ocean-oriented.

Land-Oriented Recreation: Existing on-site, land-oriented outdoor recreation facilities include an 18-hole golf course with driving range, 10 tennis courts, and an equestrian stable, all of which are available to hotel guests and the general public. An islandwide resident clientele, along with some younger hotel guests, comes to the Kahuku side of the property to enjoy a dunebuggy rental operation, handled by a private concessionnaire.

The proposed project includes redesignation of the existing golf course and open space areas to allow for one 157-acre golf course (parcel G-1 on Figure 5.9-1) and a second, 195-acre golf course (parcel G-2). A new clubhouse would be built to support the golf activities and also provide health and fitness facilities. The developer also proposes to move the equestrian stables from the Sunset Beach end of the project area to a 10-acre area bounded by Kamehameha Highway and Marconi Road.

Should the proposed expansion project not be approved, it is expected that existing land-oriented recreational facilities would continue under the present concession arrangements for at least several years. Note, however, that the project being proposed is intended to increase the visitor population and therefore attain economic viability for the entire project area. If the project is not approved, each existing recreational activity would eventually be re-evaluated for its own long-term viability. For example, while most needed land use approvals for the two golf courses are already in place (except for specific zoning and Condititional Use Permit for the second course), realignment of the existing course and construction of the new course are unlikely to take place without assurances that the condominium and higher-quality hotel units will actually be built. Also, if the proposed project is not approved, the first golf course may be too expensive to continue to operate.



KUILIMA RESORT

• BASE MAP
• MASTER PLAN

GROUP 70
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FIG. 5.9-1 PROPOSED KUILIMA PROJECT – RECREATIONAL & BEACH ACCESS FACILITIES

Ocean-Oriented Recreation and Food-Gathering: With the exception of windsurfing lessons for Turtle Bay Hilton guests, all the current ocean-oriented recreational activities are not of an organized or commercial nature. Rather, they consist simply of the availability of the coastline for residents to use, either for recreation or food-gathering. Clark (1977, pp. 131-137) has identified the following five segments of the coastline within the project boundaries, starting at the westernmost edge and moving east (see Figure 5.9-2):

- Kawela Bay is very safe for swimming and is also used for diving and board surfing. During heavy surf, there are dangerous offshore currents, although the inshore currents resulting from these are not dangerous. As will be further discussed shortly, Kawela Bay has been the portion of the project coastline which historically has been the least accessible to area residents.

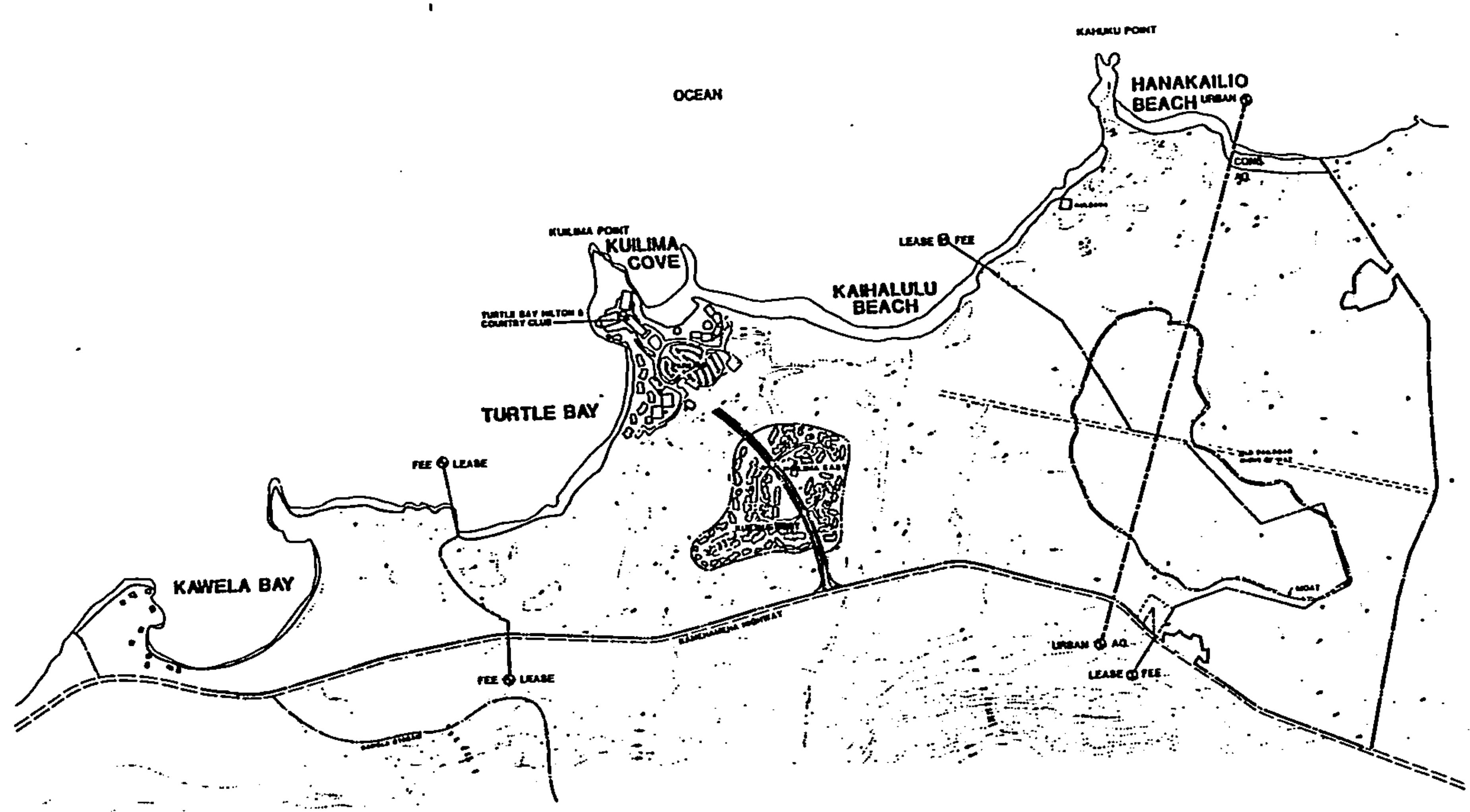
- Turtle Bay (also called "Wild Beach") offers beachcombing, diving, board surfing, paipo board surfing, and swimming. Dangerous currents and surf occur from October through April, and there are occasional strong currents during the summer. The bay is noted for its large schools of moi, or threadfish, and the common green sea turtle, or honu, although the latter has decreased in number.

- Kuilima Cove is the sandy inlet fronting the hotel. It offers snorkeling and swimming. The cove itself is safe all year, although there are strong offshore currents where the cove water runs through a channel in the reef to the open ocean.

- Kaihalulu Beach is located on the long curving bay between the existing hotel and Kahuku Point. Over a mile long, its shoreline is fronted by beach rock and coral reef. The ocean bottom there is also rocky. Except for a small cove, the beach is often too rough for recreational swimming. Activities include beachcombing, diving, pole fishing, and net throwing.

- Hanaka'ilio Beach is used almost exclusively by fishermen, including divers, pole fishers, and net throwers, because of its dangerous currents and rocky sea bottom. It extends from Kahuku Point to the area around Marconi Road.

No reliable quantitative data are available about average numbers of residents using these areas on any given day at the present time. Because use of coastal ocean resources varies greatly throughout the year according to climatic conditions, figures based on short-term observations are likely to be highly inaccurate.



KUILIMA RESORT • BASE MAP

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FIG. 5.9-2 BEACHES WITHIN PROJECT BOUNDARIES

However, interviews with area residents and resort personnel familiar with long-term patterns suggest that (1) the number of users is not large on any given day; (2) users are primarily residents of nearby communities, since residents driving from areas further away are more likely to go to public parks; (3) fishing and diving are somewhat more likely to take place along the eastern portions of the coastline.

The same interviews identified three general community issues and concerns about resident use of on-site beaches:

(1) Parking Impact on Access to Beaches: When the present hotel opened in 1972, the general community gained improved access to the beaches via private roads leading to the new hotel and its parking lot. However, when the new Hilton management imposed parking fees, many residents felt they were effectively being blocked from the beaches. The developer is now planning to construct a new parking lot for 18-20 cars of beach-goers, to be located outside the Hilton's attendant booth. Beachgoers will be allowed to go through the booth free for a limited period of time to drop off belongings and supplies, then return their cars to the designated free parking area. This is a short-term measure for improving access which is to occur independently of the proposed resort expansion; additional possible long-term measures will be discussed shortly.

(2) Accessibility of Kawela Bay: Kawela Bay historically has been off limits to the general public. The bay waters were favorite lobster grounds of the ancient kings of Oahu, who held exclusive fishing rights there. When beach cottages and homes were constructed along the Bay in the early 1900's, no public access to the beach was established. Currently, the road leading to the Bay is also private, so that parking is also restricted.

Many people from nearby communities have expressed resentment at these restrictions. They would like to see the Bay made accessible to residents, particularly because its calm waters are unlike much of pounding surf along the Kahuku coast. Some informants recounted stories of people daring to trespass on private property to reach the Bay, often leading to confrontations with Kawela residents and the police.

(3) Lack of Recreational Facilities in the Kahuku Area: As discussed in Section 5.9.2, beach rights-of-way and facilities are very limited around Kahuku. Many of the people interviewed from the Kahuku community in particular expressed a desire to see the proposed

development include recreational facilities both for the target visitor population and for residents of nearby communities.

The need for more beach access and recreational facilities in the area may also be viewed in light of the general islandwide attitude toward such facilities. In 1983, the City Department of Parks and Recreation surveyed an Oahu sample of 2,000 persons to assess resident attitudes and behavior regarding City and County recreational facilities and services (Hawaii Opinion, 1983). The survey showed that beachgoing was the most frequent leisure activity during respondents' free time, as well as the primary family free time activity. Of the City's 13 types of facilities and services, beach parks were most important to 87 percent of the respondnets, and 92 percent said someone in their household had used City beach parks in the last two years. Although geographical breakdowns of survey results did not extend to the Koolauloa or North Shore districts, comparisons between larger areas indicated little difference in results, so that the strong social importance of beach parks on Oahu may be safely presumed to apply to the Koolauloa/North Shore Region as well.

Kuilima Development Company proposes to enhance the availability and accessibility of on-site recreational and food-gathering resources by creating four new parks--three of them beach parks--and five public rights-of-way, as shown in Figure 5.9-1 and discussed below. Each park facility is assigned a key (e.g., "P-1," etc.) corresponding to the designations of Figure 5.9-1.

New Parks

- P-1: 4.8-Acre Park on Kawela Bay--To be located at the center of the Kawela Bay shoreline at its southern (most inland) coast, this proposed park would be dedicated to the City and County of Honolulu for improvement and maintenance. It would allow access to the Bay, and would contain adequate parking for 30 to 50 vehicles and a comfort station with bathroom and showers. The developer would dedicate the land, and it is anticipated that the City would provide the improvements.

  (An additional improvement to the recreational quality of the Bay would be provided by plans to redivert Kawela Stream to an outlet point in Turtle Bay--where currents will take the discharge out to sea--so that it no longer discharges muddy sediment into Kawela Bay.)

- P-2: 37-Acre Park at Kahuku Point--This park would be located in the vicinity of what is currently Hanaka'ilio Beach. With a parking lot to accommodate between 30 to 50 cars, this park would also be dedicated to the City and County of Honolulu. Possible uses include camping and other recreational activities such as picnicking. Again, the developer would provide the land, with improvements to come from the City and County.

- P-3: Six-Acre Park Adjacent to Punahoolapa Marsh--Proposed as a privately-maintained facility, this park would abut Punahoolapa Marsh, which will be improved as a waterbird habitat. The park would contain a picnic area, 15 parking stalls, and a lookout over the marsh.

- P-4: Two-Acre Park Along Kaihalulu Beach--This proposed park would be situated between the two easternmost hotels, where the "East Main Drain" emerges from the golf course to flow into the ocean. It would be privately maintained. A nearby right-of-way to the ocean (see below) would provide parking for eight to 10 cars.

New Public Rights-of-Way to Beach

- between the two proposed hotels on Kawela Bay;
- on the Sunset (western) end of Turtle Bay;
- at the center of the Turtle Bay coast;
- adjacent to the park designated P-4 and the hotel designated H-3; and
- between H-3 and the resort condominium area designated A-2.

Each of the above rights-of-way would feature parking stalls for 15 cars.

It should be noted that parks P-1 and P-2 already appear on the City Development Plan. However, it is unlikely that the developer would wish to dedicate the land free to the City unless the economic viability of the overall project is assured.

Summary: The overall impacts of the proposed recreational facilities are expected to be positive, as viewed by most community members and the developer. For the community, the proposed recreational facilities will provide (1) greater effective access to coastal areas throughout the project site; (2) access to Kawela Bay, which has historically been off limits to most area residents not living on the Bay itself; (3) 41.8 acres of public park which can be used for various passive recreational activities and allow for food gathering in the ocean; and (4) eight acres of privately-maintained parks. For the developer, these facilities will enhance the area's recreational and food-gathering resources, which will, in turn, provide a more

desirable setting for hotel guests, future residents, and the surrounding communities.

Negative aspects or problems of concern to some community members include (1) delay in establishing rights-of-way in some areas; (2) impacts of the planned park at Kawela Bay on West Kawela residents; and (3) exposure of users to strong ocean currents.

Currently, the developer plans to establish the rights-of-way based on the sequence of construction phases. Thus, access areas will be created over a 20-year period, but some community members feel the improved access should be created immediately. (Others feel that it is just as well to link access with construction. If residents are encouraged to use an undeveloped beach area, they may later feel that the beach is being "taken away" when hotels or apartments are eventually constructed there.) The desire for immediate access will be addressed somewhat in the first-phase construction of an internal access road which will extend from Kawela Bay to the proposed H-3 site.

While most area residents are enthusiastic about the proposed Kawela park, the West Kawela Bay Community Association is less enthusiastic. These homeowners have expressed strong concern that the proposed park will result in problems for adjacent residents such as loitering, trespassing into nearby private property, burglaries, noise, illegal camping, and poor maintenance and security. The community association has suggested that the developer relocate the park to an area between the two Kawela Bay hotels and retain the park as private, thus providing ongoing security and maintenance. It was felt that many of the aforementioned concerns would be avoided or alleviated if the hotels manage the park.

However, the developer has responded it would not be feasible to move the park as suggested. Such a shift would require moving much of the H-1 hotel site to the area currently designated for the park, and setback requirements (even if only 100 feet) would not leave enough room on that site for hotel development. Even if the exchange of sites were possible, it would not be desirable from a planning viewpoint because it would mean placing a public park in the center of the nucleus of the project's first-class hotel development. Finally, representatives of other communities involved in the planning effort favor the present park site because (1) this site on the highway provides the most direct public access to the bay; (2) they do not believe most local users would want to go to a park between two hotels; and (3) the current site is already on the City's Development Plan.

Potential mitigations for the concerns about the Kawela park and beachgoers' exposure to rough seas on the eastern part of the coast will be discussed in Section 5.13.5.

5.9.2 Off-Site Outdoor Recreational and Food-Gathering Resources

Numerous recreational facilities and sites are located in the Region extending from Kaaawa to Waialua. The Region also contains many sites suitable for food-gathering activities, including pole fishing, diving, torch fishing, snorkeling, net-throwing, and gathering of seaweed and shellfish.

However, as discussed in Section 3.7.5, the communities of Hauula, Laie, and Kahuku all strongly feel a need for improved recreational facilities. Much of this need relates to organized community activities such as ballgrounds and playing fields, but several elements involve area beach parks:

- lack of any public beach parks in either Laie or Kahuku (except for the new and partially-completed State park at Malaekahana, which is an islandwide rather than community attraction);
- inadequate facilities at other beach parks in the Region, including insufficient parking and overcrowded camping areas; and
- inadequately-maintained and supervised parks, which result in inoperative showers and bathrooms, vandalism, loitering, car theft, and, as in the case of the Hauula Beach Park Pavilion which recently collapsed, unsafe facilities.

While City plans for expanding existing Region beach parks or building new ones (see Section 4.2--also Garties, 1984b) will help address these concerns, a major increase in the Kuilima visitor population could exacerbate some of the problems--if it were expected that all or most of the projected increased visitor population will make heavy use of the beach parks in surrounding communities.

Two factors were considered to determine the probability of heavy visitor use of off-site recreational and food-gathering facilities:

(1) the frequency and mode of visitor travel of Kuilima guests; and

(2) the extent to which those visitors are likely to focus their off-site travel on immediately surrounding communities.

In a 1983 modeling study of Oahu tourist travel conducted for the Oahu Metropolitan Planning Organization (PRC Voorhees, 1984, pp. 36-48), it was found that there were noticeable

differences between the tendencies of guests at Kuilima vs. those in Waikiki to leave their respective hotel areas. Waikiki guests made more than twice as many off-site daily trips per person as Kuilima guests, counting all modes of travel (p. 36). Looking only at motorized trips, which are the most likely to include stops at nearby off-site recreational areas, Kuilima guests made only about 0.75 round trips off-site per day, slightly fewer than the Waikiki average. It can therefore be concluded that Kuilima guests use on-site facilities much more than Waikiki hotel guests, as is the intent of a destination resort. Furthermore, as more on-site facilities are developed through the proposed expansion, it may be expected that Kuilima guests will grow even less likely to leave the resort on any given day.

In regard to current destinations of Kuilima guests who do travel off-site in rented cars (PRC Voorhees, 1984, p. 46), data indicate that—excluding the 41% of trip portions involving return to Kuilima or initial first-day arrival there—about 43% of rental car trips are primarily oriented to destinations in the Region, and most of these are oriented to the Polynesian Cultural Center. More than half the off-site trips are primarily oriented to more distant locations such as Waikiki or Sea Life Park. These current patterns do not suggest extensive orientation to nearby communities and/or their recreational resources. (In the future, marketing efforts on behalf of nearby attractions could increase the proportion of trips to places like Waimea Falls Park or the Polynesian Cultural Center; however, such attractions themselves usually satisfy recreational demand on any given trip, further reducing the likelihood of exploratory trips through parks or residential areas.)

Thus, to the extent that sight-seers originating from Kuilima drive rental cars into local parks, the affected parks would be located throughout the island and not just in the Region. (Certain parks, however, may be expected to have disproportionate scenic appeal to all visitors to Oahu--e.g., Waimea Park in the Region on dramatic high-surf days or Hanauma Park further away.)

For validation purposes, hotel personnel and car rental agencies at both Kuilima and various other rural area Hawaii resorts (primarily Maui and West Hawaii) were queried as to the extent to which visitors are likely to use recreational facilities in immediately surrounding communities. The consistent response was that guests who do travel off the resort complex site--whether on tours or in individually-rented cars--were largely interested in roaming the entire island. At Kuilima, guests most often ask directions to Pearl Harbor or Honolulu. City parks officials in the Region said that tourists stopping at the beach parks usually appear to be traveling from Honolulu, and there is not any indication of strong "spillover" from the guests of Kuilima's one current hotel.

Based on these observations, it is believed that the projected increased Kuilima visitor population will not result in undue crowding of most nearby beach parks. Possible exceptions could involve (1) more cars and observers at North Shore surfing areas when surf is up and/or heavily-advertised surfing meets are taking place; (2) occasional use of the proposed City Kawela Beach Park in Laie, since Laie's Polynesian Cultural Center would be Koolauloa's primary visitor attraction for guests at the nearby Kuilima resort. Additionally, of course, the planned public parks which will border the resort--at Kawela and Kahuku Point--would host a large number of visitors walking over from the adjacent hotels and condominiums. However, this will probably be true from the day these parks open, so that there would be little if any sense of "loss" of an existing local recreational facilities to tourists staying at Kuilima.

It should be noted that the Koolauloa/North Shore Region is a popular area for visitors from Waikiki to tour in rental cars. Future growth in tourist use of the Region's parks is probably linked as much to islandwide growth in the visitor population as to growth at Kuilima alone.

5.10 Resident-Visitor Interaction and Resident Attitudes

If the Kuilima resort area develops to the extent proposed, it (along with other tourism activities such as the Polynesian Cultural Center) could well represent the major economic activity in the Region for some decades to come. In such a context, resident-visitor relationships take on a particular importance. If residents develop strong negative feelings toward visitors, the continued presence of visitors will be psychologically disturbing to residents, and their consequent behavioral responses could threaten the long-term viability of the industry.

Given the statewide economic significance of the visitor industry, tourism leaders have long suggested that preservation of the "Aloha Spirit" represents a top research priority (Knox, 1979a). Social science scholars have in fact devoted considerable effort to identifying the factors which affect resident-visitor relations, both in Hawaii (Knox, 1979b; Liu and Var, 1984) and elsewhere (UNESCO, 1976; Knox, 1978; Noronha, 1979; Cohen, 1979; Graburn, 1983; Kendall and Var, 1984). The picture emerging from these studies is highly complex, with many factors potentially affecting the quality of resident-visitor interaction. The purpose of this section is to discuss a selected number of these factors which seem most likely to come into play for Kuilima. The factors are presented less for the purpose of forecasting exact outcomes than for the purpose of identifying indicators subject to monitoring and management.

Economic Dependence on Tourism should first be mentioned as a factor which has been found to be not related to resident friendliness toward visitors or the visitor industry. Hawaii surveys have consistently found no relationship between real or perceived direct economic dependence on tourism and attitudes toward tourists and the tourism industry (Research Associates, 1974; Public Affairs Advisory Services, 1975; Knox, 1979b; Ward Research, 1982). This finding may initially appear counter-intuitive, but it may be noted that concern over resident attitudes grows stronger as the industry grows larger and more (not fewer) residents are economically dependent. Knox (1979b) found that perceptions of economic dependence can have opposite effects in different types of people, with some feeling "gratitude" and others reacting with "resentment." The implication for any rural resort area, including Kuilima, is that simple expansion of tourism's role in the economy does not guarantee social harmony between residents and visitors.

Following are some factors which are thought to be related to resident attitudes, at least under certain circumstances.

Competition for Resources is an important element in Hawaii. The two types of resources most likely to be the subject of conflict between visitors and rural Hawaii residents are coastal areas and residential property. In the previous section, it was noted that Kuilima visitors will probably not place strong pressures on nearby off-site park areas and that the Kuilima development itself will help provide needed coastal access in the Kahuku area; however, islandwide tourism growth will result in continued visitor presence in rural recreational areas. It has also been stated that the combination of on-site resort-condominium unit supply and Development Plan constraints on additional off-site development would dampen any tendency of tourism-induced investment to drive up the cost of residential property in most nearby communities. Thus, the initial prognosis on these points appears reasonably good, but the history of conflicts in other rural resort areas (e.g., lawsuits over resident beach access in South Kohala; rapidly spiraling residential property costs in West Maui, West Hawaii, and the Hanalei area) suggest that continuous monitoring would be wise.

Tourists as Symbols of Political/Economic Conditions: The idea that visitors are sometimes "scapegoats" for a resident sense of lost political and economic control has been argued particularly strongly in the World Bank's analysis of tourism impact (Noronha, 1979). In that study, it was suggested that a standard pattern of tourism development has been for residents to feel increasingly dependent on outside investors and owners as the visitor industry expands. Anger at the invisible and absent power brokers is displaced and focused on the visible and present tourist. Koolauloa/North Shore residents have already engaged in several power struggles with operators of the sole existing hotel at Kuilima. To date, their efforts--which have sometimes won the support of the developer--have met with a fair degree of success. The current citizen North Shore Strategy Committee organized by Prudential (Section 3.6.2) continues to provide some sense of resident involvement and control. A question for the future is whether there will continue to be any mechanisms for resident input and control other than indirect methods such as hostility toward visitors.

Perceived Visitor Respect for Residents: Residents would clearly resent perceived disrespect, such as patronizing comments or intrusions into private areas. Interviews with Region residents and Kuilima hotel personnel suggest this has been no particular problem to date, but they also suggest a potential resident sensitivity in light of the socio-economic gap between some residents of rural plantation backgrounds and some visitors (who may be more sophisticated, affluent, and well-educated). Perhaps the greatest question in this regard involves the extent to which the future Kuilima visitor profile consists of foreign guests, who are being increasingly courted by the Hawaii Visitors Bureau (Harpham, 1984). While the long-range social implications of exposure to foreign cultures will probably be positive, short-range problems of stereotypes and communication problems would no doubt require a period of adjustment. In one of the few studies of Hawaii resident attitudes toward Japanese tourists, Kuroda (1976) found that a determinant of such attitudes include beliefs about Japanese residents' respect for Island customs. Thus, the need for communication mechanisms between community and resort operators/developers will probably be even greater if and when

the visitor profile changes toward a higher proportion of Japanese or other foreign guests.

Locational Aspects of Resident-Tourist Encounters: Residents are willing to tolerate tourists in more numbers in certain places or situations than others. Knox (1979b) found that Oahu residents were least willing to tolerate large numbers of tourists in their own neighborhoods, in non-Waikiki beach parks, and on public buses; they were most tolerant of large tourist groups in Waikiki, on inter-island airline flights, and in shopping centers. Previous discussions have covered likely Kuilima visitor presence in beach parks and the very low tendency of these guests to use public buses. Interviews with area community informants suggest that tourists have tended to drive into residential areas in significant numbers in only one community. That is Laie, where the Mormon Temple is set back from the highway and sometimes results in visitors becoming lost and having to ask residents for directions. This has reportedly caused little sense of annoyance, perhaps because residents have grown accustomed to the visitor presence. (There is, of course, still annoyance up and down the Koolauloa coast over traffic problems generated by cavalcades of tour buses to and from the Laie visitor attractions; however, the buses, not the riders, are generally considered the problem.) As previously noted, Kuilima guests are expected to stay primarily on site and to be more interested in Honolulu for off-site travel than in nearby communities, with the exception of Laie.

Age of Residents: In every Hawaii survey, younger residents have been more negative toward tourists or tourism than older residents. The reasons for this have not been conclusively established, but they could involve factors such as greater sense of identity with peer groups (i.e., more sense of diffence between "us" and "them") and less concern with economic benefits. The implications for Kuilima involve the particularly large proportion of teen-agers (in Koolauloa) and young adults (on the North Shore) in the population. To the extent that young people in the Region feel alienated, they may be inclined to act out frustrations through rudeness or petty crime toward tourists.

As stated, the foregoing are less for the purpose of impact predictions than for identifying variables that can be monitored and, to some extent, managed. Suggestions for mitigations will be set forth in Section 5.13.6 on "Community Interface and Involvement."

5.11 Social Psychological Aspects of Resort Employment

The completed expansion of the Kuilima Resort would result in a substantial proportion of the Koolauloa/North Shore resident population eventually working in direct tourism jobs on-site at the resort. The purpose of this section is explore some of the social and/or psychological factors associated with resort work in Hawaii (in addition to the resident-visitor interaction aspects just discussed).

This section will necessarily depart to some extent from the traditional "impact assessment" model of comparing a "with-project future" to a "without-project future." As was discussed at more length in Section 4.1, it is difficult to establish for sure whether the "without-project future" could practically entail creation of any substantial hotel development without the currently requested resort condominium units and amendments to height and density requirements. If the current proposal is not accepted, the "without-project future" could involve development of a more intense but lower quality nature, or (less likely) no further development, at least for some period of time.

Therefore, this section will not attempt to compare the extent to which tourism-employment-related social factors will be a prominent factor in the overall population "without the project" to the future "with the project." It will not be assumed that alternative employment (with alternative social-psychological factors) would be of any particular nature--e.g., traditional plantation-style agriculture, or nonemployment and consequent outmigration. The uncertainty of the alternatives is important and should be kept in mind. However, under the circumstances, the most appropriate method would seem to consist of noting the social issues for the purposes of analysis and suggested solutions to problems (set forth in the "Mitigations" Section 5.13).

Given the growing importance of tourism employment in Hawaii, there have been strangely few studies to provide any documented evidence about the social and psychological effects of working in the tourism industry here. Comprehensive critical evaluations of the visitor industry--e.g., Farrell, 1982--concentrate more on the relationship between tourism development and local government or residential communities than on the internal social dynamics of hotel or related service work.

Thus, there are no established principles about the "most important" social aspects of Hawaii tourism employment other than those topics which arise frequently in the limited number of Hawaii tourism studies and/or figure prominently in expressed community concerns about Kuilima expansion (Section 3.7). Some of these are largely economic in nature and have already been discussed: job training, adequacy of wages and salaries, and opportunities for upward mobility. This section focuses on four additional concerns: (1) group rivalry for jobs; (2) self-image

and mental health; (3) marital stability; and (4) impacts on employees' children.

5.11.1 Group Rivalries for Jobs

In rural areas with few large employers and several distinct social and/or ethnic groupings, there is always a potential for some groups to feel that other groups are unfairly favored for jobs or have some particular advantage. Tourism is a labor-intensive business, and a sense of social rivalry for jobs is commonplace. The extent to which such rivalry becomes an active problem in the workforce varies greatly from place to place, depending on management policies and the state of social group relations outside the work setting.

While worker groups may become differentiated on the basis of numerous characteristics (sex, age, union loyalties, education, etc.), one of the most common and most sensitive involves ethnic/national groupings. Discussions with Koolauloa/ North Shore informants indicate four key groupings:

(1) Hawaii-Born Residents represent the majority of Hawaii's hotel workforce (State of Hawaii, Department of Planning and Economic Development, 1978, Office of Tourism, p. 148). Because many hotels experience high turnover rates, Hawaii-born residents with families and "roots" are often perceived as desirable employees by resort operators. Additionally, of course, they represent the "real Hawaii" for many guests.

(2) Immigrants from Other Countries or Territories are a growing component of the state's hotel workforce, according to union officials interviewed for this report. In Maui and Waikiki, Asian immigrants are reportedly particularly vigorous in securing jobs themselves and assisting family and friends in getting jobs in the same hotel. Employers are said to appreciate their enthusiasm, hard work, and willingness to accept relatively low wages.

In the Koolauloa/North Shore Region, the predominant immigrant groups are (1) South Pacific islanders (Samoans and Tongans), who tend to live in and around Laie and to be relatively recent immigrants, and (2) older Filipinos, who are discussed separately below.

(3) Plantation workers--predominantly Filipino immigrants who have lived for decades in Hawaii, but also some younger, Hawaii-born individuals of both Filipino and non-Filipino ethnicity--represent a group of special interest in the Region. The need to provide jobs for ex-workers of the Kahuku Sugar Company was a compelling public concern underlying approval for the first

Kuilima hotel. Only a handful of these Kahuku workers have yet to retire as of today, but any significant setback for the Waialua plantation could lead to a repeat of history. Like other immigrants, these individuals have a reputation for enthusiasm and hard work.

(4) Mainland-Born Residents who work at Kuilima are often generally referred to by other residents as "surfers," a label which is not always accurate but which reflects the overall youth and transience of this group. These young Mainlanders offer hotel employers generally good communication skills, a shared understanding of Mainland guests' cultural expectations, and a frequent willingness to work evening and weekend shifts which other residents--who are more likely to have families with children--view with less enthusiasm.

There is likely to be some extent of rivalry among these groups for any major bloc of jobs which becomes available in the Region, although the tourism industry has several unique characteristics which somewhat magnify this probability.

Because each group has particular strengths, there is a strong likelihood that certain types of jobs in hotels (or other aspects of the visitor industry) will be disproportionately filled--or avoided--by certain types of residents. No data are available for the Turtle Bay Hilton, which has been in operation for less than a year, but an overview of employees of the same hotel under the Hyatt management in 1979 (Chun, 1979) indicated that food-service positions (particularly waiters, waitresses, and barkeepers) were disproportionately held by the Mainland-born, while housekeeping, steward, laundry, and groundskeeping jobs were disproportionately held by immigrants. Hawaii-born residents were also disproportionately represented in the groundskeeping jobs, as well as kitchen work, front desk jobs, and various clerical positions (e.g., purchasing, PBX, etc.).

Interviews conducted for this report suggest that both immigrants and Hawaii-born residents are sometimes reluctant to take positions involving extensive personal contact with Mainland guests due to language and communication barriers. At the same time, some residents believe managers of Hawaii hotels discourage persons who are not highly articulate in Mainland-standard English from taking such positions. Thus, there are elements of both choice and perceived pressure (whether internal or external) in these concentrations of social groups within job categories.

Other aspects of visitor industry jobs which elicit different reactions from different groups include pressure for individual achievement, relatively close supervision by superiors (often of a different cultural group), and the "service" nature of some positions. According to union officials and hotel operators interviewed in several rural Hawaii areas, the groups which

have the most difficult time with these characteristics are (1) young people; (2) males; (3) Hawaii-born residents (with younger Hawaii-born males being the most sensitive and the most imbued with values which emphasize a noncompetitive, "laid back," and independent lifestyle). This also contributes to the reluctance of some people to take jobs involving extensive personal contact with residents. Young Mainlanders are perhaps least likely to equate "service" with "catering" or "subservience."

The types of job perhaps most likely to cause resentment if filled entirely by one group are management jobs. The 1979 Hyatt analysis indicated that 65 percent of the 46 management jobs at that time were filled by Hawaii-born people (as compared with 49 percent of the 568 non-management workers), and only 15 percent of the management jobs were held by persons who had come from the Mainland within the past 10 years. Nevertheless, with only a few exceptions, the very top one or two management jobs in almost every Hawaii hotel historically have been held by Caucasians originating on the Mainland. The reason for this rests largely with national and international hotel chains' standard practice of rotating managers to various resorts throughout the country or the world. Hawaii-born residents with hotel management degrees are more likely to be found working on the Mainland or in other countries than in Hawaii itself. However, the effect for Hawaii-born or immigrant visitor industry employees is that top positions are rarely filled by persons of their own backgrounds.

As previously noted, the impact of the Kuilima resort expansion on potential sense of group rivalry will depend almost entirely on management sensitivities and policies, so that one hotel or resort condominium may boast a harmonious workforce while the one next door is plagued with resentments. An internship program for BYU-Hawaii students could be viewed by workers at one hotel as "shutting out the local kids," but applauded by workers at another hotel for bringing college students into closer contact with area residents.

Finally, it should be noted that the interaction of different social groups in the same work environment is ultimately likely to have positive social effects, despite the risk of short-term rivalries. Even with the tendency for some ethnic concentrations in certain job categories, large hotel workforces probably bring more diverse types of people into interaction in a shared work environment than any other type of employment in Hawaii today. Occasional social friction and competition is preferable to isolation. Given the distinctive ethnic profiles of the various Koolauloa/North Shore communities (see Section 3.2.2), expanded employment opportunities at Kuilima could probably lead to more social interaction among residents of different backgrounds than currently occurs.

5.11.2 Self-Image and Mental Health

A common assertion about negative self-image impacts from tourism employment is that a "master-servant" relationship is forged between visitor and employee (c.f., Kent, 1975). No data whatsoever have been collected in Hawaii either to prove or disprove this contention. As previously noted, it seems likely that certain individuals or groups would be more likely than others to perceive service work as demeaning. Kuilima hotel management, union spokesmen, and workers interviewed for this report all felt that few, if any, employees feel like "servants." Still, a number of non-employee community informants in the Region contend that resort work involves unacceptable "catering."

In terms of such public perceptions, one of the more influential Hawaii studies of social impacts from rural resort development was a paper written by Honolulu psychiatrist Frances Cottington in 1969 on reputed effects of the opening of the Mauna Kea Beach Hotel in Kohala. Although never formally published, Cottington's paper received a fair amount of newspaper publicity in the early 1970's and has been widely cited in academic studies of tourism social impact. The paper--based primarily on interviews--chronicled the adjustment problems of the Mauna Kea's initial workforce, which largely consisted of plantation laborers' wives making their initial entries into the labor force:

- o reported mixed impacts on the women's self-image but generally negative impacts on husbands' self-images;
- o strains on marriages and increased divorce rates due to the foregoing and to greater social interactions outside the family;
- o difficulties with supervision of children since both parents were working.

(The first of these topics--self-image and mental health--is the focus of this sub-section, while the next two topics will be assessed in the following two sub-sections.)

Alerted by the Cottington paper to the supposed negative potential of socio-economic transitions in rural Hawaii, two University of Hawaii Department of Psychiatry doctors--Benjamin B. C. Young, M.D. and J. David Kinzie, M.D.--became aware in 1972 of the Kahuku Sugar Company's shutdown and the employment of many residents at the Kuilima hotel. Arrangements were made for one of the psychiatrists to make regular weekly visits for one year to track the extent of psychological and psychosomatic problems expected in Kahuku. The results, as detailed in another unpublished paper (Young and Kinzie, 1973) were surprising to the authors: there were no observable mental health problems whatsoever, even after inquiries to see if unreported difficulties

might be present. The authors concluded that "social change" does not necessarily lead to psychiatric or social "disturbance," and they felt that the steps taken by residents, landowners, and business interests to cope with employment and housing problems had prevented socio-psychiatric complications:

> When the right [ingredients] of leadership, planning community organizations and a sense of community identity are present, change can be dealt with effectively with a minimum of psychiatric and social disruptions. (Young and Kinzie, 1973, p. 11)

To provide an update of the mental health situation, particularly as it pertains to resort employment, the social impact consultants interviewed the Kahuku Hospital psychologist and the State Mental Health Clinic Coordinator for Koolauloa (covering the catchment area from Kualoa Point to Waimea Bay). Both sources indicate their caseloads primarily feature family disturbances, depression (predominantly women), and a smaller number of chronic psychoses (primarily among in-migrants from the Mainland). The Kahuku Hospital psychologist further observed that a fair amount of mental illness in the area seems related either to unemployment or to a sense of powerlessness in job-related situations--including Kuilima hotel work--because the limited number of employment opportunities in the areas leads supervisors to abuse their power and/or leads workers to feel they have no choice but to accept negative situations.

(Given these comments, it should be noted that this source nevertheless questions any expansion at Kuilima because of larger social concerns such as the potential for creating a "suburban" rather than rural atmosphere. The second mental health key informant favored the project because of positive mental health impacts expected from expanded employment opportunities.)

Interviews with statewide hotel union officials failed to turn up any figures or observations about the mental health status of resort employees as compared to workers in other industries. One specific question posed was whether the perceived gap in affluence between tourism workers and "rich" tourists has led to any widespread resentment, frustration, or self-image problems. No such problems were reported.

Future mental health impacts of increased tourism employment at Kuilima are largely speculative. Field work conducted by the social impact consultant for several proposed resorts in West Hawaii (Community Resources, 1980; Community Resources, Inc., 1984) does suggest several possibilities:

- o Projections of increased female labor force participation in the Kuilima Region (Section 5.1) would indicate at least a temporary increase in female role identity crises (along with similar problems for some husbands of wives working for the first time). However, any such phenomenon is likely to be confined to pockets of highly traditional families, because most Koolauloa/North Shore informants contacted for this project believe that the concept of working wives is now commonplace in the Region.

o The previously discussed conflict for some younger males between "macho" values of independence and contradictory aspects of resort work (high pressures for achievement, a "service" orientation toward outsiders) could produce stress for such individuals. Probable coping responses, though, are more likly to include either quitting the work situation or acting out hostilities in a direct behavioral manner, rather than repressing and internalizing the stress.

o Newcomers from the Mainland are likely to exhibit higher rates of clinically-defined psychiatric disorders. Such in-migrants often lack support networks in the community, and Caucasians statewide are more often diagnosed as having relatively permanent mental illnesses (Community Resources, 1980, pp. 191-198). Thus, they are the group most likely to make heavy demands on mental health clinic resources.

Against these possible impacts must be weighed a large number of studies nationwide (c.f., Hollingshead and Redlich, 1958; Gurin, Veroff, and Feld, 1960; Srole, Langner, Michael, Opler, and Rennie, 1962; Bradburn, 1969; Tiffany, Cowan, and Tiffany, 1970; Brenner, 1973; Wills and Langner, 1980; Dooley and Catalano, 1979, 1980; Catalano, Dooley, and Jackson, 1981; Liem and Rayman, 1982) as well as Hawaii itself (Frank, 1981) which basically indicate that:

(1) Mental health problems are far more prevalent among the unemployed than among the employed; and

(2) Poverty is strongly associated with virtually all forms of mental illness.

Thus, the basic mental health impact of <u>any</u> substantial economic development which increases the prosperity of Region residents would be generally positive. This conclusion would be affected by the extent to which there are adjustment problems with family roles, to which employment benefits are equitably distributed, and to which the long-range employment opportunities are for residents rather than socially isolated and psychologically vulnerable newcomers.

5.11.3 Marital Stability

Cottington's 1969 report on the Mauna Kea Beach Hotel opening claimed that Kohala-area marriages were disrupted not only because of male difficulties in accepting wives as breadwinners, but also because improved female appearance and contact with male guests or co-workers raised husbands' suspicions about faithfulness. The outcomes were alleged to include both increased divorces and wife abuse. A few years later, a follow-up study by Smith (1972) reached the conclusion that the marital problems reported by Cottington had reflected only temporary problems and that husbands learned to trust their wives' faithfulness and had come to take pride in their wives' new capabilities. However, recent fieldwork by the social impact consultant in the Kohala area (Community Resources, Inc., 1984) turned up numerous reports by police and social agencies of marital difficulties and spouse abuse, although there was uncertainty as to how much of this could be attributed to the expanding tourism sector there.

In the Kahuku area, Young and Kinzie's (1973) study of mental health impacts also featured a search for marital problems associated with the sugar mill shutdown and Kuilima hotel start-up. No such problems were found at the time. According to some informants contacted for this report, however, a few marital problems did surface later, primarily involving cases where wives working at the hotel were married to much older and conservative husbands.

No detailed statistical studies have been carried out to test the hypothesis that tourism work (and/or socioeconomic transitions involving resort development) results in any greater strains on marriages than other types of work in Hawaii. A study of selected hotel workforces for the 1978 Hawaii State Tourism Study (State of Hawaii, Department of Planning and Economic Development, 1978) did find that hotel workers were slightly more likely to be divorced than was the case for the general population, but it could not be established whether hotel work caused divorce or whether divorcees were disproportionately attracted to hotel work. Statewide divorce rates (which are not available on a district basis) increased through the 1970's to a peak of 5.3 per 1,000 residents in 1979 but have subsequently fallen back to 4.3 per 1,000 residents in both 1982 and 1983 (State of Hawaii, Department of Planning and Economic Development, <u>State of Hawaii Data Book 1983</u>, p. 93).

Interviews with Kuilima-area social agency informants, hotel personnel, and statewide union officials generally indicate that marital disruptions among hotel workers do not constitute a major perceived social problem but that there may be some grounds for believing there is a limited degree of association between resort employment and marital problems. Several factors have been suggested as contributing to such an association:

- Shift work is a standard characteristic of resort employment and can present important logistical problems for family life, especially if both spouses are tourism employees. Routines are difficult to establish, and tasks such as transporting children to and from school must be constantly negotiated. Husbands and wives may find themselves with less shared time at home together than is the case for most couples.

- The "glamour-and-gossip" environment of large hotels is also seen as a contributing factor. Especially in rural areas, residents may be exposed to a new spectrum of sophistication which can change the values of one or both partners. At the same time, the communication networks among hotel employees are very similar to the gossip grapevines of a small town. Even innocent smiles or flirtations are observed by numerous co-workers and may be quickly reported to spouses.

- Changing sex roles are often at the heart of marital disruptions, and women making their initial entries into the labor force have often turned to resort work as the vehicle. While the female labor force participation rate in the Kuilima Region is lower than the Oahu average (Section 5.1), however, social norms and economic necessities now have familiarized most area residents with the concept of working wives. Laie community leaders interviewed for this report consistently said that younger women in that community are now routinely entering the labor force despite the traditional "family values" orientation of the Mormon Church.

  At the same time, several Kuilima-area informants said that men have exhibited more tendencies to marital instability in the hotel than women. Historically, men's work environments in rural Hawaii areas for several decades prior to the 1970's were either predominantly male or involved contacts with limited numbers of co-workers. However, as hotel workforces have increasingly included more male staff, men find themselves working with large numbers of female co-workers.

For the foregoing reasons, it may be expected that a substantial increase in the proportion of longtime residents who work in resorts will lead to at least a temporary period of increased marital disruptions. However, the limited available evidence does not suggest any such problems will be of crisis magnitudes. And the potential for marital difficulties associated with resort development must be weighed against numerous studies--both going back to the Great Depression (Bakke, 1934, 1940; Angell, 1936; Komarovsky, 1940) and more recent (Strange, 1977; Root, 1979; Gordus, Jarley, and Ferman, 1981)--which have demonstrated the negative family impacts of unemployment and financial crisis. Thus, while the short-term effects of economic

change and development may include family adjustment problems for rural residents, the long-term effects of improved economic stability should be positive for family life.

5.11.4 Parental Supervision

The third major social psychological adjustment problem asserted by Cottington (1969) to be an impact of rural resort development involved inadequate supervision of children in families where wives had gone to work in the hotel. This was felt to be a problem in and of itself, but was also associated with reports of increased juvenile delinquency in the Kohala area.

Statistical data on reported child neglect (and/or abuse) were published on a district basis by the State of Hawaii starting in the late 1970's. Table 5.11-1 reproduces the figures for the three most recent years for which data are available, focusing both on areas around Kuilima and various rural resort areas on the Neighbor Islands. Also listed are countywide figures and percentages of countywide cases in each area (for comparison purposes with percentage of the juvenile population).

This table provides a limited and preliminary means for determining whether rural resort areas appear to have reported child neglect or abuse caseloads out of proportion to the juvenile population. Results are mixed. Child abuse appears to be a matter of concern for Molokai and North Kona but not other areas. Child neglect was also disproportionate in these two areas for some years, but was more frequently a concern in the Lahaina (West Maui) and the Hanalei (North Shore of Kauai) areas. Child neglect was also very marginally disproportionate in the Haleiwa and Waialua areas of the Kuilima Region. Intriguingly, both abuse and neglect data from Kohala--the focus of the Cottington study--indicate very few reported problems there.

Unfortunately, the State's districts for recording and reporting child abuse figures merge the communities closest to the Kuilima project site--Sunset Beach, Kahuku, Laie, etc.--with a number of suburban Koolaupoko communities extending as far south as the Pali Highway. This essentially loses any information about unique patterns around the Kuilima resort. Again, therefore, results of qualitative interviews with key informants from the Region provide more insight:

Social agency informants (mental health, schools, police) in the area had the impression of increasing numbers of reported child neglect/abuse, but felt this was (1) as likely to be related to an increased tendency to make complaints rather than actual increases in the phenomenon and (2) was not related to hotel employment by parents. Significant parent-child stresses are perceived in the Laie community of South Pacific Islanders because the younger generation is more acculturated to American and/or local Hawaiian values than the older generation; again, this is not seen as related to past or present Kuilima

TABLE 5.11-1

Child Abuse and Neglect Data for Region and Selected Other Rural Hawaii Resort Areas, 1980 - 1982

		1980				1981				1982				District's Pct. of Total County Population Aged 0 - 17, 1980
		Abused		Neglected		Abused		Neglected		Abused		Neglected		
		Rep	Con	Rep	Con	Rep	Con	Rep	Con	Rep	Con	Rep	Con	
CITY AND COUNTY OF HONOLULU	no.:	1112	595	604	252	1352	612	767	263	1476	750	860	343	
	(%):	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
-mauka Kaneohe to Waimea	no.:	52	32	26	10	82	32	35	14	85	36	37	11	
	(%):	5%	5%	4%	4%	6%	5%	5%	5%	6%	5%	4%	3%	5%
-Waialua, Haleiwa	no.:	17	11	9	3	21	11	10	6	33	19	17	11	
	(%):	2%	2%	1%	1%	2%	2%	1%	2%	2%	3%	2%	3%	1%
HAWAII COUNTY	no.:	110	42	114	41	134	60	102	34	172	64	146	45	
	(%):	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
-Kohala (South and North)	no.:	2	2	3	2	0	0	0	0	0	0	1	1	
	(%):	2%	5%	3%	5%	-	-	-	-	-	-	1%	2%	9%
-North Kona	no.:	32	12	30	11	22	10	24	5	33	9	15	5	
	(%):	29%	29%	26%	27%	16%	17%	24%	15%	19%	14%	10%	11%	14%
KAUAI COUNTY	no.:	69	42	80	37	98	58	95	56	101	48	101	50	
	(%):	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
-Hanalei	no.:	3	2	6	1	6	0	10	6	10	3	8	4	
	(%):	4%	5%	8%	3%	6%	-	11%	11%	10%	6%	9%	8%	6%
MAUI COUNTY	no.:	77	38	61	25	103	68	40	23	74	51	51	37	
	(%):	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
-Lahaina	no.:	8	4	10	3	13	9	9	4	6	3	11	6	
	(%):	10%	11%	17%	12%	13%	13%	23%	17%	8%	6%	22%	16%	12%
-Molokai	no.:	11	5	12	6	23	15	4	3	15	8	4	3	
	(%):	14%	13%	20%	24%	22%	22%	10%	13%	20%	16%	8%	8%	11%

NOTE: "Rep" = Reported; "Con" = Confirmed

Source: State of Hawaii, Department of Social Services and Housing, Statistical Report on Child Abuse and Neglect in Hawaii, 1980, 1981 - 1982; U.S. Census Bureau, 1980.

development since Laie is a highly self-contained community with most parents working in Laie itself. Throughout the rest of the Region, though, it is common for both parents to work and for at least one to commute long distances to a job outside the area. As a result, families have already grown accustomed to arranging child care. There are relatively fewer problems in Koolauloa because of the large proportion of stable, extended families; more difficulties have been observed on the North Shore side because the relatively more transient population there includes more single-parent families and fewer social support networks to assist with child care.

Hotel personnel and union officials feel that some of the same characteristics of resort employment which affect husband-wife relations--particularly shift work--cause problems in parent-child relations as well. However, as with marital disruptions, there was a perception that the problem was not of crisis proportions. Difficulties were again felt to be greater for single-parent and/or Caucasian families originating on the Mainland. For this reason, the long-term effects of Kuilima resort development on family cohesion and parental supervision are likely to be less if the goal of employing current area residents is realized.

Additional social topics related to family life--juvenile delinquency and preservation of extended families--will be considered in the following section.

5.12 Social Structure/Cohesion

Forecasting the impacts of a resort complex on the social structure and/or social cohesion of a rural area is one of the most significant but also one of the most difficult of impact assessment tasks. Much of the discussion may be conveniently focused on crime, partially because this is an area of particular community concern (Section 3.7.5) and partially because it has been a topic of enough statistical studies to warrant a careful review. However, existing studies on tourism and crime leave many unanswered questions, and so the discussion will be in two parts--statistical and police comments. "Preservation of Extended Families/Jobs for Grown Children" represents a third portion of the discussion, and a qualitative discussion of "Social Values and Structure" will complete this section.

5.12.1 Tourism and Crime--Statistical Evidence

A search of published statistical analyses indicates there have been seven statistical studies--four of them based on Hawaii data--exploring the mathematical relationship between tourism and crime. Several of the Hawaii studies examined two different sets of data (e.g., two different islands or Oahu and statewide data), and/or have used different measurements of "crime" or of "tourism." All in all, the following seven studies provide analyses of nine different data sets:

(1) Pizam (1982) used data from various places during a single year (i.e., a "cross-sectional" analysis) to explore the statistical relationship between crime and tourism nationwide. The "various places" were the 50 states of the union. The mathematical technique was "multiple regression," which is a type of analysis that evaluates the separate relationships of various different potential causal factors with a single outcome (in this case, crime), assuming the other potential causal factors are held constant. The analysis found zero relationship (no relationship) between tourism and a number of different types of crime. For other types of crime, the analysis found relationships which were statistically greater than zero but which were of such slight magnitude that the author termed them "negligible."

(2) Jud (1975) did a cross-sectional analysis for Mexico's 32 states. The primary analysis was a "simple" rather than "multiple" regression analysis (i.e., tourism was the only potential causal factor explored rather than being just one of a number of possibilities). This study found some extent of relationship between tourism and many crimes involving economic gain (e.g., robbery) but not most crimes of passion (e.g., murder).

(3) McPheters and Stronge (1974) carried out a simple regression analysis in a single place--Miami, Florida--over various points in time (i.e., a "time-series analysis"). This analysis also tended to suggest some degree of relationship between tourism and crimes against property, but not crimes of violence against persons.

(4) Fujii, Mak, and Nishimura (1978) carried out the first study in Hawaii, which actually consisted of two separate analyses: (a) a time-series multiple regression analysis of the relationship between crime and tourism (along with other variables) for statewide data over a 15-year period; and (b) a cross-sectional variant of multiple regression analysis for Oahu data. This was the first study to find a sizeable statistical relationship between tourism and some forms of violent crime, although the results of the two different analyses were partially contradictory.

(5) Fujii and Mak (1980) later rewrote the same study slightly and published it in a scholarly journal.

(6) Fujii and Mak (1979) published a separate analysis using different measures of both "tourism" and "crime," and they came to somewhat different conclusions about the relationships.

(7) Chesney-Lind and Lind (1984) have been the only researchers to attempt to calculate separate crime rates for residents and for tourists on two different islands--Oahu and Kauai. Their study was the only one not to utilize regression analysis, but it was like most of the others in focusing on "Type I," or serious, crimes. ("Type II" crimes are those for which, like gambling or prostitution, crime rates are subject to local police policy. Reports of "Type I" crimes are much more likely to be initiated by victims rather than police.)

Table 5.12-1 provides additional information about these studies and their findings. The major conclusions to be drawn from this summary table include: (1) no single type or measure of crime has been consistently related to tourism in all studies; however (2) the types of crimes which have been most frequently associated with tourism are rape and robbery, with other types of crime either inconsistently related or tending not be related to tourism. Murder, assault, and auto theft have been least often associated with tourism. Burglary has been associated with tourism in a number of studies, although the Kauai figures indicate tourists had a slightly lower burglary rate there than did residents.

TABLE 5.12-1

Results of Various Published Studies on the Statistical Relationship Between "Tourism" and "Crime"

Study/Location	Method	Definitions	Total Type I Crime	Total "Violent"	Total "Property"
1. Pizam, 1982; Total U.S.A.	Cross-sectional multiple regression analysis of 50 states.	"Tourism" = tourist expenditures in dollars. "Crime" = rate per resident population.	N/A	Zero	Positive, slight
2. Jud, 1975; Total Mexico	Cross-sectional regression analysis of 32 states.	"Tourism" = no. of int'l-level hotel rooms per capita resident population. "Crime" = rate per resident population.	Positive, moderate (but only for crimes by males)	N/A (but pattern for individual crimes suggests Zero)	N/A (but pattern for individual crimes suggests Positive)
3. McPheters and Stronge, 1974; Miami, Florida	Time-series simple regression for months of one year featuring seasonal fluctuation.	"Tourism" = employment in eating and drinking places. "Crime" = numbers of reported offenses.	Positive, slight/ moderate	N/A (but pattern for individual crimes suggests Zero)	N/A (but pattern for individual crimes suggests Positive)
4. Fujii, Mak, and Nishimura, 1978, 1980; Hawaii (statewide)	Time-series multiple regression 15-year period.	"Tourism" = ratio tourist-to-resident population. "Crime" = rate per total population, including tourists.	N/A	N/A	N/A
5. Fujii and Mak, 1979; Hawaii (statewide)	(as above)	"Tourism" = proportion jobs in hotels. "Crime" = rate per resident population.	N/A	N/A	N/A
6. Fujii, Mak, and Nishimura, 1978, 1980; Oahu	Cross-sectional 2-stage least squares multiple regression	(same as #4 above)	Positive, moderate	N/A	N/A
7. Fujii and Mak, 1979; Oahu	(as above)	(same as #5 above)	N/A	N/A	N/A
8. Chesney-Lind and Lind, 1984; Oahu	(Comparison of crime rates for victim populations: resident vs. visitor)		tourists somewhat higher	tourists slightly higher	tourists moderately higher
9. Chesney-Lind and Lind, 1984; Kauai	(same as above)		tourists slightly lower	tourists slightly lower	tourists slightly lower

(continued)

TABLE 5.12-1
(continued)

Results of Various Published Studies on the Statistical Relationship Between "Tourism" and "Crime"

Study/Location	Murder/Homicide	Rape	Robbery	Assault	Burglary
1. Pizam, 1982; Total U.S.A.	Zero	Positive, slight	Positive, slight	Positive, slight	Zero
2. Jud, 1975; Total Mexico	Zero	Positive, slight	Positive, strong	Zero	N/A
3. McPheters and Stronge, 1974; Miami, Florida	Zero	Zero	Positive, moderate	Zero	Positive, strong
4. Fujii, Mak, and Nishimura, 1978, 1980; Hawaii (statewide)	Positive, moderate	Positive, moderate	Positive, slight	Zero	Positive, moderate/ strong
5. Fujii and Mak, 1979; Hawaii (statewide)	Zero	Positive, moderate	Zero	Zero	Positive, moderate/ strong
6. Fujii, Mak, and Nishimura, 1978, 1980; Oahu	Zero	Positive, strong	Positive, slight	Positive, moderate	Positive, strong
7. Fujii and Mak, 1979; Oahu	Zero	Positive, slight	Zero	Zero	Positive, moderate/ strong
8. Chesney-Lind and Lind, 1984; Oahu	tourists lower	tourists slightly higher	tourists much higher	tourists much lower	tourists much higher
9. Chesney-Lind and Lind, 1984; Kauai	tourists much lower	tourists much higher	tourists much higher	tourists much lower	tourists much lower

(continued)

TABLE 5.12-1
(continued)

Results of Various Published Studies on the Statistical Relationship Between "Tourism" and "Crime"

Study/Location	Larceny	Motor Vehicle Theft	Other Crimes	Residual "Other"
1. Pizam, 1982; Total U.S.A.	Zero	Zero	N/A	N/A
2. Jud, 1975; Total Mexico	Positive, moderate	N/A	Fraud: Positive, moderate; Kidnapping: Positive, slight	Positive, slight
3. McPheters and Stronge, 1974; Miami, Florida	Positive, moderate	Zero	N/A	N/A
4. Fujii, Mak, and Nishimura, 1978, 1980; Hawaii (statewide)	Zero	Zero	N/A	N/A
5. Fujii and Mak, 1979; Hawaii (statewide)	Positive, slight/ moderate	Zero	N/A	N/A
6. Fujii, Mak, and Nishimura, 1978, 1980; Oahu	Zero	Zero	N/A	N/A
7. Fujii and Mak, 1979; Oahu	Zero	Zero	N/A	N/A
8. Chesney-Lind and Lind, 1984; Oahu	tourists somewhat higher	N/A	N/A	tourists much lower
9. Chesney-Lind and Lind, 1984; Kauai	tourists somewhat higher	N/A	N/A	N/A

The studies summarized in Table 5.12-1 prove frustrating as a basis for forecasting crime impacts of the proposed Kuilima project for several reasons. First, of course, they are inconsistent and contradictory, reflecting the limited body of available data and the pioneering nature of the research. Second, all are based on reported crime, which does not always reflect the actual extent of criminal activity (because, even for Type I crimes, there are still variations in police policies about recording crimes, and different people at different times may be more reluctant to report crimes than other people at other times or places). A third reason is that the impacts of rural resort development on crime in surrounding rural areas may be much different than crime impacts of urban tourism development. With the sole exception of the comparison of tourist and resident crime rates on Kauai (Chesney-Lind and Lind, 1984), all the published studies are heavily influenced by crime and tourism data from urban settings. The Oahu and statewide Hawaii studies are greatly affected by the large amounts of tourism activity and reported crime in the Waikiki area.

As a preliminary step toward analyzing crime-tourism linkages in rural Hawaii settings comparable to Kuilima's surroundings, Community Resources, Inc. assessed a number of areas which experienced significant tourism development between 1970 and 1980. (These two years were chosen because they were U.S. Census years, and accurate population estimates are needed for crime rate calculations.) The goal was to find rural areas which (1) experienced significant resort development and/or expansion during the 1970-80 period, and (2) had available crime data for geographical areas essentially identical to census-defined areas.

Four rural Hawaii resort areas examined but ruled out were:

- The Kuilima area itself. Both sections of the affected Region (Koolauloa and the North Shore) are parts of much larger police districts--based in Kaneohe and Wahiawa--and crime data from environs closer to Kuilima are submerged in figures from larger population centers. (It should, however, be noted that interviews with police in these districts established that crime rates in the Kuilima Region, particularly Koolauloa, are lower than the islandwide average.)
- Waianae, where relatively little development occurred between 1970 and 1980.
- South Kohala, where a major resort (the Mauna Kea Beach Hotel) opened prior to 1970 and where two other hotels have opened since the 1980 census, but where little development occurred between 1970 and 1980.
- Kauai, for which crime data are not available by district. The district of most interest was the Hanalei

area, which includes the Princeville resort complex. To date, Princeville has been comprised entirely of resort condominium units (which represent the type of development proposed in the requested Development Plan amendment for Kuilima).

Three other areas which were judged suitable for comparison purposes were:

- The Lahaina division of Maui (i.e., West Maui, not including Kihei or Wailea), which featured a net increase of 4,351 hotel and condominium units between 1970 and 1980 (over the 1970 base of 1,821). The town of Lahaina is within this division, and this town represents a tourist-oriented urban area which is not duplicated within the Kuilima study Region (despite the fear of some residents that Haleiwa could someday be "another Lahaina"). In general, the Lahaina area has become the most urbanized of the "rural" Hawaii resort areas.
- The combined North and South Kona divisions of Hawaii Island. Most of the resort development took place in North Kona, but crime data are for the police district incorporating both districts. Between 1970 and 1980, Kona witnessed the development of a net additional 2,311 visitor units over the 1970 base of 1,449. The Kona area is relatively less urban than Maui's Lahaina division, but the town of Kailua-Kona again provides an urban tourist core.
- Molokai Island in Maui County, where a net 468 hotel and resort condominium units were added by 1980 to the 1970 base of only 89. Molokai is the least urbanized of the comparison areas and lacks the "street scene" of Lahaina town or Kailua-Kona. Most of its resort development is within a single planned development (Kalua Koi). That, combined with its plantation past, makes its experiences in some ways the most comparable with the Kuilima area.

Tables 5.12-2(a) and (b) show the pertinent overall Type I crime rate information for the three comparison areas, while Table 5.12-3 provides information on juvenile delinquency in the same three areas. Table 5.12-2(a) computes crime rates based only on resident population, while Table 5.12-2(b) computes rates based on combined resident and visitor population. (Table 5.12-3 is about number of juveniles charged with Type I crimes, and so the appropriate base is resident population in the 5-17 age bracket.) In each table, countywide figures are also given to provide appropriate context for overall trends outside the resort areas. It should be noted that conclusions based on crime data

TABLE 5.12-2(a)

Overall Serious Crime Rates (Resident Population) for Three Comparison Rural Hawaii Resort Areas: 1970 - 1980

	1970	1980	Percentage Change 1970-80
Maui County (incl. Kalawao)			
Population	46,156	70,991	+ 53.8%
Total Type I Crimes*	1,834	6,658	+263.0%
Crime/10,000 Residents	397.3	937.9	+136.0%
Molokai Island			
Population	5,261	6,049	+ 15.0%
Total Type I Crimes*	154	340	+120.8%
Crime/10,000 Residents	292.7	562.1	+ 92.0%
Lahaina Division			
Population	5,524	10,284	+ 86.2%
Total Type I Crimes*	425	2,157	+407.5%
Crime/10,000 Residents	769.4	2,097.4	+172.6%
Hawaii County			
Population	63,468	92,053	+ 45.0%
Total Type I Crimes*	2,046	6,078	+197.1%
Crime/10,000 Residents	322.4	660.3	+104.8%
Kona			
Population	8,836	19,662	+122.5%
Total Type I Crimes*	478	1,616	+238.1%
Crime/10,000 Residents	541.0	821.9	+51.9%

NOTE: "Kona" combines North and South Kona, because police district covers both areas.

* Reported crime figures based on both offenses and complaints known to police. Crime rates are more conventionally computed only according to "reports," rather than the larger number of "complaints" (which can include calls about incidents which police are unable to verify really occurred). However, the only data available by districts were those including complaints.

Source: Computed by Community Resources, Inc., 1984, based on data from Annual Reports, Maui County and Hawaii County Police Departments, 1970 and 1980, and U.S. Census, 1970 and 1980.

TABLE 5.12-2(b)

Overall Serious Crime Rates (Total Population) for Three Comparison Rural Hawaii Resort Areas: 1970 - 1980

	1970	1980	Percentage Change 1970-80
Maui County (incl. Kalawao)			
Visitor Units*	2,270	10,483	+361.8%
Occupancy Rates*	73.03%	72.95%	
Persons/Room*	2.04	1.94	
Avg. Daily Visitor Pop.*	3,382	14,836	+338.7%
Total Population**	48,919	85,124	+ 74.0%
Crime/10,000 Total Pop.	374.9	782.2	+108.6%
Molokai Island			
Visitor Units*	89	557	+525.8%
Occupancy Rates*	63.68%	67.38%	
Persons/Room*	2.13	1.77	
Avg. Daily Visitor Pop.*	121	664	+448.8%
Total Population**	5,311	6,653	+ 25.3%
Crime/10,000 Total Pop.	290.0	511.0	+ 76.2%
Lahaina Division			
Visitor Units*	1,821	6,172	+238.9%
Occupancy Rates*	75.39%	74.84%	
Persons/Room*	2.02	1.99	
Avg. Daily Visitor Pop.*	2,773	9,192	+231.5%
Total Population**	8,223	19,374	+135.6%
Crime/10,000 Total Pop.	516.8	1,113.3	+115.4%

(continued)

	1970	1980	Percentage Change 1970-80
Hawaii County			
Visitor Units*	3,182	6,260	+ 96.7%
Occupancy Rates*	58.97%	47.31%	
Persons/Room*	1.97	1.93	
Avg. Daily Visitor Pop.*	3,697	5,716	+ 54.6%
Total Population**	66,314	96,858	+ 46.1%
Crime/10,000 Total Pop.	308.5	627.5	+103.4%
Kona			
Visitor Units*	1,449	3,760	+159.5%
Occupancy Rates*	55.94%	53.30%	
Persons/Room*	1.97	1.95	
Avg. Daily Visitor Pop.*	1,597	3,908	+144.7%
Total Population**	10,314	23,375	+126.6%
Crime/10,000 Total Pop.	493.0	691.3	+ 40.2%

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* Average daily visitor population calculated by multiplying number of visitor units (source: Hawaii Visitors Bureau, *Visitor Plant Inventory*, June 1970 and June 1980) times occupancy rates and persons per room (source: *Statistics and Trend of Hotel Business in Hawaii*, Harris, Kerr, Forster & Company 1972 (earliest available year) and Pannel Kerr Forster 1980; Molokai figures from "other Maui" category).

** Total population = de facto population, calculated by adding daily visitor population to resident population. Resident population slightly discounted to reflect persons temporarily absent, according to average figures for 1970 and 1980 in State of Hawaii, Department of Planning and Economic Development, *State of Hawaii Data Book 1983*, p. 15.

Additional Sources: *Annual Reports*, Maui County and Hawaii County Police Departments, 1970 and 1980; U.S. Census, 1970 and 1980; percentages and crime rates computed by Community Resources, Inc., 1984.

TABLE 5.12-3

Rates of Juveniles Being Charged with Serious Crime for Three Comparison Rural Hawaii Resort Areas: 1970 - 1980

	1970	1980	Percentage Change 1970-80
Maui County (incl. Kalawao)			
Population Age 5-17	12,695	15,064	+ 18.7%
Total Type I Charges	101	232	+129.7%
Rate/10,000 Residents 5-17	79.6	154.0	+ 93.6%
Molokai Island			
Population Age 5-17	1,654	1,625	- 1.8%
Total Type I Charges	8	16	+100.0%
Rate/10,000 Residents 5-17	48.4	98.5	+103.6%
Lahaina Division			
Population Age 5-17	1,385	1,799	+ 29.9%
Total Type I Charges	7	64	+814.3%
Rate/10,000 Residents 5-17	50.5	355.8	+603.9%
Hawaii County			
Population Age 5-17	17,656	19,792	+ 12.1%
Total Type I Charges	202	414	+105.0%
Rate/10,000 Residents 5-17	114.4	209.2	+ 82.8%
Kona			
Population Age 5-17	2,501	4,016	+ 60.6%
Total Type I Charges	31	105	+238.7%
Rate/10,000 Residents 5-17	124.0	261.5	+110.9%

Source: Computed by Community Resources, Inc., 1984, based on data from *Annual Reports*, Maui County and Hawaii County Police Departments, 1970 and 1980, and U.S. Census, 1970 and 1980.

from single years are somewhat tenuous because of typical annual fluctuations in reported crime, but it is necessary because population estimates are usually erroneous for non-Census years; also, the dangers are somewhat reduced by looking at results from three separate islands.

Points to be gleaned from these tables include:

- Serious crime and crime rates increased in all the rural areas considered in the tables--including the overall counties of Maui and Hawaii (i.e., non-tourist as well as tourist areas).
- In both 1970 and 1980, crime rates (whether calculated by counting residents only or including visitors) were greater than the countywide rates in the more developed areas of West Maui and Kona, but less in Molokai.
- The ten-year proportionate change in the crime rate per resident population was greater than the countywide growth in only one of the three areas--West Maui. For Kona and Molokai, the crime rate did increase, but not as rapidly as it increased countywide.
- Examining changes in crime rates based on total population (i.e., including visitors), it may be seen that the ten-year growth in crime rates for West Maui was actually essentially equal to the countywide change (115% vs. 109%) and was considerably less for Molokai or Kona. For Kona, the growth in crime rate was so much slower than the islandwide growth that Kona's 1980 crime rate (691 per 10,000 de facto population) was now only slightly greater than the countywide crime rate (627.5).
- The juvenile delinquency figures suggest a less benign relationship with tourism growth in rural areas. For all three areas studied, the ten-year percentage change in rates of juveniles charged was higher than countywide changes. The difference was not extensive for Molokai or Kona, but it was dramatically greater for West Maui.

The overall pattern suggested by the foregoing statistical evidence about tourism growth and crime in rural Hawaii areas (including the 1984 Chesney-Lind and Lind study of countywide Kauai data and the Community Resources, Inc. analysis of serious crime in Molokai, West Maui, and Kona) would be as follows:

(1) Crime rates in rural Hawaii areas are increasing overall, in both tourist areas and non-tourist areas.

(2) Additional population--whether resident or visitor--will provide more crime opportunities and more crime.

(3) However, overall serious crime is unlikely to increase faster in tourist-growth areas than other rural areas, and it may even grow less rapidly.

(4) Some specific aspects of crime--which represent small proportions of the overall total but may nevertheless be of particular concern--could be disproportionately affected. These include juvenile offenses, rape, robbery, and theft (larceny).

5.12.2 Tourism and Crime--Police Comments

The previous statistical studies and analyses were, to a large extent, academic in nature. It was deemed desirable to supplement them by interviewing police professionals--i.e., police station captains, research officers, etc. Contacts were made with key police informants in the Wahiawa and Kaneohe stations on Oahu (which serve the Kuilima Region), Molokai, Maui, the Hanalei-Princeville area of Kauai, South Kohala and Kona. While many of the responses reflected purely personal opinions and could also have been influenced by the "conventional wisdom" of the law enforcement community, answers to the following questions were generally very consistent:

What crime impacts can be expected from construction phases of resort development? There are sometimes short-term increases in social disturbances, such as weekend fights in bars or restaurants. The more that local-area residents get the construction jobs, the more that such disruptions may be expected (because construction workers living elsewhere tend to go home on the weekends).

What sort of crime problems occur on-site in rural resort areas? On-site crime is considered a minimal problem ...tially due to the effectiveness of private security operatio.... When it does occur, it tends to involve either burglaries or else complaints about noise, vandalism, rowdiness, etc. Perpetrators of thefts and burglaries are often resort workers, although there have been occasional instances of professional hotel thieves coming in from outside.

Do resort condominiums produce different on-site crime problems than hotels? This question is of particular interest because the current proposal for expansion at Kuilima would permit condominium as well as hotel development. The consistent answer from rural area police: Crime patterns in condominium areas differ little from those of hotel areas. Sometimes condominium owners may be a little more inclined to make comp[illegible] about noise or other perceived intrusions on peace and quiet.

What types of crimes do police most associate with tourist victims? Primarily theft of valuables from parked cars or beaches--i.e., off-site from the resorts themselves. Police felt visitors are rarely victims of violent crimes. This is the current perception for both the Oahu Koolauloa/North Shore Region and for most of the Neighbor Island resort areas studied. Only on Maui was there a feeling that tourists are more likely than residents to be victims of violent crimes--assault, rape, or robbery (which is defined as theft involving force or threats). It will be recalled that several of the previously discussed statistical studies indicated a relationship between tourism and some of these crimes. Contradictory police impressions could be due to (1) the possibility that this relationship is stronger in more urban tourist areas (e.g., West Maui is the most urbanized of the "rural" resort areas), and/or (2) the fact that these crimes occur so much less frequently than thefts that any statistical tendency is still not intuitively obvious even to police captains.

Are crimes against tourists motivated primarily by economic motives or by motives of social hostility? Almost unanimously, police officers believe that tourist thefts are due to the fact that visitors are "easy marks." The only exception was, again, on Maui, where younger local residents were believed to hold a certain amount of active antagonism. It may be noted that tourists are present in particularly large proportionate numbers there; the figures in Table 5.12-2(b) show that nearly half the total 1980 de facto population of West Maui consisted of visitors and more than 17% of the islandwide total population were tourists.

What is the relationship in TIME between crime increases and resort construction--i.e., temporary or permanent? In areas where the existing visitor plant inventory was still small (Molokai or South Kohala), police have observed a temporary spurt in crime (again, primarily thefts) following completion of a new resort project. After a year or two, the tendency would be for a plateau or dip in crime. In areas with larger pre-existing visitor plants, police seemed less aware of clear immediate impacts from new operations (possibly due to reasons in the next paragraph).

What are the SPATIAL crime implications of resort development--i.e., will crime increase particularly in nearby areas? First, all police agreed resort development has not increased crime in nearby purely residential areas to any significant extent. Second, while the most important crime aspect of tourism involves off-site thefts, visitors' tendencies to drive all over the various islands--and not just to nearby parks or beaches--means that crime impacts are to some extent dispersed. Resort development at West Beach could slightly inflate crime figures on

the North Shore, and resort development at Kuilima could result in a few more reported thefts in Waimanalo.

Does the presence of tourists tempt residents to crime if they are not already engaged in criminal activities? Almost unanimously, police believed that tourist presence may increase the number of criminal events, but not the number of criminals. Again, the one exception was on Maui, where there was some feeling that tourists are seen by certain younger persons as "fair game," not subject to conventional standards of decency.

What indirect crime effects may resort development have? The previously noted increase in juvenile delinquency is one potential consequence; however, police in Kona and Maui associate this largely with the "street scene" aspects which exist there but not (at present) on Oahu's North Shore. Another indirect consequence in some areas has involved crime spin-offs of social conflicts between longtime residents and newcomers attracted by resort employment. When resident population growth has been rapid, people are also more likely to report crimes to police rather than work out problems between families; hence, there is the possibility of a "paper" increase in reported crime. For the North Shore/Koolauloa Region, however, the Development Plan constraints on resident population growth would tend to mute this potential effect.

Are there unique crime-tourism linkages for the Kuilima Region? According to representatives of the local police, criminal activity in the Koolauloa and North Shore districts differ considerably. The Koolauloa area is characterized as having a declining crime rate over the past five years, while the North Shore's has been increasing. Drug-related activity on the North Shore has been a continuing problem, and there is some possibility that growing numbers of tourists in the area could be viewed as a potential market by drug merchants, as has occurred in West Maui. (Again, however, the lack of a "street scene" near Kuilima would dampen this possibility.) The historical movement of transients in and out of the North Shore area is felt to contain a possibly higher percentage of potential criminals than other portions of the population, so this could contribute to a crime-tourism link there.

In Koolauloa, certain crimes victimizing tourists have received extensive publicity. There have been newspaper reports extending back many years about stoning of tour buses to the Polynesian Cultural Center (e.g., Knox, 1972) and the recent robbery of visitors to Sacred Falls was highly publicized. (e.g., Gartles, 1984a). However, area police point out that the Sacred Falls robbers were not area residents, and the tour bus stoning was characterized as a reaction to interference with television reception that has abated since cable TV service is now available. In general, therefore, Koolauloa police do not see unique crime-tourism links in that district.

5.12.3 Preservation of Extended Families/Jobs for Grown Children

A desired form of social cohesion in most communities nearby the Kuilima project site is the preservation of extended families by providing jobs for residents' grown children. Some project supporters who might not themselves seek employment at the hotels or resort condominiums nevertheless believe that Kuilima jobs (including indirect and induced employment outside the resort itself) could keep young people in the area who would otherwise be forced to outmigrate to seek work. Some project opponents, on the other hand, believe that most area young people would prefer to outmigrate no matter how many jobs are locally available, just because the young people feel they have grown up in an isolated area and wish to see more of the island or the country as a whole. They also question whether many Region residents, especially young people, feel that resort work is desirable employment.

In the absence of any solid data about Hawaii's rural youth lifepaths--either in the Kuilima Region or on other islands--it is difficult to forecast with certainty whether the proposed resort would keep residents' grown children in the area or not.

Most of the jobs available at resorts can be filled by persons with high school degrees or two-year junior college diplomas. College graduates who have studied travel industry management would qualify for a smaller percentage of the jobs; however, it must be remembered that upper-level managers are usually rotated to different hotels throughout the country or even the world.

The State Department of Education used to survey graduating high school seniors about their immediate plans for work or further education, then conduct a follow-up survey a few months later to determine actual behavior. The last year in which both surveys were conducted was 1977. These surveys indicate nothing about plans or behavior in regard to preferred place of residence, but they do give a sense of the extent to which graduating seniors are on an upwardly mobile educational track which would make them unlikely candidates for the great majority of jobs which would be made available at Kuilima.

Results of the last pair of surveys, partially summarized in Table 5.12-4, indicate graduating seniors of the Region's two high schools at that time were less likely than seniors statewide to plan to enroll in any school the following Fall, and (except for Kahuku High School seniors planning to attend college near home at Laie) were particularly less likely to attend a four-year college, especially an out-of-state one. Results of the follow-up survey (filled out by a much smaller number of graduates, which raises the possibility of a biased sample) indicates that

TABLE 5.12-4

Plans and Behavior of 1977 Graduating Seniors in Kuilima Region

plans for Fall at graduation	Kahuku H.S.	Waialua H.S.	State-wide
out-of-state college	8.5%	8.3%	13.5%
Univ. of Hawaii 4-year campus	2.8%	14.1%	17.9%
Church College*	24.1%	0.0%	1.0%
other 4-year Hawaii college	0.0%	0.6%	0.7%
community college or trade school	11.9%	36.5%	31.5%
--plan later transfer to 4-year college**	-- 6.4%	--11.5%	--16.6%
will attend school/don't know where	7.1%	5.8%	9.2%
no plans yet for Fall	16.3%	12.2%	11.0%
will not enroll in school	29.1%	22.4%	14.8%
--plan to work full-time**	--15.6%	--10.3%	--11.0%
(number surveyed)	(141)	(156)	(11,417)

* now Brigham Young University Hawaii campus
** figures from separate question; not actual subcategory

actual situation in follow-up survey	Kahuku H.S.	Waialua H.S.	State-wide
no employment/in school	25.0%	51.0%	33.1%
working full-time	11.4%	8.2%	8.3%
working part-time	31.8%	16.3%	33.7%
working as apprentice	0.0%	0.0%	0.2%
military service full-time	0.0%	6.1%	2.6%
want work (not employed or in school)	25.2%	10.2%	6.6%
want work (in school/not employed)	6.8%	8.2%	14.3%
not in school, not employed, not looking for work (incl. housewives)	0.0%	0.0%	1.1%
(number returning surveys)	(44)	(49)	(4,442)

Source: State of Hawaii, Department of Education, 1977 Graduate Plans and 1977 Graduate Follow-Up Survey (unpublished data)

Kahuku High School students in particular were very likely to be working and/or seeking work soon after graduating. While this would not necessarily indicate an interest in Kuilima resort work or continuing to live in the Koolauloa/North Shore Region, it does suggest that a relatively high proportion of area high school graduates fit into categories potentially compatible with Kuilima's labor supply needs.

Another possible contribution of any major new source of jobs in the Region would be to facilitate the return of grown children now living elsewhere but interested in moving back. Again, the extent of interest in returning to the area is a matter of debate, since no surveys or other studies have been conducted to provide objective measures. However, one available indicator does suggest such a desire may be present: of the first 81 individuals formally to express interest in future housing development slated for Kahuku, 17 were married sons or daughters of ex-plantation workers who were no longer living in Kahuku (unpublished data, Kahuku Housing Corporation, 1984).

The issue of resident attitudes toward tourism jobs--particularly on the part of young people--is to some extent a separate question. On the one hand, the fact that several thousand persons applied for the few hundred available jobs at the Turtle Bay Hilton in early 1984 suggests there is abundant interest in such work. On the other hand, a number of persons involved in training and/or resort operations for rural Hawaii resorts who were interviewed for this report suggested that long-time local residents in particular sometimes feel that "service" work is equivalent to "servant" work and/or that communication problems make direct-contact hotel work uncomfortable for them (see Section 5.11.1).

Perhaps the clearest statement which can be made about the project's potential impact on preserving family ties through jobs for grown children is that it would greatly increase opportunities for this to occur. The extent to which these opportunities would be realized will depend on factors such as the job training programs discussed in Section 5.1. Such programs might well include a component designed to address the attitudinal considerations by better acquainting prospective trainees with the full range of employment opportunities in resort work. Attitudes could also be affected by acquainting young people with the resort environment while they are still in school, thus reducing any sense of cultural alienation. (See "Mitigations" Section 5.13.6 for further comments on possible youth programs.)

5.12.4 Social Values and Structure

The most intangible and speculative of social impact topics would involve the resort's effects on social values and structure. Although the development of a major resort complex in the Region may reasonably be expected to have significant effects on community composition and functioning, a host of other factors--

e.g., national and statewide trends in such areas as family life, agriculture and aquaculture, telecommunications, transportation costs in rural areas, cost of living, ethnic relations, etc.--will surely interact with resort impacts in unpredictable ways over the next 20 years or more.

For this reason, the analysis in this section is confined to broad scenarios of potential (but hardly inevitable) major consequences for each community in the Region:

Kaaawa/Kahana/Punaluu: Because of these communities' distance from the Kuilima area and the tendency of their residents to commute to Kaneohe/Kailua or Honolulu for work, no immediately apparent impacts on social values or structures can be identified. It may be expected that property values on or near the beach will continue to increase and that vacation homes there will gradually change hands from Honolulu to Mainland or foreign residents. Arguably, the Kuilima hotels could speed this tendency by exposing more outsiders to the beauties of the Koolauloa Coast. Equally speculatively, the proposed resort condominiums could counteract any such tendency by providing an alternative supply of housing units closer to resort amenities.

Hauula: The increased need for employees at Kuilima could have particular positive implications for Hauula, one of Oahu's poorest communities. Especially if job training programs are effective, Hauula's overall economic prosperity could improve greatly. At the same time, Hauula residents are characterized by a marked degree of independence, pride, and sensitivity. Youth problems are considered somewhat more acute here than in other communities. Should any feelings of social inequities arise due to events at Kuilima (e.g., hiring practices), the people of Hauula are as likely or more likely than those in other areas to feel affected. Because of the potential for social division in such a community, any major new economic development in the area--whether tourist-oriented or otherwise--stands the risk of generating some controversy due to sensitivities about which individuals do or do not get jobs.

Laie: Laie is currently one of Hawaii's most socially homogenous communities, with the great majority of its population subscribing to the same religious values and even working within the village boundaries. Expanded Kuilima resort activity will provide more business for Laie's economic center, the Polynesian Cultural Center, and more visitors to the Mormon Temple. At the same time, it will eventually employ more of Laie's current population outside the community (bringing residents into contact with guests whose leisure-time activities may sometimes seem in conflict with Mormon values) and could also eventually lead to more non-Mormon hotel employees or other residents seeking residences in or around Laie. Thus, the community's homogeneity may be affected while the economic underpinnings of the Mormon society there are strengthened.

__Kahuku:__ Plans for continued expansion of Kahuku's housing supply will bring substantial social change to the village with or without the further development of Kuilima. The population will grow younger, and new residents will eventually seek a greater voice in community affairs. However, Kahuku's history as a "company town" could be to some extent repeated if Kuilima expands as proposed, since the community's proximity to the resort and the plans to locate 90 to 100 employee housing units there make it likely that a large number of Kahuku residents will be Kuilima employees. Kahuku's future will likely be perceived as being tightly linked to the welfare of the resort--a situation which would seem more natural and appropriate to the older, longtime residents than to newcomers.

__Kuilima Condominiums:__ Present Kuilima condominium residents will probably enjoy an appreciation in property values, and the existing condominiums conceivably could fill up with full-time residents more rapidly as new employees seek rental units. Future condominium developments at Kuilima will each have unique and individual characters, but the overall long-term effect will be an increased community of the general types of people now living in the Kuilima condominiums.

__West Kawela Bay:__ Increased property values (and taxes) will likely lead to a gradual exodus of current renters and a slow turnover of ownership to affluent purchasers who want to live near a resort but prefer single-family homes to condominiums.

__Sunset/Waimea/Pupukea:__ Already established as "surfer" communities, these areas will be the most desirable residential locations for young single hotel employees, particularly although not exclusively those originating on the Mainland. Because the City Development Plans will permit little additional new development in the area, higher rents and larger households of young, unrelated individuals could result. Kuilima conceivably could increase the international market for mauka residential properties on the North Shore (i.e., Pupukea). These economic changes--already underway--could make it more probable that young residents of the area would have to be working in one or more jobs to enjoy the "laid-back" surfer lifestyle.

__Haleiwa:__ Kuilima's impacts on Haleiwa are likely to be indirect. They would depend on the extent to which entrepreneurs capitalize on Haleiwa's potential for being an oceanside, visitor-oriented commercial center. If Haleiwa artisans and craftsmen successfully market their community as a visitor attraction for resort guests, the community could well become Oahu's premiere rural arts-and-crafts center. This of course carries with it the negative potential for developing a "street scene" of young drifters such as has developed at Lahaina or (to a lesser extent) Kailua-Kona. However, Haleiwa's Special Design District provides a planning tool which can help community organizations avoid such mistakes.

__Waialua:__ This plantation community's current, predominantly Filipino population enjoys a social structure characterized by values of equality, reciprocal neighborly obligations, and a gently cynical attitude toward most clubs and organizations other than labor unions (Alcantara, 1973). It is, however, rapidly aging and highly uncertain about its economic future. Should plantation activities again become economically strong and healthy, development at Kuilima will likely have little impact on Waialua. However, a sudden cutback or shutdown simultaneous with increased employment at Kuilima would likely result in the same extensive social restructuring which Kahuku residents underwent more than a decade ago. Perhaps the most likely scenario, though, is a gradual reduction in Waialua's dependence on sugar or pineapple and a consequent gradual interest in some residents (probably younger ones) in resort employment. In this case, adjustments in community values and social structure would be both slow and minor.

5.13 Potential Mitigations for Socio-Economic Concerns

The following discussion will point out various potential mitigations for undesired socio-economic impacts--and/or enhancements for desired ones. As of this writing, the developer has made at least tentative commitments to some of the mitigations, but others represent preliminary consultant suggestions. The latter are being further studied for feasibility by the developer and may also be submitted to the North Shore Strategy Committee for community response and recommendations. For each suggested mitigation, it will be stated whether the developer has yet made any commitment.

Socio-economic mitigations may be presented in seven broad areas: (1) employment and training programs; (2) use of resort to stimulate community economic development; (3) housing; (4) dislocation; (5) resident access and on-site recreational impacts; (6) community interface and involvement; and (7) working conditions for employees with families. (Several other topics with broad social implications for residents--e.g., traffic and design issues--will not be addressed here because they are the responsibility of other consultants.)

5.13.1 Employment and Training Programs

KDC, along with the North Shore Career Training Corporation (NSCTC), and the North Shore Strategy Committee are involved in a effort to identify the appropriate types of and mix of training programs to assure that residents of the Region can qualify for construction and operating jobs generated by development at the Resort. This effort was not completed at the time this report was prepared. Thus the mitigating actions discussed in this section are preliminary, and they do not necessarily reflect the actions that would be taken.

Coordination of Training Needs and Resources: There is a need to coordinate the efforts of the Resort developer with public and private sector providers of training services. This would improve the cost effectiveness of both the private and public monies spent on training, and enhance the overall job training provided. As indicated in Section 5.1.9, there are several public and private sector training programs relevant to preparing residents in rural communities for employment in hotels and related visitor industry establishments. Several of these programs, such as those offered by the State's Employment Training Office, should be utilized, if they are available. Others, such as those that could be offered through Windward Community College, need to be developed in conjunction with anticipated development at the Resort. Still others, such as the Federally funded JTPA program, require a joint public-private effort.

Coordination with the providers of training programs is an important function that will have an impact on the extent of publicly assisted training made available. In this regard, it is recommended that the responsibility of coordinating with existing publicly funded training programs be centralized, and either be undertaken by a representative of KDC or delegated to a third-party, such as the North Shore Career Training Center. Meetings public sector providers of services should be arranged to coordinate future needs with program requirements.

Provision of Information and Counseling: There is a need to provide residents basic information concerning future job opportunities, and to counsel them regarding the training and experience required to potentially qualify for opportunities. Potentially, such information could be provided using a computerized list of Regional residents interested in jobs in the area. Such a list should include current and past residents of the Region, such as children who have moved away. By maintaining such a list, advance notice could be given when large blocks of new jobs are made available, such as when a new hotel opens.

Another aspect of providing information would be a staff person trained and experienced in personnel counseling. Both the Alu Like manpower training program and Maui Community College's co-operative education program, have a moderate degree of emphasis on an on-going counseling program during their respective programs. The counseling is perceived of as providing a communication link between the trainee and the employer, and helping the trainee during their initial period of acclimation.

Construction Period Opportunities: Employment opportunities related to the construction activities would range from relatively unskilled construction laborers to highly skilled construction trades and crafts. One factor affecting the accessibility of these jobs to Regional residents will be their having appropriate prerequisite skills. A second factor would be the union membership requirements of many of the skilled trades and crafts. During periods of high unemployment in the construction industry, such as the is presently being experienced, it will be difficult for untrained individuals to secure union membership in the skilled trades and crafts. A third important factor would be the need for a co-operative effort, involving the developer of a particular site and representatives both the general contractor and the construction trade unions. A final factor would be the need to coordinate training efforts with anticipated job opportunities.

Efforts to provide construction employment opportunities to Regional residents will be most effectively addressed prior to the finalization of construction contract negotiations for the development of individual sites at the Resort. It is not realistic to set quotas for future construction employment in light of uncertainty regarding the skills that are or will be available among Regional residents, and the uncertainty regarding the future level of unemployment in the construction industry. At this point in time, the most realistic commitment that KDC should entertain regarding construction period employment is a commitment to coordinating the efforts of site developers, contractors, unions, and providers of training services.

Visitor Industry Career Information: High school students and residents of the Region should be made familiar with the diverse spectrum of hotel and visitor industry job opportunities. This could motivate individuals in terms of there thinking about future jobs, and should also be beneficial with respect to their attitudes. Both the Department of Education and the privately funded Visitor Education Counsel presently have programs and materials that are applicable.

KDC and representatives of Resort property operators should participate in such efforts. Their participation could include career days for students and organized tours of properties, including "the back-of-the-house", for students and community groups. An important category of participants representing operators would be residents of the Region who have established careers in the visitor industry. Such individuals would serve as role models for students and other residents.

Middle- and Upper Level Management Positions: Employment of Regional residents for middle- and upper management positions would be enhanced by establishing scholarships for residents at any of three the Travel Industry Management (TIM) schools on Oahu. Entry into these management positions requires both formal education and moderate to extensive on the job training. Funding of scholarships for local residents would be an important initial step towards enhancing residents opportunity to secure the necessary educational requirements.

Employee Transportation: Coordinating public and private transportation services. The former would entail working with the County to provide public bus services that matches employee shift changes. The latter may entail encouraging car pooling efforts, by providing parking in closer proximity of participants. If the Wahiawa area residents become a significant source of labor, it may be appropriate to consider supplementing public bus service with service provided by the Resort. Hotel operators at Kaanapali presently provide bus service for employees living in central and east-Maui.

Day Care Services: Day care services would also facilitate women with young children working. The feasibility of providing such services at the Resort should be examined. This is discussed briefly in Section 5.13.7

5.13.2 Use of Resort to Stimulate Community Economic Development

The likelihood of Regional residents attaining a share of the business opportunities would be enhanced by providing information and referral services regarding technical and financial assistance. Financial assistance refers to business loan programs such as those offered by the Federal Small Business Administration (SBA). Technical assistance is defined as third party business or technical expertise intended to assist in identifying, diagnosing and resolving business problems that either jeopardize a business continuing or inhibit growth.

Technical and Financial Assistance: The "target market" for technical assistance would be new and existing small businesses based in the Region. Potential providers of technical assistance include individuals who are small business persons, professionals such as attorneys and bookkeepers, and academicians involved in business education. It is recommended that a committee of interested volunteers be formed to provide technical assistance that supports the expansion of existing and the development of new small business opportunities in the Region. Participants could logically include the principals in the Brigham Young University Business program, managers of financial institutions based in the Region, professionals such as accountants or bookkeepers who live in the Region, and other interested parties.

Financial assistance for small businesses is available from a variety of sources, and the developer could assist the volunteer committee in disseminating information about these sources. The availability of financial assistance is extremely limited for small businesses in the start-up phase, and more readily available for businesses that have a "track record." Therefore, the committee should work closely with existing providers of financial assistance. The lead in any financial assistance effort should include representatives of financial institutions operating in the Region.

Other Measures: The expansion of existing and the development of new small businesses in the Region would also benefit from the following.

1) Include as part of the commercial-retail space an area devoted to products associated with North Shore and/or its residents--e.g., arts and crafts, restaurants specializing in local ethnic food, etc.

2) In each hotel room, provide a brief but attractively-printed "North Shore Guide," including map, which points out area attractions and stresses local gift shops, restaurants, roadside food stands, etc. Merchants could pay advertising to help finance.

3) For services which may be requested by guests but which any single hotel may find economically infeasible to operate on its own (possible examples: babysitting, taxi/limousines to nearby attractions), have a central coordinating office for entire resort arrange contracts to ensure provision of such business opportunities.

5.13.3 Housing

Housing located in the existing communities will contribute to the overall life satisfaction of residents with family roots in area, thereby reducing turnover and the likelihood that the work force will increasingly be made up of in-migrants. The extent that new housing can be developed in the Region is controlled by public policy. Thus, the impact that increased housing need has on the increased availability of housing may not be significant.

Presently, KDC proposes to develop between 90 to 100 affordable housing units, located in Kahuku or elsewhere off the Resort, to help mitigate housing need. The job training activities mentioned previously also represent a "housing mitigation" in that they are intended to maximize employment among current (i.e., already-housed) area residents. And, although the feasibility of this concept is not currently known, it is recommended that the developer or Resort operators explore the idea of establishing an employee housing rental information pool. The purpose of the pool would be to facilitate employees finding landlords with suitable rental housing located in the Region, since (as was indicated in Section 3.4.4), there has historically been substantial turnover in the Region's rental housing stock.

5.13.4 Dislocation

Section 5.8 identified two classes of tenants or landholders who would need to move or surrender land in order to permit implementation of the proposed project: (1) six agricultural lessees, and (2) 37 lessees or sublessees of Kawela Bay residential cottages. For both groups, the major impact subject to mitigation is timeframe--i.e., providing adequate advance notice.

Lessees were notified in 1980 that the previous lease terms were being changed and that all leases would henceforth be on a month-to-month basis. This written notification informed lessees that there was no agreement for long-term tenancy and that each lessee would be given 30-day notice for termination. It was further hoped that, as project plans developed and were publicized, lessees would prepare for eventual termination of leases.

As of this writing (November 1984), no formal notification has been given to lessees that leases will be terminated as of any specific date. The developer has indicated that, when such notice is given, lessees will probably have one year to vacate, in order to provide them with ample time for relocation.

5.13.5 Resident Access and On-Site Recreation Impacts

Most of the recreational impacts of the development are likely to be considered highly positive by area residents, since they involve provision of considerable new park space and beach rights-of-way (see Section 5.9). However, concern has been expressed about impacts of the Kawela park on West Kawela residences and about increased exposure of both guests and residents to rough waters in the eastern coastal areas.

Possible mitigation measures for the Kawela park concerns might include:

- o Barriers at the western boundary of the park to discourage park users (or hotel guests) from physically wandering into the residential area. Such barriers could range from landscaping buffers such as dense plantings (which would also alleviate noise and visual impacts) to rock walls or fences. Such devices could not, of course, extend to the beach itself.
- o Extending security from the adjacent hotel to include the park.
- o Establishing a voluntary community oversight system, similar to that of the Crime Stoppers Program. Nearby residents would periodically check their area, possibly including the park itself, and maintain some form of communication with the police.

Regarding the strong ocean currents on the beaches east of Kawela Bay, a possible mitigation measure is continuous lifeguard supervision at all of the major on-site beaches.

5.13.6 Community Interface and Involvement

This section is comprised entirely of preliminary consultant suggestions (based in some cases on ideas supplied by community members in the key informant interviews) for further review and evaluation by the developer and the community. The suggestions fall into four broad groupings: (1) creation of an ongoing Kuilima Resort Association to provide a single entity for communication purposes with the community, and establishment of a community affairs coordination office under the auspices of that Association; (2) creation of various communication mechanisms;

(3) resort sponsorship of community-related events and activities; (4) resort sponsorship of programs for area youth.

Kuilima Resort Association/Community Affairs Coordination: In a resort complex, most of the operators of hotels and other amenities (i.e., stores and recreational franchises) are independent businessmen not bound by understandings between the community and the original developer. (To some extent, early agreements could be passed on to subsequent owners and operators through deed covenants, but an abundance of these would impair the marketability of hotel and commercial sites.) Furthermore, any communication between the community and one operator does not necessarily apply or get passed on to other developers. From the community perspective, a completed resort area is often just a group of businesses lacking any single entity through which communication can take place.

It is suggested that such an entity be created in the form of a Kuilima Resort Association, to which all hotel and commercial operators would belong. Membership could be made by a deed covenant or as part of the agreement for developing a site. Membership would consist of all on-site owners and operators: (1) developers (and/or landowners); (2) hotel operators; (3) commercial owners and operators; (4) condominium associations. Such associations are frequently created at rural resorts, but their functions are often restricted to marketing; what is being suggested here is that the association should also have an on-site and community-oriented function.

A second aspect of this suggestion is that the association fund an office of community affairs coordination. The individual who heads this office would be the day-to-day spokesman for all resort businesses in dealings with the community. (S)he would carry out the previously-suggested (Section 5.13.2) functions of coordinating needed outside service contracts with community businesses for services needed by multiple operators, providing information and referral services about small business programs, and arranging for updated publications of a "North Shore Guide" for dissemination to guests. This office could also provide an overall resort liaison for employment and housing matters.

Communication Mechanisms: Suggested communication mechanisms between the resort (and/or its guests) and the community would include:

- Provision of a "North Shore Guide" in each guest's room, to be updated once or more a year as experience proves appropriate. In addition to the previously-noted (Section 5.13.2) function of directing visitors to community-based businesses, the Guide could also direct visitors away from any locations which eventually prove sensitive or unsafe (e.g., beaches which are dangerous

under certain conditions or "local" areas where residents are complaining about too many outsiders)--either through direct, diplomatically-worded statements or through simple omissions. Periodic inserts could draw visitors' attention to special community-based events where tourist patronage would be appreciated--e.g., the Haleiwa Sea Spree.

- A bulletin for part-time condominium occupants (i.e., owners who are weekend or vacation users only) to promote integration into the community by informing them of current community events and activities. (This might be integrated into the following mechanism.)

- A regularly-purchased and written column in the North Shore News to acquaint residents with current events and activities at the resort. (The North Shore News also represents an option as a communication vehicle for some of the previously mentioned guides or bulletins.)

- A standing citizens' advisory committee which would meet with the Kuilima Resort Association at least once a year--to plan some of the events and activities to be discussed shortly--but which could also be activated on relatively short notice to discuss any developing sources of friction between the resort and the community. This could be an extension or evolution of the current North Shore Strategy Committee. Depending on future circumstances, it could be identical with or separate from the community economic development corporation suggested in Section 5.13.2. Membership is a matter for further discussion with the community. Points for consideration include whether or not labor unions should be represented and exactly who selects community delegates.

- To provide a record of community objectives and concerns which would also provide instant background in local sensitivities for new resort managers or operators, the advisory committee as one of its first order of businesses could draft a Statement of Community Goals. Such a Statement could focus on current community concerns about assuring maximum employment and economic benefits for area residents. The responses of the Kuilima Resort Association (and/or its individual members) could be appended. The Statement would serve the purpose of strongly expressing community sentiment in an enduring fashion without binding any party to act on any particular position. However, to ensure that the Statement remains current and is not relegated to obscure files, it could be mandatorily reviewed on an annual basis. Additionally, amendments or additions to the Statement could form the basis for the agenda of most meetings between the Resort Association and the citizens' advisory committee.

Community-Related Events and Activities: The basic recommendation here is that both the overall resort and its individual operators attempt to promote events and activities which are of interest to both visitors and area residents. These would be primarily periodic "special" occurrences (to assure an overall atmosphere of vacation seclusion for guests and not to intrude the resort into residents' lives too often). However, it is conceivable that some events of community interest might take place on a weekly or everyday basis. The desired outcome is to provide guests with entertaining experiences while simultaneously giving residents a sense of participation in resort activities.

Some examples for consideration:

- Resort cooperation in resident use of Kawela Bay for regularly-scheduled canoe races, hukilaus, etc. In other coastal areas, the resort could sponsor windsurfing competition.

- Occasional holiday festivals such as Hilton's 1984 July 4 fireworks exhibition could attract both residents and visitors. These might feature current holidays or revivals of ancient Hawaiian events such as the Makahiki games. Depending on the amount of space required, events could be held on-site, or transportation could be provided to nearby off-site locations (possibly provided by the Campbell Estate) for temporary activities.

- Special resident discount days can be held for resort attractions such as golf, horseback riding, and hotel dining or entertainment. This is already being done at the resort, and the suggestion here is simply to continue and search for additional opportunities.

Youth Programs: The youth of the North Shore and Koolauloa areas represent both a source of pride to the parents (hence, a particularly important target for resort community relations programs) and also a future source of labor supply for the resort. One of the major concerns of some residents is that local young people will not actually apply for resort jobs (or, if they do apply, not get them) because they lack social skills and/or because the resort seems an alien environment to which they do not relate until they seek a job. Thus, it is very much in the resort's interests to cooperate with local schools and youth programs. Some potential activities:

- School tours for area elementary and intermediate students, to familiarize young people with the resort long before they must think about vocations. Such tours should include the opportunity to meet the visitors.

- As major new resort facilities are developed (e.g., as new hotels are opening or about to open), special tours for all high school students, to acquaint them with the new attraction and reduce the likelihood they will cut classes and/or "sneak in" to sample the sights.

- Cooperate with school athletic departments or selected youth groups to explore the possibility of controlled use by youth of certain recreational amenities (e.g., horseback riding, tennis) at otherwise underutilized times.

- To the extent that the developer or operators contribute to community organizations or events, focus on programs aimed at building young people's social skills and self-confidence (e.g., creative arts programs or the Kahuku High School Band, considered among the best on the island).

- Seek to establish at least one joint visitor-resident attraction which features skills of high school youths or young adults--e.g., a rodeo or water sports event.

5.13.7 Working Conditions for Employees with Families

Section 5.11 discussed potential impacts of resort employment on the workers and noted that there were several possible sources of disruption for family life--e.g., shift work and difficulties in maintaining adequate parental supervision of children. These can be significant social impacts in and of themselves. However, to the extent that such problems discourage local residents from entering or remaining in the resort workforce (and hence necessitate greater dependence on transients with historically high turnover rates), they are also a threat both to resort profitability and to the concept of the Kuilima resort as the centerpiece of local community economic development.

To a great extent, working conditions will be determined through negotiations between operators and worker labor unions. Some of the potential future issues include proposals for a guaranteed work week; counting family status in determining seniority for lay-off or scheduling purposes; having more on-call employees to allow parents time off for childrens' sicknesses or other emergencies. The merits of these ideas are not appropriate for analysis or debate here. However, there are a few steps which it can be recommended that the developer (or a future Kuilima Resort Association) might take. The following are again consultant recommendations for further study.

- Child care facilities are clearly a primary need for families with two working spouses. There has recently been a fair amount of newspaper publicity regarding the child-care program of Maui Land and Pineapple Co. for the children of its employees, including employees of its subsidiary at the Kapalua resort (Castillo, 1984; Creamer, 1984). The economics of a child care operation might be analyzed by the developer, with special attention to questions such as: (a) the feasibility of on-site vs. off-site operations; (b) the possibility of combining with other major nearby employers; (c) the need for evening as well as daytime facilities.

o Particularly because many hotels have a policy forbidding employees to use hotel facilities in off-hours, employee families often have little contact with resorts. For this reason, consideration could be given to periodic special dinners, picnics, etc. oriented to employees and their families.

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APPENDIX:

INTERVIEW GUIDE FOR DISCUSSIONS WITH COMMUNITY LEADERS

General Community Nature, Issues

1. Aware of any books or studies on their community?

2. Have there been any major changes in this community in recent years? What, and how important have they been?

3. Are there any major changes anticipated for the near future?

4. Much sense of "community?" What things does it focus on (e.g., schools, churches, youth, community organizations? What are roadblocks to greater sense of community?

5. Who "runs" the community--individual leaders? community organizations? govt. agencies/leaders? businesses?

6. Which other nearby communities are yours tied into, and to what extent? Why not so much the others?

7. What are the best communication mechanisms for getting word out to the grass roots--community meetings, local news media, community bulletin boards, what?

8. What sub-groups are there in community (ethnic, geography, newcomer vs. longtime, SES)? How do they get along? Any efforts, past or present, for greater community integration?

9. Any groups with particular problems, or who are poorer, or who don't have needed programs/facilities?

10. Youth: Are there many problems--e.g., delinquency or neglect by working parents? What programs or facilities exist?

    Are they leaving the community as they grow up (more than in other communities)? What would keep them here?

11. Issues, Needs, Problems:

    --what do people most value or like about this community?

    --what are the major lacks, problems, or needs?

    - o general (e.g., jobs, crime)
    - o specific facilities (e.g., new gym, bypass, etc.)

    --any formal documentation of above?

    - o surveys
    - o formal policy statements by community organizations

Resort-Related Questions

1. What opportunities does the proposed project represent, and how important are these?

   What actions could be taken to make sure these opportunities are fully realized?

   (Areas for probing: Employment, business opportunities, access to Kawela or other areas)

2. What problems could the development bring, and how important are these?

   What actions could be taken to minimize such problems?

   (Areas for probing: rural lifestyle/landscape, relocation, cost of land/living)

3. Are your views shared by many others? Documentation?

   o surveys
   o formal policy statements by community organizations

4. How much interest do you think there will be in resort employment in your area?

   o current commuters
   o people not now in labor force (housewives, etc.)
   o youth
   o any other groups esp. interested or disinterested?

5. Do you see development at Kuilima as closing off any other desired options for economic development?

6. How many and who in your community now use the Kuilima area, and for what purposes? Any problems in this use?

   o Turtle Bay Hilton
   o Kawela area
   o other yet-undeveloped coastal areas
   o golf course
   o marsh or other interior area

7. Do many tourists come into your community? Do people see this as desirable, or is there resentment? If resentment, a serious problem or just minor annoyance?

   o restaurants/bars
   o other retail operations
   o parks, coastal areas
   o highways
   o residential areas
   o community events, fundraisers

8. Has the resort (either Kuilima Development Co. or the hotel) played any particular role in community affairs to date? Do they provide anything to the community besides jobs?

9. How easy or adequate has communication been between the community and the resort? Suggestions for improvements?

10. Any other throughts, ideas, or suggestions?

APPENDIX K

ASSESSMENT OF PROJECT IMPACT ON STATE AND COUNTY FINANCES

IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT

Prepared by:
Decision Analysts Hawaii, Inc.

CONTENTS

TABLES

IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT

INTRODUCTION

The proposed expansion of the Kuilima Resort will have a significant impact on the economy of Oahu and, correspondingly, will have a significant impact on State and County revenues and expenditures. Estimates for these fiscal impacts on government are summarized in this section, with all values expressed in 1984 dollars. The analysis is contained in four tables which cover growth assumptions, revenues, expenditures, and a summary. Furthermore, the analysis is divided into three phases: Phase I, Phase II, and Phase III. The development planned for Phase III is the portion of the resort expansion which requires State land redistricting from Agriculture to Urban.

The analysis covers all relevant activity directly or indirectly related to or supported by the proposed expansion, including: expenditures by visitors, airline and ship companies, and airline and ship crews; direct, indirect, and induced sales; onsite and offsite businesses directly and indirectly supported by the increased activity; direct, indirect, and induced employment; people and households directly and indirectly supported by the increased economic activity; household income; etc. The revenue estimates include all sources of government revenues including taxes (property, excise, income, and other taxes), user charges and fees, fines, earnings, etc. Thus, the revenue estimates are larger than those which would be based simply on tax revenues. Similarly, the analysis covers all capital improvements which have been identified as being required to accommodate the resort expansion, and all operations and services normally required to support the various activies directly or indirectly related to or supported by the resort.

Detailed assumptions for the calculations are contained in the footnotes to the tables.

GROWTH ASSUMPTIONS

The fiscal impacts are based on the addition of 1,450 hotel rooms, 2,063 resort condominiums, and 40,000 square feet of commercial space. Phase III development includes the addition of 1,000 condominiums. The conversion of this additional development to the growth assumptions which underlie the fiscal analysis is presented in Table 1. As shown, the additional development is expected to add about 4,783 people to the average visitor population on Oahu, with about 1,250 visitors per day added as a result of the Phase III condominiums. The increase in employment, people and homes directly and indirectly supported by the resort are expected to number about 6,275, 14,809, and 4,894, respectively. About 57 percent of the employment, people, and homes are expected to locate on the North Shore. Also, about 19 percent are expected to be added as a result of the Phase III development.

The tax base is estimated to increase by $1.1784 billion dollars, including $635.1 million for the resort, $52.0 million for offsite businesses, and $489.4 million for the value of homes directly and indirectly supported by the resort. Phase III is expected to add $302.9 million to the property tax base.

Upon project completion, direct, indirect, and induced sales and household income are projected to be $304.5 million and $110.8 million, respectively. About 20 percent of this amount will be added by Phase III. The increase in sales and household income will occur throughout Oahu, with only a fraction occurring at the Kuilima Resort itself.

Excluded from these estimates are the economic impacts of tip income, government employment supported by revenues derived from the Kuilima expansion, and government expenditures of the added tax revenues.

REVENUES

The translation of these growth assumptions to State and County revenues is shown in Table 2. Construction activity is estimated to generate a total of $86.7 million in tax revenues to the State, with $48.1 million generated by construction of the resort, and the remainder from construction of offsite business facilities and homes. About $22.6 million will be generated during Phase III. These revenues will be distributed over time as construction proceeds.

During full operations, the estimate for the added County revenues is $12.1 million per year, the bulk of which will derive from property taxes, including about $5.0 million per year in property taxes generated by the resort. Phase III will add about $2.7 million per year to County revenues. The increase in State tax revenues is expected to be $24.1 million per year, with the largest source being excise taxes. Phase III will add about $4.8 million per year to State revenues. Excluded from these revenue estimates are increased Federal-to-State/County transfers and State-to-County transfers based on population formulae.

The combined State and County revenues during full operations is expected to total $36.2 million per year, with $7.5 million per year added by Phase III. This total for added tax revenues is very substantial, amounting to about 1.4 percent of the combined State and City & County tax revenues for 1983. However, this sum is consistent with the fact that tourism is Hawaii's dominant economic activity, and that the increase in visitor activity over 1983 levels amounts to 4.4 percent for the State and 7.2 percent for Oahu.

EXPENDITURES

Estimates for State and County expenditures required to accommodate and support the expansion of the Kuilima resort and related activities are given in Table 3.

Capital Improvements

For the County, the major capital improvements projects needed on the North Shore to accommodate growth (and satisfy health standards even without the resort) are local sewers now under development. Their cost is estimated to be $25.3 million in 1984 dollars. The share attributed to population growth supported by the proposed Kuilima expansion is estimated to be $7 million, which is a high allocation based on projected population for the year 2000 rather than projecting over the much longer useful life of the project. Debt service on this sum is $0.7 million per year (10 percent, 30 years bonds). It should be noted, however, that Kuilima will provide its own onsite sewer system.

For the State, the major capital improvement projects needed on the North Shore to accommodate growth are highway improvements. Efforts will be made to minimize traffic by providing many activities on site at the resort, and by adding jitney and shuttle services. Nevertheless, new resort development on the North Shore will contribute to the need for highway improvements. In the short term, relatively inexpensive but temporary spot improvements will suffice, including pavement widening, paved shoulders, left-turn lanes, and bridge widening. These temporary spot improvements are expected to total $17 million. But over the long-term, more expensive permanent improvements will be needed —an estimated $41.6 million to widen Kamehameha Highway to four lanes from Pupukea to Haleiwa, and from Weed Junction to Wahiawa, excluding the Haleiwa bypass. This estimate is high in that some of the spot improvements may decrease the cost of the permanent improvements.

However, only a portion of the cost for transportation improvements can be fairly attributed to the expansion of Kuilima, since a major share of the increased travel will derive from residents who are independent of the Kuilima, and from visitors staying elsewhere on Oahu. A high allocation of the cost for highway improvements to growth

supported by Kuilima is $23.2 million (see Footnotes 5 and 6 of Table 3 for allocation assumptions).

Other State capital improvement projects which will be required to accommodate growth supported by the Kuilima are school improvements. A high estimate for their cost is $1.6 million.

The total cost estimate for State capital improvement projects which can be allocated to growth supported by the Kuilima expansion is $24.8 million, with a debt service of about $2.6 million per year.

The combined State and County debt service for capital improvement projects which can be allocated to growth supported by the Kuilima expansion is about $3.4 million per year, with about $0.6 million being added as a result of Phase III.

Operations and Maintenance

An approximate estimate for operations and maintenance expenditures needed to service the growth supported by the Kuilima is $23.7 million per year, with $7.8 million of this allocated to the the County and $15.9 million to the State. Phase III will contribute about $4.5 million per year. These expenditures should provide approximately the same level of per-unit services to residents, visitors, and businesses as is currently the case with locally generated revenues. The cost estimates include appropriate adjustments for Federal grants, and aging of the population to reflect slower growth in the school-age population.

SUMMARY

The net impact on State and County finances of expanding the Kuilima Resort is summarized in Table 4. This table differs from the previous ones in that the values shown are average amounts which are expected to occur over the course of a phase, as opposed to the amount which is expected to occur at the completion of a phase.

For the County, expenditures are projected to exceed revenues slightly during Phase I. This occurs because of the high allocation of sewer costs to the future population on the North Shore which will be directly or indirectly supported by Kuilima. For all subsequent phases, however, revenues exceed expenditures, with net revenues expected to grow to an estimated $3.6 million per year upon completion of the project.

For the State, revenues exceed expenditures for each phase, and are projected to reach a maximum during Phase II because of the construction-generated taxes. Upon completion of the expansion, net revenues to the State are projected to be $5.6 million per year.

The resulting combined fiscal impact on the State and County is that revenues will exceed expenditures, with net revenues amounting to $9.2 million per year upon completion of the Kuilima expansion.

To summarize the previous discussion and the results of Tables 2 through 4, State and County revenues derived from the proposed expansion of Kuilima will be very large, and will be sufficient for government to easily afford capital improvements and services needed to accommodate resident, visitor, and business growth which will be directly or indirectly dependent on the increased visitor activity made possible by the expansion of the Kuilima Resort. The revenues will be sufficient to: (1) finance the fair share of the cost for major transportation and other capital improvements which are or will be needed on the North Shore; (2) provide the same level of per-unit services as are currently provided; and (3) serve other community needs with the remaining net revenues. Furthermore, government will be exposed to little, if any, risk since major government investment need not be made until the success of the expanded resort is proven, and substantially increased tax revenues are already being derived.

Table 1.— IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT: GROWTH ASSUMPTIONS

Item	Phase I	Phase II	Sub-total	Phase III	TOTAL
Duration of Construction (years)	4	5	9	5	14
Proposed Developments:					
Rooms:					
Hotel Rooms	600	850	1,450	--	1,450
Condominiums	--	1,063	1,063	1,000	2,063
Total Rooms	600	1,913	2,513	1,000	3,513
Commercial Area (1,000 sq. ft.)	20	20	40	--	40
Average Number of Daily Visitors:					
Hotel Visitors[1]	912	1,292	2,204	--	2,204
Condominium Visitors[2]	--	1,329	1,329	1,250	2,579
Total Visitors	912	2,621	3,533	1,250	4,783
Extent of Economic Support Provided:					
North Shore: (Assuming no commuting from outside the region.)					
Employees[3]	928	1,964	2,893	663	3,556
People[4]	2,190	4,635	6,827	1,565	8,392
Homes[5]	724	1,532	2,256	517	2,773
Oahu:					
Employees[3]	1,638	3,467	5,105	1,170	6,275
People[4]	3,866	8,182	12,048	2,761	14,809
Homes[5]	1,278	2,704	3,981	912	4,894

[1] 1.52 daily visitors/room. Community Resources, Inc. and A. Lono Lyman, Inc.

[2] 1.25 daily visitors/room. Community Resources, Inc. and A. Lono Lyman, Inc.

[3] Direct, indirect, and induced employment:
North Shore: 1.326/hotel room, 0.663/condo, 0.00663/sq. ft. of commercial space.
Oahu: 2.34/hotel room, 1.17/condo, 0.0117/sq. ft. of commercial space.
Source: Community Resources, Inc. and A. Lono Lyman, Inc.

[4] 2.36 residents/employee. DPED, Data Book: 1983.

[5] 3.026 people/home. DPED, Data Book: 1983.

Table 1.— IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT: GROWTH ASSUMPTIONS
(continued)

Item	Phase I	Phase II	Sub-total	Phase III	TOTAL
Property Tax Base (millions):					
Resort:					
Hotel Rooms ($150,000/room)	$ 90.0	$127.5	$217.5	$ --	$ 217.5
Condominiums ($200,000/unit)	--	212.6	212.6	200.0	412.6
Commercial ($125/sq. ft.)	2.5	2.5	5.0	--	5.0
Total	$ 92.5	$342.6	$435.1	$200.0	$ 635.1
Offsite Businesses[6]	11.4	28.9	40.3	11.7	52.0
Residential ($100,000/home)	127.8	270.4	398.1	91.2	489.4
Total Tax Base	$231.7	$641.9	$873.5	$302.9	$1,176.5
Sales (millions):					
Direct Expenditures throughout Oahu:					
Visitors[7]	$ 37.3	$ 85.8	$123.1	$ 31.0	$ 154.1
Airlines, and Airline and Ship Crews[8]	5.4	12.4	17.8	4.5	22.3
Total Direct Expenditures	$ 42.7	$ 98.2	$140.9	$ 35.5	$ 176.4
Indirect and Induced Sales[9]	31.0	71.3	102.3	25.8	128.1
Total Sales	$ 73.7	$169.5	$243.2	$ 61.3	$ 304.5
Household Income[10] (millions)	$ 26.8	$ 61.7	$ 88.5	$ 22.3	$ 110.8

[6] $2,910/person (de facto), minus value of onsite commercial area. DPED, Data Book: 1983.

[7] Based on average visitor expenditures of $112 and $68 per day for hotel and condominium visitors, respectively (for hotel visitors, 1980 expenditures of $185 and $71.24 per day for Japanese and others, respectively, increased to 1984 values using the Honolulu CPI, and 15% of the visitors being Japanese; for condominium visitors, expenditures reduced by condominium/hotel employment ratio). DPED, Data Book: 1983.

[8] 14.5% of Direct Expenditures by Visitors. DPED, Data Book: 1983.

[9] 72.6% of Total Direct Expenditures. DPED, Data Book: 1983.

[10] 36.4% of Total Sales. DPED, Data Book: 1983.

Table 2.— IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT: REVENUES[1]
[In millions of 1984 dollars.]

Item	Phase I	Phase II	Sub-total	Phase III	TOTAL
CONSTRUCTION-RELATED REVENUES:	TOTAL REVENUES				
State Revenues:					
Resort[2]	$ 7.0	$ 26.0	$ 33.0	$ 15.2	$ 48.1
Offsite Businesses Supported by Resort Activity[2]	0.9	2.2.	3.1	0.9	3.9
Homes Supported by Resort Activity[3]	9.1	19.2	28.2	6.5	34.7
Total State Revenues	$ 17.0	$ 47.4	$ 64.3	$ 22.6	$ 86.7
	AVERAGE ANNUAL REVENUES				
Total State Revenues	$ 4.3	$ 9.5	—	$ 4.5	—
OPERATIONS-RELATED REVENUES:	ANNUAL REVENUES (at completion of phase)				
County Revenues:					
Property Taxes:[4]					
Resort	$ 0.9	$ 2.7	$ 3.7	$ 1.4	$ 5.0
Offsite Businesses Supported by Resort Activity	0.1	0.3	0.4	0.1	0.5
Homes Supported by Resort Activity	0.9	1.8	2.7	0.6	3.3
Total Property Tax Revenues	$ 1.9	$ 4.8	$ 6.8	$ 2.1	$ 8.8
Other Revenues[5,6]	0.9	1.8	2.7	0.6	3.3
Total County Revenues	$ 2.8	$ 6.6	$ 9.5	$ 2.7	$ 12.1
State Revenues:					
Excise Tax[7]	$ 2.5	$ 5.7	$ 8.2	$ 2.1	$ 10.2
Income Tax (excluding tax on tips)[8]	0.8	1.9	2.7	0.7	3.4
Other Revenues[9,10]	2.7	5.8	8.4	2.0	10.5
Total State Revenues	$ 6.0	$ 13.4	$ 19.3	$ 4.8	$ 24.1
Total State and County Revenues	$ 8.8	$ 20.0	$ 28.8	$ 7.5	$ 36.2

Table 2.— IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT: REVENUES (continued)

[1]Includes tax and non-tax revenues.

[2]7.58125% of property tax base: 4% for excise tax on finished development, 0.13125% for excise tax on building materials, 0.05% for conveyance tax, and 3.4% for income tax. C&C of Honolulu, "Impact of Construction on Employment and Tax Revenues," April 1978; and Table 4 for property tax base.

[3]7.0825% of property tax base: 4% for excise tax on finished development, 0.1125% for excise tax on building materials, 0.05% for conveyance tax, and 2.92% for income tax. Same source as above.

[4]Tax rates per $1,000 of $10 for hotel, $9 for commercial, and $8.75 for residential.

[5]$201/resident for fuel tax, motor vehicle weight tax, public utilities franchise tax, licenses and permits, charges (sewers, refuse, parking, golf, etc.), bus fees, and other revenues. $50/daily visitor for fuel tax, motor vehicle weight tax, public utilities franchise tax, and charges; revenues per visitor for these items are assumed to be about one-half that of residents. City and County of Honolulu, "A Guide to the Budget of the City and County of Honolulu," Fiscal Year 1984-85; and DPED, Data Book: 1984.

[6]Excludes Federal and State transfer payments.

[7]4% of Total Direct Expenditures, 4% of 65% of Household Income (the estimated share of personal income spent on consumption that is subject to 4% tax), and 0.5% of the remainder of Total Sales. Expenditures, Sales, and Household Income from Table 4; and DPED, Data Book: 1983.

[8]3.09% of Household Income. Household Income from Table 4; and average tax rate on personal income, DPED, Data Book: 1983.

[9]$599/resident for specific excise taxes (tobacco, liquor, and fuel) in excess of 4%, corporate income tax, unemployment tax, other taxes and permits (franchise, inheritance, estate, conveyance), fines, forfeits, escheats, income from other agencies, rents, royalties, land income, department earnings, and miscellaneous. $208/daily visitor for specific excise taxes, corporate income tax, fines, forfeits, income from other agencies, department earnings, and miscellaneous; revenues per visitor for these items are assumed to be about one-half that of residents.
DPED, Data Book: 1984.

[10]Excludes Federal transfer payments.

Table 3.— IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT: EXPENDITURES
[In millions of 1984 dollars.]

Item	Phase I	Phase II	Sub-total	Phase III	After 2000	TOTAL
MAJOR NORTH SHORE CAPITAL COSTS:			TOTAL COSTS			
County:						
Sewers[1]	$ 25.3	$ --	$ 25.3	$ --	$ --	$ 25.3
Kuilima Share[2]	$ 7.0	$ —	$ 7.0	$ —	$ —	$ 7.0
State:						
Transportation:						
Spot Improvements[3]	$ 4.0	$ 5.8	$ 9.8	$ 7.2	$ --	$ 17.0
Widening to 4 Lanes[4]	--	--	--	--	41.6	41.6
Total	$ 4.0	$ 5.8	$ 9.8	$ 7.2	$ 41.6	$ 58.6
Kuilima Share (high allocation)[5,6]	$ 3.0	$ 4.4	$ 7.4	$ 5.4	$ 10.4	$ 23.2
Schools, Kuilima Share[7]	$ 0.4	$ 0.9	$ 1.3	$ 0.3	$ --	$ 1.6
Total, Kuilima Share (high allocation)	$ 3.4	$ 5.3	$ 8.7	$ 5.7	$ 10.4	$ 24.8
Total State and County Capital Costs, Kuilima Share (high allocation)	$ 10.4	$ 5.3	$ 15.7	$ 5.7	$ 10.4	$ 31.8
DEBT SERVICE[8]			ANNUAL PAYMENTS			
County	$ 0.7	$ —	$ 0.7	$ —	$ --	$ 0.7
State (high allocation)	$ 0.4	$ 0.6	$ 0.9	$ 0.6	$ 1.1	$ 2.6
Total Debt Service	$ 1.1	$ 0.6	$ 1.7	$ 0.6	$ 1.1	$ 3.4
OPERATIONS AND MAINTENANCE (O&M)			AVERAGE ANNUAL EXPENDITURES (at completion of phase)			
County O&M[9]	$ 2.0	$ 4.3	$ 6.3	$ 1.5	$ --	$ 7.8
State O&M[10]	4.1	8.8	12.9	3.0	--	15.9
Total State and County O&M	$ 6.1	$ 13.1	$ 19.2	$ 4.5	$ —	$ 23.7

Table 3.— IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT: EXPENDITURES (continued)

[1]For Kaaawa, Hauula-Punaluu, Pupukea, Haleiwa, and Waialua, with the cost updated according to the Honolulu Consumer Price Index. State Department of Health and City and County of Honolulu, Water Quality Management Plan for the City and County of Honolulu, September 1978.

[2]27.6%, based on an estimated 8,390 people on the North Shore supported directly or indirectly by the Kuilima Resort in the year 2000, and a total regional population of 30,400. Table 4.

[3]Pavement widening, paved shoulders, left-turn lanes, bus-turn lanes, and bridge widening.

[4]Current State traffic projections plus traffic expected from the expanded Kuilima Resort indicate that portions of Kamehameha Highway (Pupukea to Haleiwa and Weed Junction to Wahiawa) may have to be widened to four lanes some time after the year 2000. The estimated cost for this widening was $16.3 million in 1978 dollars, or $41.6 million in 1984 dollars, excluding the Haleiwa by-pass. This estimate is high in that some of the spot improvements may decrease the cost of the permanent improvements. Cost estimate based on City and County of Honolulu, "Fiscal Impacts, Transportation System, and Beach Use Analysis," June 1978.

[5]75% of the cost for spot improvements, assuming (to the disadvantage of Kuilima) that: costs are allocated to those who generate new traffic (as opposed to allocating according to current and new traffic); ignoring traffic growth after project completion; allocating cost by contribution to peak weekday traffic (as opposed to the higher weekend traffic which reflects residential demand from outside the region); allocating cost by contribution to traffic at Waimea Bay (which overestimates Kuilima's contribution to traffic in more distant locations); assuming that all of the residential traffic (which accounts for about 75% of the current traffic, with the other 25% generated by visitors) is generated from within the region (with negligible traffic from those living outside the region); all of the traffic related to region population growth is assigned to Kuilima under the (unrealistic) assumption that all new residents will depend economically on Kuilima; and ignoring the fact that most new traffic generated by the Kuilima will be in the opposite direction from that of commuters to town.

[6]25% of the cost for widening to four lanes after the year 2000, assuming (to the disadvantage of Kuilima) that: costs are allocated according to the contribution to year 2000 traffic flow (as opposed to allocating costs to those who will generate new traffic); and other assumptions as given in Footnote 5.

[7]One-half of the high estimate made in 1978, updated to 1984 dollars, and allocated among phases by the distribution of the population supported by the Kuilima expansion. This estimate is based on the fact that the proposed expansion is about one-half of that assumed in 1978. Table 3; and City and County of Honolulu, "An Assessment of Potential Off-Waikiki Resorts on Oahu," August 1978.

[8]Based on 10%, 30-year bonds.

[9]$496/resident for general government, public safety, highways and streets, sanitation and waste removal, culture and recreation, utilities and other enterprises, debt service, retirement and pensions, cash captial improvements, and miscellaneous. $90/daily visitor for public safety, highways and streets, sanitation and waste removal, debt

service, retirement and pension, cash captial improvements, and miscellaneous; expenditures per visitor for these items are assumed to be about one-third that of residents. City and County of Honolulu, "A Guide to the Budget of the City and County of Honolulu," Fiscal Year 1984-85; and DPED, Data Book: 1984.

[10]$1,025/resident for general government, public safety, highways, natural resources, health and sanitation, hospitals and institutions, public schools, libraries and other, recreation, utilities and other enterprices, debt service, retirement and pension, employees' health and hospital insurance, grants-in-aid to counties, urban redevelopment and housing, cash capital improvements, and miscellaneous. $148/daily visitor for public safety, highways, natural resources, recreation, debt service, retirement and pension, employees' health and hospital insurance, cash capital improvements, and miscellaneous; expenditures per visitor for these items are assumed to be about one-third that of residents. DPED, Data Book: 1984.

Table 4.— IMPACT ON STATE AND COUNTY FINANCES OF EXPANDING THE KUILIMA RESORT: SUMMARY
[In millions of 1984 dollars.]

Item	Phase I	Phase II	Phase III	Project Completion
	AVERAGE ANNUAL REVENUES/EXPENDITURES			
COUNTY:				
Revenues[1,2]	$ 1.4	$ 6.2	$ 10.8	$ 12.1
Expenditures:				
Debt Service[3]	$ 0.7	$ 0.7	$ 0.7	$ 0.7
Operations and Maintenance[1,4]	1.0	4.2	7.1	7.8
Total County Expenditures	$ 1.7	$ 4.9	$ 7.8	$ 8.5
Net County Revenues	$ -0.3	$ 1.3	$ 3.0	$ 3.6
STATE:				
Revenues:				
Construction	$ 4.3	$ 9.5	$ 4.5	$ --
Operations[1,2]	3.0	12.7	21.7	24.1
Total State Revenues	$ 7.3	$ 22.2	$ 26.2	$ 24.1
Expenditures:				
Debt Service (high allocation)	$ 0.4	$ 0.9	$ 1.5	$ 2.6
Operations and Maintenance[1,4]	2.1	8.5	14.4	15.9
Total State Expenditures	$ 2.5	$ 9.4	$ 15.9	$ 18.5
Net State Revenues	$ 4.8	$ 12.8	$ 10.3	$ 5.6
STATE AND COUNTY:				
Revenues[2]	$ 8.7	$ 28.4	$ 37.0	$ 36.2
Expenditures[4]	4.2	14.3	23.7	27.0
Net State and County Revenues	$ 4.5	$ 14.1	$ 13.3	$ 9.2

[1] Average of the begining and end values for each phase.

[2] Excludes State and Federal transfers to the County, and Federal transfers to the State.

[3] Assumes complete sewering of the North Shore in the near future, and allocation of cost to Kuilima based on year 2000 population supported by the resort.

[4] Assumes the same level of per-capita government service as currently.

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APPENDIX L

TRAFFIC IMPACT ANALYSIS

TRAFFIC IMPACT REPORT

FOR THE PROPOSED TURTLE BAY RESORT

PREPARED FOR

KUILIMA DEVELOPMENT COMPANY

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ENGINEERS * SURVEYORS

HONOLULU, HAWAII

JUNE 1985

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.

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EXECUTIVE SUMMARY

The Turtle Bay Resort is envisioned to be a self-contained resort community providing for most of the needs of its guests. Trip surveys conducted at the existing Turtle Bay Hilton generally indicate a lower trip rate when compared to Waikiki resort hotels and standard trip generation rates for hotels. The expansion of the existing resort will reinforce the "resort community" concept by providing a larger visitor population base from which to support a wider range of services and activities within the resort complex. Therefore, it is anticipated that most of the guest activity would be confined to the resort complex and any external trips would consist of special trips to destinations on the North Shore rather than the daily sightseeing excursions taken by visitors from a typical Waikiki hotel.

Previous origin and destination trip surveys taken at the Turtle Bay Hilton indicate that most of the trip-making outside the resort occur within the Haleiwa to Laie area. Particular attractions include Haleiwa Town, Waimea Falls, and the Polynesian Cultural Center.

Another trip-making component includes the passer-by traffic composed of both visitors and residents bound for other North Shore destinations, or just driving around the island. The Turtle Bay Hilton is the only rest stop between Laie and Haleiwa; therefore it attracts motorists on long automobile trips. These trips are not "new" trips since the Resort attracts motorists already on the road.

By the Year 2000, the traffic from the proposed development, together with the projected growth in background traffic, i.e., future traffic without the proposed development, is not expected to exceed the carrying capacity of an

upgraded, two-lane Kamehameha Highway. Field investigations of traffic conditions on weekends and holidays show that traffic congestion occurs because of "bottleneck" locations rather than a breakdown of the overall highway facility. This indicates that the highway's capacity restraint is not the number of lanes on the roadway but rather the increased roadside activity, such as motorists turning off the highway to beach parks and commercial establishments fronting the highway, and physical restrictions such as narrow bridges and curvilinear alignment. The greatest impacts are expected to occur at Haleiwa and Waimea Bay. The State-proposed Haleiwa Bypass should relieve the problems at Haleiwa. Left turn lanes at Waimea Bay would alleviate much of the problems currently experienced there on weekends and holidays, as well as those conditions projected for the Year 2000. Other such spot improvements at key intersections should minimize the side street delays resulting from the increased traffic on Kamehameha Highway.

The site-specific roadway improvements for the proposed Turtle Bay Resort are:

1. Construct left-turn lane on Kamehameha Highway at the existing Kuilima Drive.
2. Construct fully channelized intersections on Kamehameha Highway, including left-turn lanes on the main highway and separate right- and left-turn lanes on the side road, at the proposed West Kuilima Drive and at the existing Marconi Road.
3. Signalize the Kamehameha Highway intersections at West Kuilima Drive, Kuilima Drive and Marconi Road.

This report and previous studies have identified problem areas along the North Shore and the need for highway improvements. While the Developer is committed to making site-specific roadway improvements on Kamehameha Highway, the regional needs are a governmental responsibility and not that of a single developer. The regional improvements recommended in this report are:

1. Construct the Haleiwa Bypass already proposed by the State of Hawaii.
2. Upgrade Kamehameha Highway and provide left turn lanes at Waimea Bay.
3. Improve the remaining segments of Kamehameha Highway between Haleiwa and Kaawa to provide left-turn lanes at key intersections, paved shoulders, and bus turnouts.

The Turtle Bay Resort Master Plan represents a commitment of resources by the private sector in a responsible and proactive manner. The Traffic Impact Report for the Turtle Bay Resort is presented within the context of that comprehensive master plan.

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TRAFFIC IMPACT REPORT
FOR THE PROPOSED TURTLE BAY RESORT

I. INTRODUCTION

A. Purpose and Scope

The purpose of this study is to identify and assess the impacts of traffic generated from the Turtle Bay Resort proposed by the Kuilima Development Company in the Kahuku area. Furthermore, this study incorporates the findings of previous studies in the area into the analysis for this study. Finally, based upon the findings of this and prior studies, recommendations are made to minimize any adverse traffic impacts resulting from the proposed development.

This report presents the findings and recommendations of this study including:

1. A brief description of the proposed development.
2. A summary of previous transportation studies relevant to proposed development.
3. An assessment of the existing conditions.
4. Derivation of the trip generation characteristics of the proposed development.

5. An evaluation of the traffic generated by the proposed development superimposed over the projected background traffic conditions and their impacts on the existing highway network.
6. Recommendations to minimize the impacts identified in this report.

B. Location

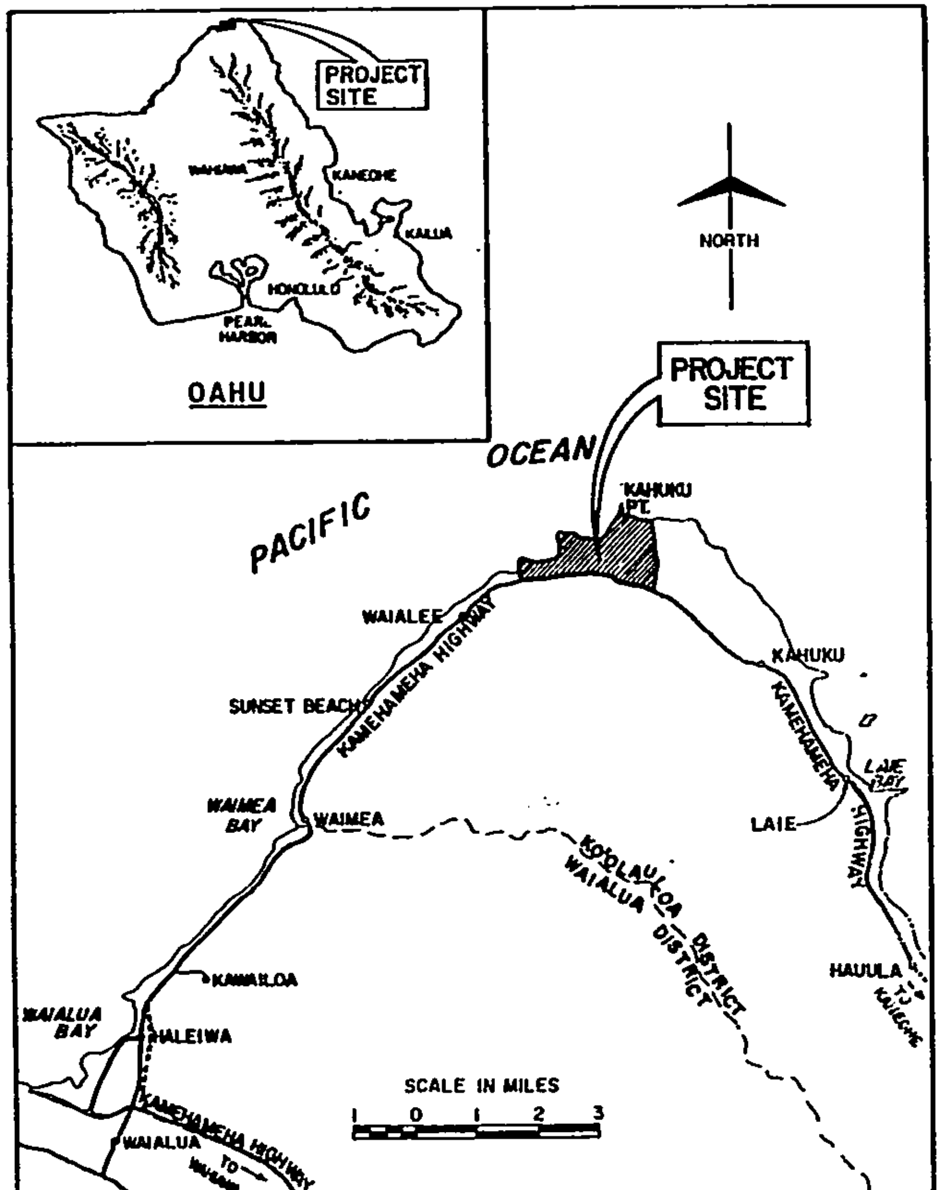
The proposed Turtle Bay Resort is located at the northernmost point of the island of Oahu in the vicinity of the existing Turtle Bay Hilton and the Kuilima Estates. The 808± acre site, identified as portions of Tax Map Keys: 5-6-03, 5-7-01, 03 and 06 (see Exhibit 1). The property is bounded on the south by Kamehameha Highway and on the north by the Pacific Ocean from Kawela Bay on the west end to the area just east of Kahuku Point.

II. PROJECT DESCRIPTION

A. General

The existing Turtle Bay Hilton and Country Club consists of 487 rooms and a soon-to-be completed, renovated 157-acre golf course identified as G-1. The Kuilima Estates consists of a total of 368 dwelling units.

The master plan for the Turtle Bay Resort will integrate resort hotels, low density resort-condominium developments, a resort-related commercial development, recreational amenities, and necessary support facilities, while maintaining the character



KUILIMA DEVELOPMENT COMPANY
TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT

ATA AUSTIN, TSUTSUMI, & ASSOC., INC

LOCATION AND VICINITY MAP

EXHIBIT 1

of the North Shore community. Exhibit 2 shows the proposed master plan.

B. Development Master Plan

The proposed Turtle Bay Resort is comprised of four hotel developments, totaling 1,450 rooms; seven resort-condominium developments, totaling 2,063 dwelling units; commercial development consisting of 40,000 square feet gross floor area; four park areas totaling 49.8 acres; and a 194-acre golf course. The total development is expected to span about 15 years to the Year 2000.

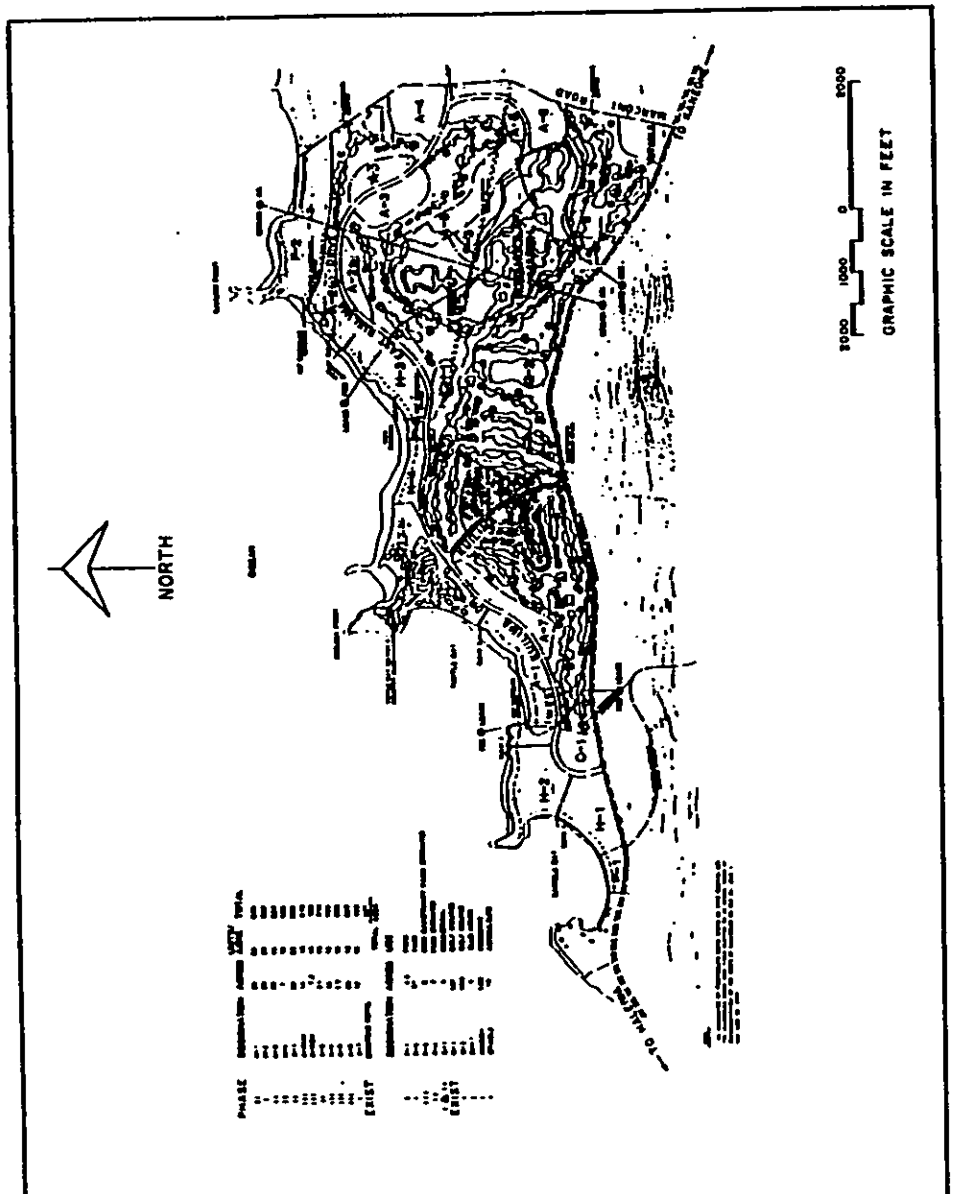
The development will begin generally from west to east, starting with hotel developments in the Kawela Bay area to resort-condominium developments along Marconi Road near the Punahoolapa Marsh area. The proposed improvements to the existing infrastructure, including those recommended in this report, will occur as necessary to support the activities proposed in the development master plan.

III. BACKGROUND

A. General

Since 1979 several studies related to the Turtle Bay Resort, formerly known as the Kuilima Resort Expansion, have been conducted, both from the perspective of the Resort and within the context of a regional transportation plan. These include:

1. Haleiwa Bypass, Final Environmental Impact Statement, Report Number: FHWA-HI-EIS-80-01-F, U.S. Department of Transportation, Federal Highway Administration and State of Hawaii



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TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT
KIHI AULOA, OAHU, HAWAII

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DEVELOPMENT MASTER PLAN

EXHIBIT 2

Department of Transportation, Highways Division, August 18, 1981.

2. An Assessment of Potential Off-Waikiki Resorts on Oahu, August 1978. Technical Report #4 "Evaluation of Off-Waikiki Resort Sites - Fiscal Impacts, Transportation System, and Beach Use Analysis" by Department of General Planning, City and County of Honolulu (DGP), June 1978.

3. "Appendix C, Traffic Impact Analysis" of the Proposed Expansion of the Kuilima Resort Community Environmental Impact Statement by Belt, Collins and Associates (BCA), June 1979.

4. Report on the Kamehameha Highway Traffic Improvement Study for the Kuilima Resort Community by Parsons, Brinkerhoff Quade and Douglas (PBQD), October 1979.

5. Tourist Travel Study in Honolulu - Final Report by PRC VOORHEES (PRC), June 1984.

B. Haleiwa Bypass, Final EIS

The proposed Kamehameha Highway Realignment from Weed Junction to Haleiwa Beach Park, better known as the Haleiwa Bypass, is a 2.34 mile long, two-lane, with possible upgrade to four-lane divided, high quality, rural arterial highway with limited access. When completed, it will connect to the existing Kamehameha Highway facility just east of Weed Junction, run roughly parallel to the existing highway, and connect back to the existing alignment just north of Haleiwa Beach Park. Some of the deficiencies along the existing length of Kamehameha Highway, identified in the EIS, are:

1. Substandard lane widths varying between 10 and 11 feet.
2. Capacity

   1265 vehicles per hour (vph), total for both directions (uninterrupted flow)

   1440 vehicles per hour, total for both directions (stop-and-go conditions)

   Traffic Demand (total for both directions)

Year	AM Peak Hour	PM Peak Hour	Average Daily Traffic
1978	1310 vph	1580 vph	14,500 vpd*
1985	1535 vph	1870 vph	17,000 vpd
2000	2080 vph	2535 vph	23,000 vpd

*vehicles per day

The EIS indicates that the 1978 traffic counts already exceeded the estimated highway capacity. The 1985 and 2000 traffic projections only further increase the need for the Bypass.

3. Substandard bridge width (17 feet) at Anahulu River Bridge near Haleiwa Beach Park.
4. Accident rate (1973 to 1977) of 6.36 accidents per million vehicle miles (mvm) as compared to the Oahu rate (1977) of 2.72 accidents/mvm for primary highways.

One alternative to the bypass presented in the EIS was the widening of Kamehameha Highway to four lanes, requiring an 84-foot right-of-way. The existing right-of-way varies from 50

to 60 feet in width. The study points out that this would eliminate about 30 existing structures and destroy the historic character of Haleiwa.

Alternative modes of transportation were also discussed, however, they were discounted as ineffective or unfeasible. Generally, bus, van pool and car pool alternatives are effective only for work trips. Since travel on the North Shore includes recreational and tourist trips which are usually associated with private vehicles, an alternative mode would not attract enough motorists to significantly reduce the overall traffic demands and eliminate the need for the Haleiwa Bypass.

C. Resort Impact Study

An Assessment of Potential Off-Waikiki Resorts on Oahu, 1978 was prepared by the Department of General Planning (DGP), City and County of Honolulu to evaluate the relative merits of alternative resort sites on Oahu. Technical Report No. 4, "Evaluation of Off-Waikiki Resort Sites: Fiscal Impacts, Transportation System and Beach Use Analysis", presented the traffic impact analysis for the proposed Kuilima Resort Expansion. The fundamental premise of this report that should be noted is that the impact analysis was based upon a master plan development calling for 4,700 hotel rooms, in addition to the 500 rooms existing at that time; 1,500 condominium units in addition to the 370 units also existing at that time; 500 single family residences; and 100,000 square feet of commercial space. The study also developed an estimated trip generation rate of 5.2 trips/occupied unit for the Resort. This figure was derived from the correlation between traffic counts taken at the hotel driveway and the hotel occupancy figures.

The findings of this study were as follows:

1. By the Year 2000, with the completion of the Kuilima Resort Expansion, Kamehameha Highway would exceed the capacity of a two-lane highway between Kahuku and Wahiawa.
2. Kamehameha Highway, between Wahiawa and Kahuku, should be widened to four lanes beginning in 1983 and reach completion by 1990.
3. Total cost of the Kamehameha Highway improvements between Wahiawa and Laie, excluding the Haleiwa Bypass, was estimated at $51 million (1978 dollars).

D. 1979 Kuilima Resort EIS

The Proposed Expansion of the Kuilima Resort Community Environmental Impact Statement, by Belt Collins and Associates (BCA) June 1979, presented a comprehensive traffic impact analysis also based upon a higher density development master plan. Its study area extended from Haleiwa to Kahaluu. It included a travel demand forecast based upon a BCA regression analysis and a trip generation projection based upon a questionnaire survey conducted by BCA. The BCA study also attempted to quantify the number of non-hotel-related trips stopping at Kuilima Resort. These may be round-the-island motorists making a rest stop or just driving through the grounds. A license plate survey

observed over 60% of the vehicles entering the Kuilima Resort and leaving within a short period of time. It was concluded that this percentage could be used to estimate the number of non-hotel-related trips stopping at the Kuilima Resort.

The aggregate trip generation characteristics developed by BCA are as follows:

Type of Generator	Independent Variables (I.V.)	No. of Units	Trips/ Day/ I.V.	Average Daily Trips
Hotel	Room	4700	2.68	12,596
Resort Condominium	Dwelling Unit	1700	2.0	3,400
Residential	Dwelling Unit	475	5.9	2,803
Commercial	1,000 SF	100	7.0	700
			Total	19,499

The resulting BCA-developed travel forecast model for the region, assuming no further resort development in the Year 2000, is as follows:

Location	Capacity (vph)	Avg. Daily Traffic (vpd)	Avg. Weekday Peak Hour (vph)	Summer Weekend Peak Hour (vph)
Waimea Bay	1200	11,200	1010	1610
Kii Bridge	1425	7,300	720	1140
Kaaawa	1350	12,000	1020	1620

Superimposing the BCA projections based upon the 1979 Resort Master Plan, the peak period traffic volumes for the Year 2000 are as follows:

Location	Capacity (vph)	Avg. Daily Traffic (vpd)	Weekday Peak Hour (vph)	Weekend Peak Hour (vph)
Waimea Bay	1200	19,180	1760	2450
Kii Bridge	1425	17,070	1690	2180
Kaaawa	1350	17,170	1460	2190

The conclusions of the EIS indicated that under existing highway conditions, the proposed resort expansion would increase a traffic demand beyond the current capacity in the Year 2000 at Waimea Bay, Kii Bridge and in Kaaawa.

Some of the improvements suggested by the study are as follows:

1. Acceleration/deceleration and left turn lanes be constructed at the Kuilima Resort entrances.
2. Additional 2-lane widening of the existing Kamehameha Highway alignment between the proposed Haleiwa Bypass and Waimea Bay.
3. Continue widening through Waimea Bay. This study concluded that a mauka bypass was not possible.
4. Widening the existing highway to four lanes or constructing a new 2-lane mauka bypass through Pupukea, Sunset Beach, Waialee, Kawela Bay and Kahuku Town.
5. Construct a mauka bypass between Kahuku and Laie.
6. No further improvements from Hauula to Kahaluu.

E. Kamehameha Highway Improvement Study

The Report on the Kamehameha Highway Traffic Improvement Study for the Kuilima Resort Community, by Parsons, Brinkerhoff, Quade and Douglas (PBQD) October 1979, was undertaken to evaluate a widening of the existing highway to four lanes or a new bypass, or a combination of the two between Wahiawa and Laie. The PBQD study basically addressed the physical constraints associated with any improvements. Social and environmental impacts were not discussed in detail.

One alternative route, presented by PBQD, is as follows:

1. Wahiawa to Haleiwa - continue the four-lane, divided configuration of Wilikina Drive at the end of Interstate Route H-2 to Kamananui Road, improving this connection, making the south leg of Wilikina Drive and Kamananui Road the thoroughfare and the north leg of Wilikina Drive a side street connection; continue the four-lane, divided road section to Kamehameha Highway; abandon the portion of Kamehameha Highway between Kaukonahua Road and Kamananui Road and improving the Kaukonahua Road/Kamananui Road intersection for access to Wahiawa; continue the four-lane, divided highway to the Haleiwa Bypass. This alignment emphasizes the Interstate Route H-2 - to Wilikina Drive - to Kamananui Road - to Kamehameha Highway - to the proposed Haleiwa Bypass route as the thoroughfare from Central Honolulu to the North Shore.

2. Haleiwa to Waimea Bay - Implement the proposed Haleiwa Bypass, continuing the four-lane configuration to Waimea Bay along the existing alignment.
3. Waimea Bay to Waialee - Realign Kamehameha Highway through Waimea Bay makai of the existing bridge, crossing the park entrance with an overpass; tunneling through the north ridge of Waimea Bay; and continuing the highway along the base of the Pupukea-Sunset Beach bluff, bypassing the beach parks along the existing Kamehameha Highway; and finally connecting back to the existing alignment at Waialee.
4. Waialee to Laie - Widening along the existing alignment can be accomplished within existing right-of-way or additional right-of-way can be obtained without any major adverse impacts.

F. Tourist Travel Study

The Tourist Travel Study in Honolulu - Final Report, by PRC Voorhees (PRC) June 1984, was undertaken to address the tourist travel on the island of Oahu. The objective of this study was to develop a model to forecast future tourist travel on Oahu. In the data collection phase of the study, an "off- Waikiki" site was necessary to evaluate the impact of any new resort area outside of Waikiki. The only readily available site was what formerly was known as the Hyatt Kuilima and is now known as the Turtle Bay Hilton. Personal travel behavior interviews and vehicle classification counts were the primary data collection techniques employed along with supporting data from the Hawaii

Visitors Bureau. The relevant information presented by this study pertaining to the Kuilima Resort is as follows:

1. On the Windward and North Shore of Oahu, tourist-related traffic accounted for about 25% of the total vehicular traffic, about 2100 vehicles/day.
2. Tourist-related vehicles were primarily rental cars, with tour vans and buses comprising a very small and often negligible portion of total vehicular traffic, 1.7% on the North Shore and 3-4% on Windward Oahu.
3. There was no apparent difference in vehicular trip making activity on the weekday as opposed to the weekend.
4. Visitor trip generation rate developed by PRC for the Turtle Bay Hilton (Hyatt Kuilima) was 1.5 vehicle trips per day per person.
5. The breakdown by mode of transportation was as follows: 3790 person-trips by rental car, 135 person-trips by private car, 980 person-trips by tour vans, 170 person-trips by public transit and none by taxi/limousine and tour bus.
6. There was a low tendency for tourists staying at the Kuilima Resort to visit Waikiki (8%) or Urban Honolulu (13%) and a high tendency to make local trips (70%). Only 9% traveled beyond the Polynesian Cultural Center to Kaneohe/Kailua and Makapuu areas.
7. Round-the-island travel is not a predominant part of tourist travel on Oahu.

8. Tourists traveling to and from the Kuilima Resort/Kahuku area invariably utilize the Central Oahu-North Shore route instead of the longer Windward coast route.

G. Discussion

The previous studies agree that most of Kamehameha Highway is substandard and requires upgrading even without the proposed Kuilima Resort Expansion. Furthermore, based upon the 1978 Kuilima Resort Master Plan, all the Kuilima-related studies recommended widening Kamehameha Highway to four lanes, two in each direction. Where widening along the existing alignment was not possible, a bypass route was recommended. However, it should be pointed out that these prior studies were based upon master plans calling for 6700 - 6900 additional resort/residential units. This figure is almost twice the number of units being proposed in the present Turtle Bay Resort Master Plan, upon which this study is based.

IV. EXISTING CONDITIONS

A. General

The North Shore and Windward Oahu, north of Kahaluu, has maintained much of its rural character in spite of the growth experienced on other parts of Oahu. However, evidence of this growth can be seen at the beach parks that line the North Shore and Windward Oahu on weekends and holidays, where the resident and tourist populations alike seek to escape the crowded beaches on the southern coast of Oahu. The value of the recreational resources on the North Shore is most apparent during the winter

months when heavy surf attracts both spectator and sportsman to the world famous surfing locations such as Waimea Bay and Sunset Beach. Except for community shopping centers in Laie and Hauula, Haleiwa is the only concentration of commercial activity in the area. Roadside developments, such as convenience stores, souvenir stands, service stations, and local fast food restaurants, are scattered along Kamehameha Highway.

B. Roadways

Kamehameha Highway is the only arterial highway serving the North Shore and Windward Oahu. It is a two-lane, two-way, undivided State highway generally following the coastline, except for the Kahuku area where it turns inland. Past Haleiwa, Kamehameha Highway turns southward toward Wahiawa and connects to Interstate Route H-2 and continues on to urban Honolulu. On the Windward side of Oahu, Kamehameha Highway connects to the Pali Highway/Likelike Highway Trans-Koolau corridors leading to the heart of Central Honolulu.

The roadway width varies between 20 and 24 feet with unpaved shoulders. The highway varies from flat straightaways with few driveway connections to a curvilinear alignment with many driveway connections. Between the Polynesian Cultural Center and Haleiwa Town, there are no provisions for left-turn lanes except in Kahuku Town.

C. Traffic

1. General

In order to establish the baseline traffic conditions on the North Shore and Windward Oahu, traffic surveys were conducted in the form of traffic counts, both peak period manual counts and 24-hour mechanical counts; travel time runs; "floating car" observations; and a compilation of all available traffic count data from the State Department of Transportation (DOT) and City and County Department of Transportation Services (DTS). The study area included the entire length of Kamehameha Highway between Haleiwa and Kaaawa. The traffic study was conducted during the peak summer season for three conditions: weekday, weekend (Saturday) and holiday (July 4). Although holiday traffic is considered an atypical condition, it provided an opportunity to observe the effects of heavy traffic, 57% higher than the normal weekday traffic, on Kamehameha Highway.

As indicated by previous studies, Haleiwa Town and Waimea Bay are the primary capacity restraints on Kamehameha Highway along the North Shore. The narrow Anahulu Bridge located near Haleiwa Beach Park requires opposing stream of vehicles to slow down. In the case of westbound (Waialua bound) buses and trucks, the opposing traffic must yield right-of-way. Eastbound (Kahuku bound) buses and trucks must wait until the bridge is clear. Through Haleiwa Town,

left-turn traffic and motorists pulling off to park on the roadside queue traffic in both directions.

At Waimea Bay, motorists turning left into Waimea Beach Park and into Waimea Valley Road also queue traffic in both directions. The curvilinear alignment of Kamehameha Highway along Waimea Bay causes a further slowdown. Furthermore, vehicles parking on the roadside impose additional restraints on capacity and operating speeds.

Similiar frictional effects occur at other beach parks such as Pupukea Beach Park, Sunset Beach, Hauula Beach Park and Swanzy Beach park when large gatherings occur, such as a a surf meet or a community picnic. Moreover, periodic slow-downs occur behind MTL buses stopping in the traveled way to pick up or drop off passengers. Finally, narrow bridges along the entire stretch of Kamehameha Highway do not affect operating capacity as much as they impose a potential traffic hazard to errant vehicles.

2. Traffic Counts

Manual and machine traffic count surveys were conducted during the month of July. According to historical traffic count data taken at the State Department of Transportation continuous count station on Kamehameha Highway at the Old Sugar Mill Ruins at Kualoa, the heaviest daily traffic for both the weekday and the weekend occurs during the summer months of June, July and August.

Manual counts were taken between 9:00 AM and 5:00 PM on Tuesday, July 10 and Saturday, July 14, 1984 at Kuilima Drive. The count data show that peak periods occur between 1:15 PM and 2:15 PM, on the weekday and 2:00 PM and 3:00 PM on the weekend. The traditional morning peak period was not measurable. Recreation trips, tourist trips and Turtle Bay Hilton employee trips appeared to be the primary components of the afternoon peak period traffic. Exhibit 3 shows the weekday and weekend peak periods of traffic.

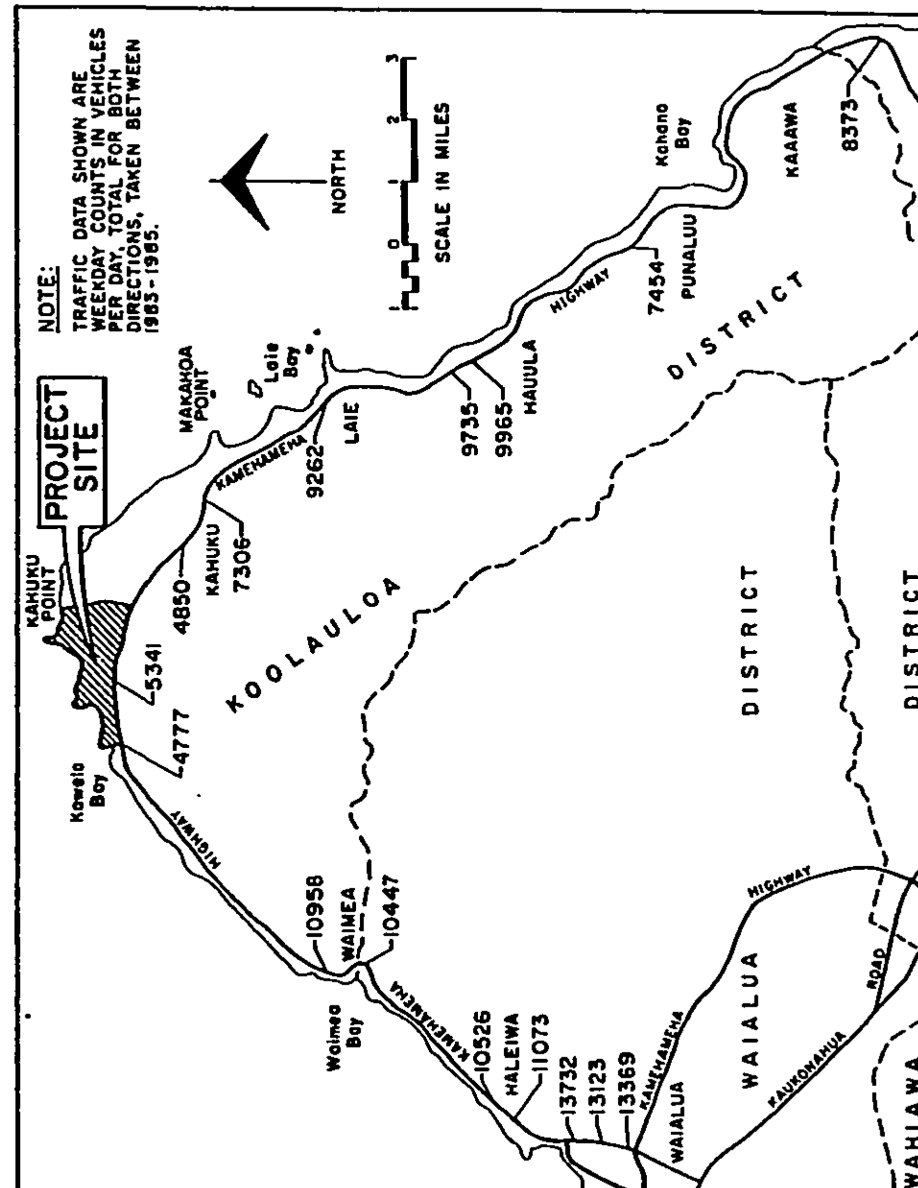
Machine counts were taken for 24-hour periods on Kamehameha Highway, north of Kawailoa Road, west of Kuilima Drive, and at Hauula Kai Shopping Center and on Kuilima Drive. Additional counts were obtained from the City and County of Honolulu Department of Transportation Services (DTS), and from the State of Hawaii Department of Transportation (DOT) on Kamehameha highway at various locations between Kualoa and Haleiwa (see Exhibit 4).

3. Level of Service Calculations

Level of Service for the existing conditions are shown in Exhibit 3 and are based upon the Highway Capacity Manual methods discussed in Chapter VII.

4. Travel Time Survey

Travel time runs were conducted during the traffic count periods to measure the quality of flow using travel time/average speed under free flow conditions and during periods of congestion. Under free flow conditions, the



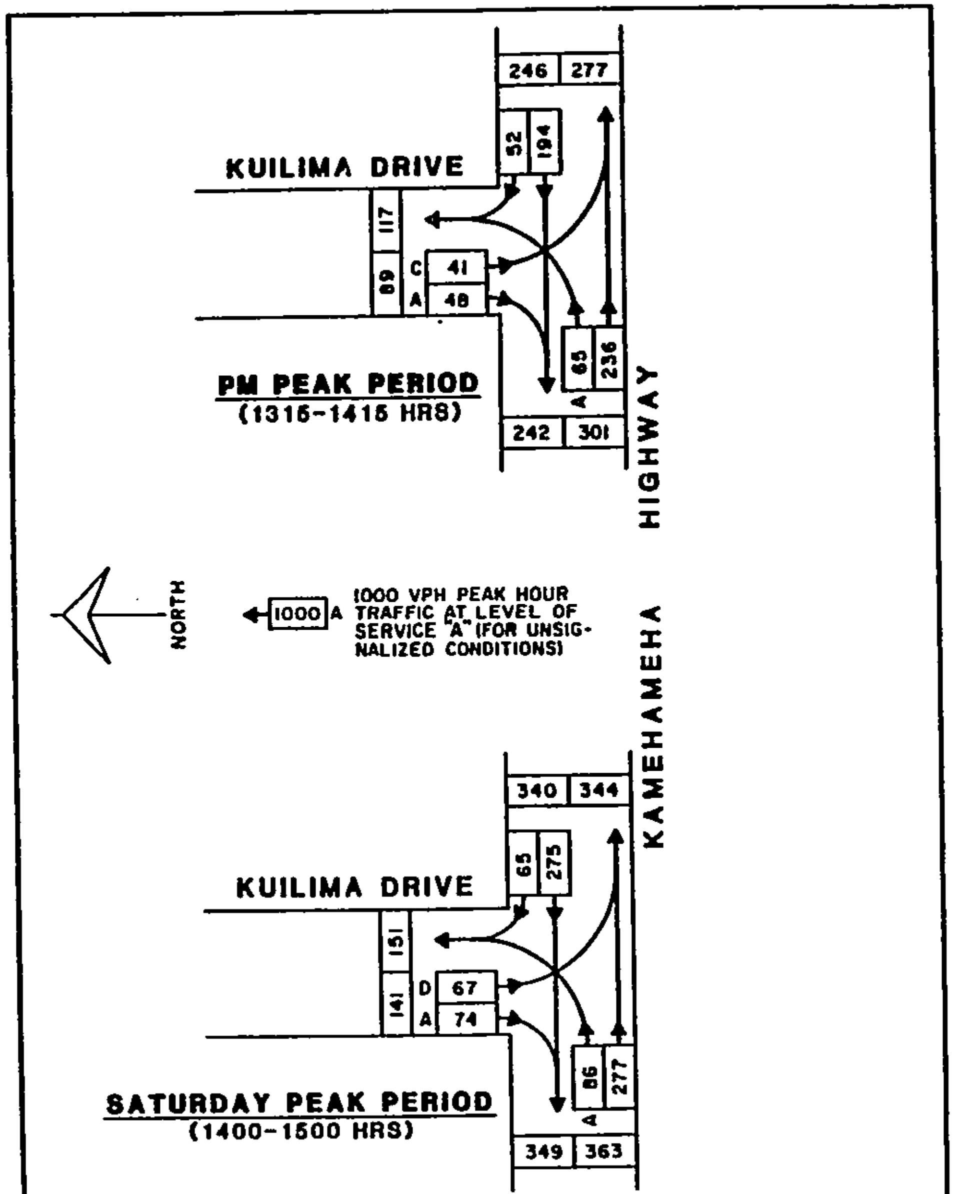
KUILIMA DEVELOPMENT COMPANY

TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT

ATA AUSTIN, TSUTSUMI, & ASSOC., INC

EXISTING TRAFFIC COUNT DATA

EXHIBIT 3

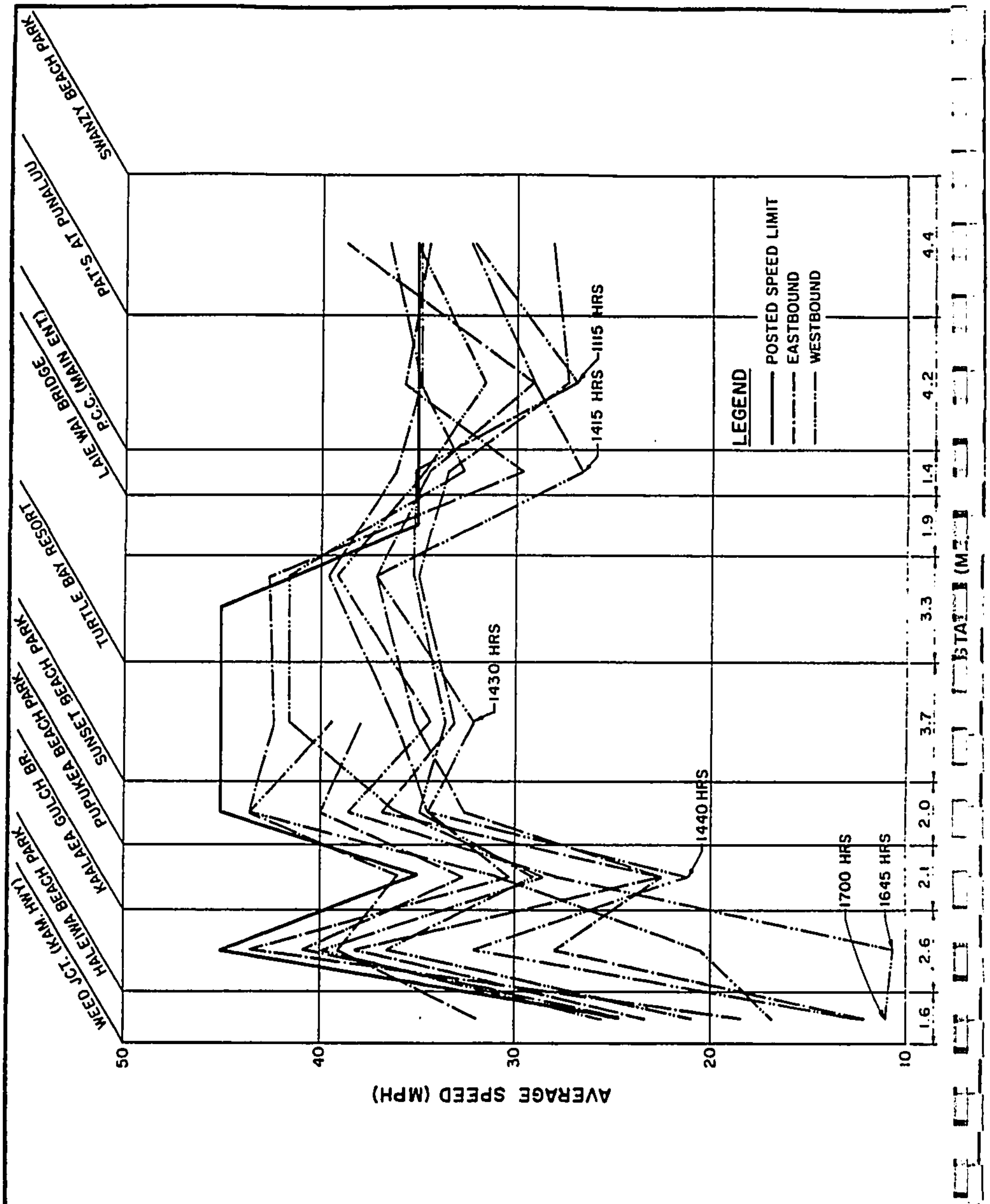


KUILIMA DEVELOPMENT COMPANY TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT KAHUKU, OAHU, HAWAII	ATA AUSTIN, TSUTSUMI, & ASSOC., INC EXISTING CONDITION	EXHIBIT 4

"comfortable" operating speed can be compared to the posted speed limit to assess the adequacy of the highway design. Under congested conditions, the average running speed does not differentiate between stop-and-go conditions and a "slow crawl" speed. However, in terms of overall travel time, this distinction is not significant.

Travel time runs were taken on July 4, 1984 (Holiday), July 10-11, 1984 (Tuesday-Wednesday) and July 14, 1984 (Saturday) between Weed Junction in Haleiwa and Swanzy Beach Park in Kaaawa. Exhibit 5 illustrates the July 4 data, indicating a wide variation in average operating speeds between Haleiwa Town and Waimea Bay. The July 10, 11 and 14 data, shown on Exhibit 6, displays a more normalized speed distribution. The approximate time of day for the major slowdowns are indicated.

The travel time survey indicates that temporary slowdowns and stoppages experienced during the average weekday and weekend do not significantly affect overall travel time. However, the July 4 survey shows a significant impact, resulting from the increased traffic, on the quality of flow, especially in the Haleiwa to Waimea Bay area. Finally, the free flow travel time runs indicate that the posted speed limits adequately reflect the highway design speeds.



KUILIMA DEVELOPMENT COMPANY

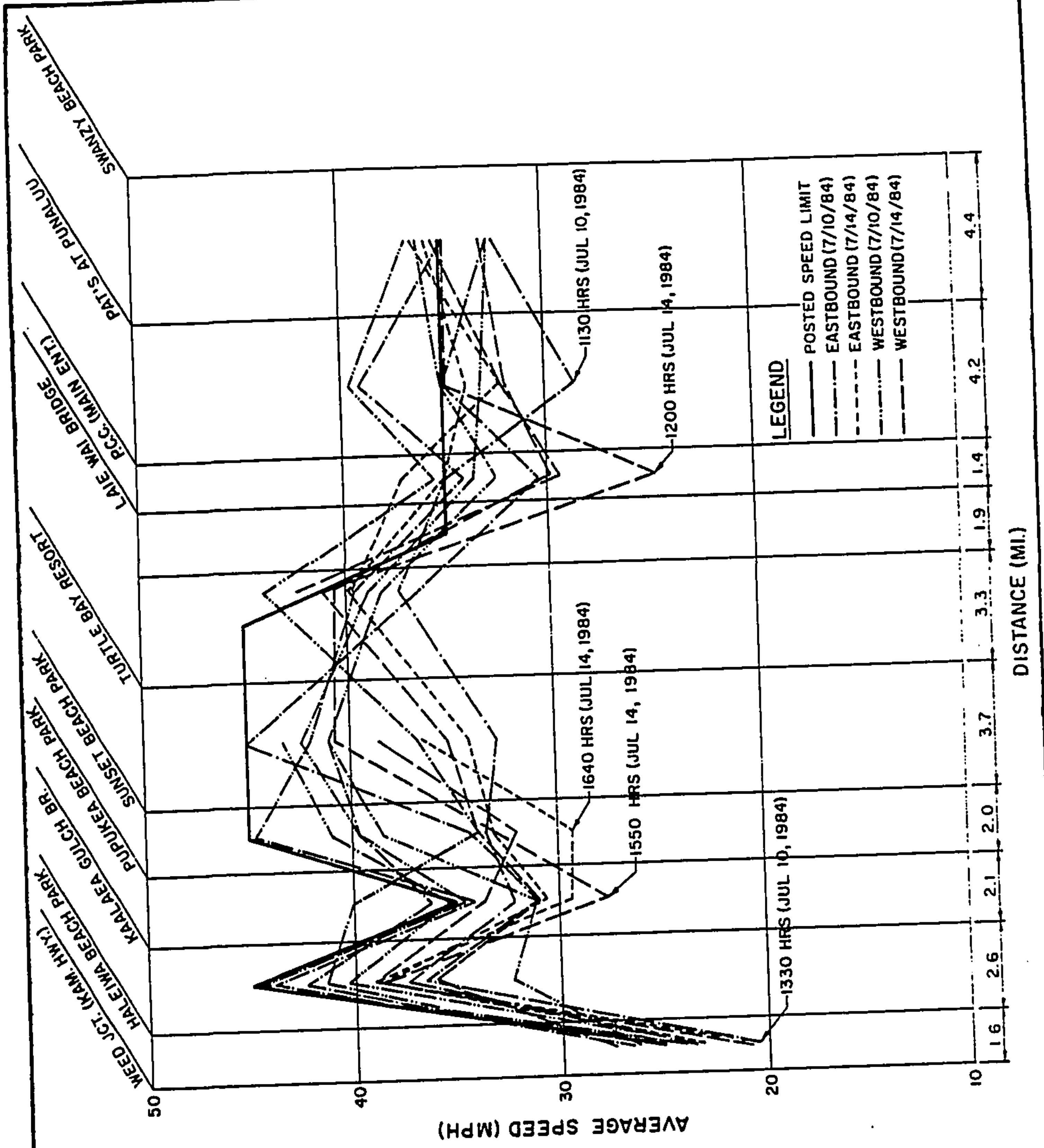
TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT

KOOLAULOA, OAHU, HAWAII

AUSTIN, TSUTSUMI, & ASSOC., INC.
ENGINEERS SURVEYORS • HAWAII GUAM

OPERATING SPEED DISTRIBUTION
JULY 4, 1984

EXHIBIT
5



KUILIMA DEVELOPMENT COMPANY **TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT** KOOLAULOA, OAHU, HAWAII	ATA AUSTIN, TSUTSUMI, & ASSOC., INC. ENGINEERS SURVEYORS • HAWAII GUAM OPERATING SPEED DISTRIBUTION JULY 10, 1984 AND JULY 14, 1984	EXHIBIT **6**

V. TRIP GENERATION

A. General

Trip generation resulting from the proposed Turtle Bay Resort is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in the "Informational Report on Trip Generation, Third Edition - 1982". These empirically-derived rates are based upon commonly used independent variables which define land use intensity relative to trip generation potential. These rates were modified using a baseline study which correlated the 24-hour counts taken on Kuilima Drive to occupancy of the Turtle Bay Hilton and the number of dwelling units in the Kuilima Estates. The modified ITE rates are in aggregate form which includes guest trips, employee trips, delivery/service trips, non-guest patrons of the resort facilities and incidental trips made by round-the-island motorists. Aggregate trips are simpler to work with and more easily verifiable than disaggregate rates involving a number of independent assumptions.

Except for the existing Kuilima Estates, which is assumed to be recreational homes in the baseline study, all the hotel developments and resort condominiums are assumed to be hotel-like trip generators. An 80% occupancy rate is assumed for the hotel developments and a 70% occupancy rate is assumed for the resort-condominium developments.

The proposed master plan is divided into three phases, generally in chronological order and based upon their spatial

relationship. Because the traditional morning peak period is virtually non-existent, it is anticipated that the greatest impact on traffic will occur during the afternoon peak period. therefore, only afternoon peak period for the average weekday and Saturday will be discussed, along with their total daily traffic.

B. Development of Trip Generation Characteristics

Trip-making activity is generally lower for a remote resort such as the Turtle Bay Hilton than a Waikiki hotel. This was verified in the earlier PRC report; however, the report goes on to point out that although person-trip generation is lower for an "off-Waikiki" hotel, the vehicle trip generation is essentially the same as the Waikiki Hotel. Except for local trips to the Polynesian Cultural Center, Waimea Falls, Haleiwa Town or any of the numerous beach parks along the North Shore, most of the visitor activity is contained in the Resort itself, whereas visitors staying in Waikiki make numerous walking trips. Another characteristic unique to the Turtle Bay Hilton is its attraction of non-guest trip-makers. Tourists and residents alike may stop off on the way to or from North Shore destinations for lunch or refreshment. The Resort is the only rest stop for several miles in either direction.

In the BCA study, a license plate survey at the entrance to Turtle Bay Hilton (Kuilima Resort) found that over 60% of the traffic entering the Resort departed within a short period of time. It concluded that these were non-hotel-related trips; that is, although the hotel attracted these motorists off Kamehameha

Highway, it did not generate new trips. Such non-hotel-related trips or "stop-over" trips might include tourists or residents headed for one of the visitor attractions or beaches in the area or tourists traveling around the island. This could account for the difference between the low visitor trip-rates developed by both the BCA study and the PRC study and the observed traffic volumes at Kuilima Drive. It is, therefore, assumed that only 40% of the modified ITE trip generation rates be considered resort-generated trips.

These trip rates are used to estimate the resort-generated trips in order to project future traffic generated by the proposed project. However, the remaining 60% component of the existing traffic attracted to the Turtle Bay Resort is assumed to be a function of the passing traffic on Kamehameha Highway, rather than the size of the Resort. It is more logical to assume that as Kamehameha Highway traffic increases, more motorists will stop off, rather than assume that an expanded resort will attract more "stop-over" trips. Based upon existing traffic counts, the non-resort-generated trips estimated by BCA translates to about 15% of the traffic passing the Turtle Bay Resort. Therefore, it is further assumed that the "stop-over" trips amount to 15% of the passing traffic.

C. Development Phasing

The Turtle Bay Resort is an ongoing process; however, for the purpose of this study, the development will be divided into

three phases. Phase I will consist of a 500-unit hotel, identified as H-2 development; a 180-unit resort-condominium development, identified as A-7 development; a 194-acre golf course, identified as G-2 development; a 20,000 square foot commercial development, identified as part of the C-1 development; and parks identified as P-1 and P-2 covering 4.8 and 37 acres, respectively.

Phase II consists of hotel developments identified as H-1, H-3 and H-4, totaling 950 rooms; resort-condominium developments identified as A-1 and A-3, totaling 880 dwelling units; an additional 20,000 square feet of commercial development on C-1; and a park shown as P-4 covering 2 acres.

The final phase, Phase III, covers the east end of the Resort including resort-condominium developments A-2a, A-2b, A-4, A-5 and A-6, totaling 1,003 dwelling units; and a park identified as P-3 covering 6 acres.

Table 1 shows the development phases and the resulting trip generation volumes for the afternoon peak period traffic, the Saturday peak period traffic, total weekday traffic and total Saturday traffic.

VI. TRAVEL FORECAST

The Oahu Metropolitan Planning Organization, (OMPO) recently completed the HALI 2000 Study which is intended to update Oahu's Long Range Transportation Plan originally developed in 1967.

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TABLE 1. TRIP GENERATION TABLE

PHASE	PARCEL	IND. VAR.	OCCUP. UNITS	AVG. TRIP RATE	AVG. DAILY TRIPS	PM PEAK HOUR RATE IN	PM PEAK HOUR RATE OUT	PM PEAK HOUR TRIPS IN	PM PEAK HOUR TRIPS OUT	SAT. TRIP RATE	SAT. VEH. TRIPS	SAT. PEAK HOUR RATE IN	SAT. PEAK HOUR RATE OUT	SAT. PEAK HOUR TRIPS IN	SAT. PEAK HOUR TRIPS OUT
I	H-2	ROOM	400	3.33	1332	0.14	0.15	56	60	2.57	1028	0.14	0.13	56	52
	A-7	ROOM	126	3.33	420	0.14	0.15	18	19	2.57	324	0.14	0.13	18	16
	C-1	1000 SF	20	47.16	943	2.74	2.81	55	56	61.94	1239	1.28	3.90	26	78
	SUBTOTAL				2695			129	135		2591			100	146
II	H-1	ROOM	400	3.33	1332	0.14	0.15	56	60	2.57	1028	0.14	0.13	56	52
	H-3	ROOM	280	3.33	932	0.14	0.15	39	42	2.57	720	0.14	0.13	39	36
	H-4	ROOM	80	3.33	266	0.14	0.15	11	12	2.57	206	0.14	0.13	11	10
	C-1	1000 SF	20	47.16	943	2.74	2.81	55	56	61.94	1239	1.28	3.90	26	78
	A-1	ROOM	395	3.33	1317	0.14	0.15	55	59	2.57	1016	0.14	0.13	55	51
	A-3	ROOM	220	3.33	734	0.14	0.15	31	33	2.57	567	0.14	0.13	31	29
	SUBTOTAL				5525			247	262		4776			218	256
III	A-2a	ROOM	147	3.33	490	0.14	0.15	21	22	2.57	378	0.14	0.13	21	19
	A-2b	ROOM	76	3.33	252	0.14	0.15	11	11	2.57	194	0.14	0.13	11	10
	A-4	ROOM	126	3.33	420	0.14	0.15	18	19	2.57	324	0.14	0.13	18	16
	A-5	ROOM	143	3.33	478	0.14	0.15	20	22	2.57	369	0.14	0.13	20	19
	A-6	ROOM	210	3.33	699	0.14	0.15	29	31	2.57	540	0.14	0.13	29	27
	SUBTOTAL				2338			99	105		1805			99	91
	TOTAL				10558			475	502		9172			417	493

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Based upon the transportation forecasts made by the OMPO Study, the following traffic projections are presented in Table 2.

TABLE 2. TRAFFIC SUMMARY

LOCATION	EXISTING W/O PROJ	EXISTING W/ PROJ	EXISTING % INCR	1990 W/O PROJ	1990 W/ PROJ	1990 % INCR	2000 W/O PROJ	2000 W/ PROJ	2000 % INCR
KAHUKU									
24 HOUR-WKDY	4850	5637	16.2	5824	8672	48.9	7900	11800	49.4
24 HOUR-SAT	6330	6938	9.6	7600	9800	28.9	10311	13322	29.2
PEAK HR-WKDY	440	508	15.5	528	766	45.1	717	1043	45.5
PEAK HR-SAT	607	658	8.4	729	913	25.2	989	1241	25.5
KAWAILOA									
24 HOUR-WKDY	10526	11051	5.0	11523	13422	16.5	13400	16000	19.4
24 HOUR-SAt	14136	14542	2.9	15475	16941	9.5	17996	20003	11.2
PEAK HR-WKDY	848	885	4.4	928	1063	14.5	1080	1265	17.1
PEAK HR-SAT	1187	1216	2.4	1299	1404	8.1	1511	1654	9.5
HAUULA									
24 HOUR-WKDY	9735	9892	1.6	9870	10440	5.8	10100	10880	7.7
24 HOUR-SAT	12115	12237	1.0	12283	12723	3.6	12569	13172	4.8
PEAK HR-WKDY	765	778	1.7	776	823	6.1	794	859	8.2
PEAK HR-SAT	962	972	1.0	975	1012	3.8	998	1048	5.0

VII. TRAFFIC IMPACTS

A. General

In order to superimpose the trip generation figures onto the travel forecasts, several assumptions need to be made which were documented by previous reports or verified in the course of this study. Furthermore, these assumptions should "make sense" so that the "cause" can be rationalized from the observed "effect". Finally, this study has attempted to build upon the foregoing body of knowledge that has been developed for the Turtle Bay Resort (Kuilima Resort Expansion) and the region as a whole.

Obviously, the Turtle Bay Resort will not occur in a vacuum. Regional growth can be expected due to a "multiplier" effect. This includes population growth and commercial development. The proposed Resort is expected to generate new jobs on site as well as off site, i.e., jobs generated from non-resort commercial development resulting from spinoff opportunities created by the presence of the Turtle Bay Resort. When the region's unemployment is absorbed, new residents will be attracted by the employment opportunities. Furthermore, since the primary residential trip is the work trip, the Resort trip generation figures already account for these trips.

The commercial development in the proposed Turtle Bay Resort is expected to be tourist-oriented. However, because of its small size, it is not expected to attract visitors from Waikiki. It is assumed that the trips generated by the commerical development are composed of Turtle Bay Resort guests and "stop-over" motorists.

The PRC survey indicated that 70% of the trips were local; that is, between the Polynesian Cultural Center (PCC) and Wahiawa. Only 9% went beyond PCC and the remaining 21% journeyed to Honolulu. Furthermore, the Kahuku to Honolulu motorist almost exclusively used the Central Oahu route. It can be concluded that most of the visitor travel is confined to the immediate vicinity and, therefore, should not significantly impact the Central Oahu and Windward Oahu highways.

B. Traffic Assignments

The traffic assignment process is evaluated at two levels of analyses. At the micro-level, the traffic generated from each phase of the development is distributed among the turning movements for each of the three access roads to the Turtle Bay Resort: West Kuilima Drive, Kuilima Drive and Marconi Road. The eastbound/westbound distribution is based upon the split observed during the manual traffic counts taken at Kuilima Drive.

At the macro-level, the traffic assignment is analyzed at three locations coinciding with State traffic count stations on Kamehameha Highway at Kii Bridge in Kahuku, Kawailoa/Waimea Bay, and in Hauula. The trip distribution split observed at Kuilima Drive is further distributed among the destinations identified in the PRC travel survey discussed earlier.

C. Site-Specific Impacts

1. General

Level of service computations are based upon procedures presented in the "Interim Materials on Highway Capacity" Transportation Research Circular Number 212, January 1980 and the "Proposed Chapters for the 1985 Highway Capacity Manual" Transportation Research Circular Number 281, June 1984. These capacity analysis techniques are applied to unsignalized stop-controlled intersections. In concept, this approach assumes adequate capacity and exclusive left-turn lanes on the major highway. Therefore, it is further assumed that through traffic on a major street is unaffected by the side street movements. Levels of Service are based upon the "available capacity" on each movement to and from the side street. The potential capacity is determined by the number of adequate gaps in the conflicting traffic streams that are available for side street motorists to turn on or off the major highway. As the major highway traffic increases, the number of gaps decreases; and as the side street traffic increases, the number of available gaps in the major highway traffic stream is insufficient to satisfy the side street demand. Either condition, or a combination of both, can cause congestion and long delays on the side street. The Levels of Service are generally conservative for major two-lane highways. As the major street traffic increases the "platooning effect", i.e., a moving queue of vehicles following the slowest vehicle, periodically creates wider gaps than if the traffic stream were flowing in a more continuous manner. Therefore, at Level of Service "E", where available capacity is greater than zero, there may be some delay, but it is still tolerable. However, at Level of Service "F" the available capacity becomes negative. Side street queues do not clear and may appear to lengthen during the peak period. Under these conditions, there is usually sufficient warrant for a traffic signal. Traditional definitions of Levels of Service are contained in the Appendix.

Exhibits 7 through 12 illustrate the intersection traffic assignments for each of the three phases under two conditions: the average weekday afternoon peak hour and the Saturday peak hour. The Levels of Service are also indicated on their corresponding turning movements.

2. Phase I

The Levels of Service for Phase I development are essentially the same as the existing conditions. The Saturday peak period shows Level of Service "D" condition on the left-turn movement from Kuilima Drive and West Kuilima Drive.

3. Phase II

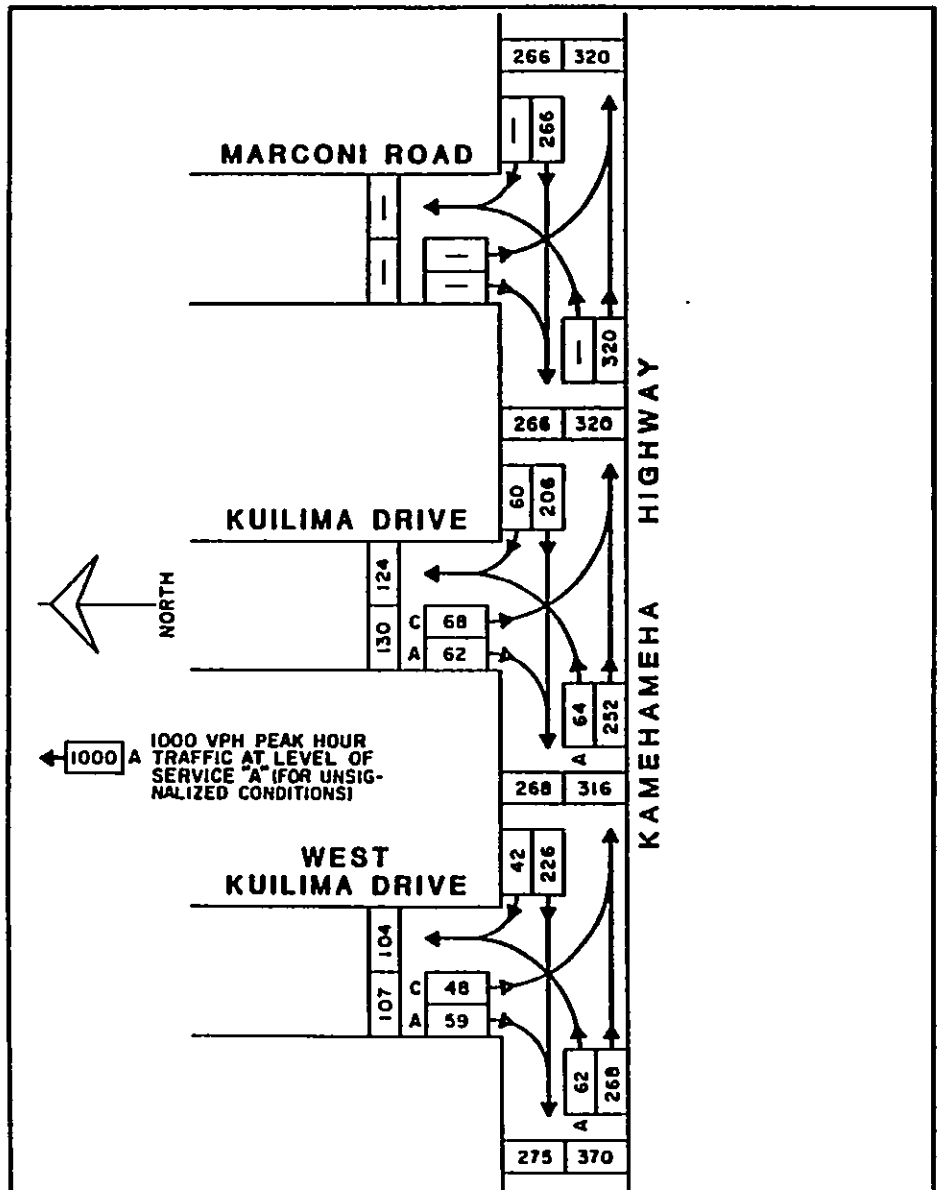
In Phase II of the development, the increased left-turn movements from Kuilima and West Kuilima Drive become less tolerable, resulting in capacity conditions. Traffic signals may be required to allow side street traffic to turn onto the main highway.

4. Phase III

Finally, upon completion of the Turtle Bay Resort, the left-turn movement from the side street will remain the critical movement at all three access points to the Resort.

D. Regional Impacts

Exhibits 13 through 21 illustrate the average weekday traffic and weekend traffic near Kahuku, at Kawailoa, and at Hauula for each of the three phases under projected traffic

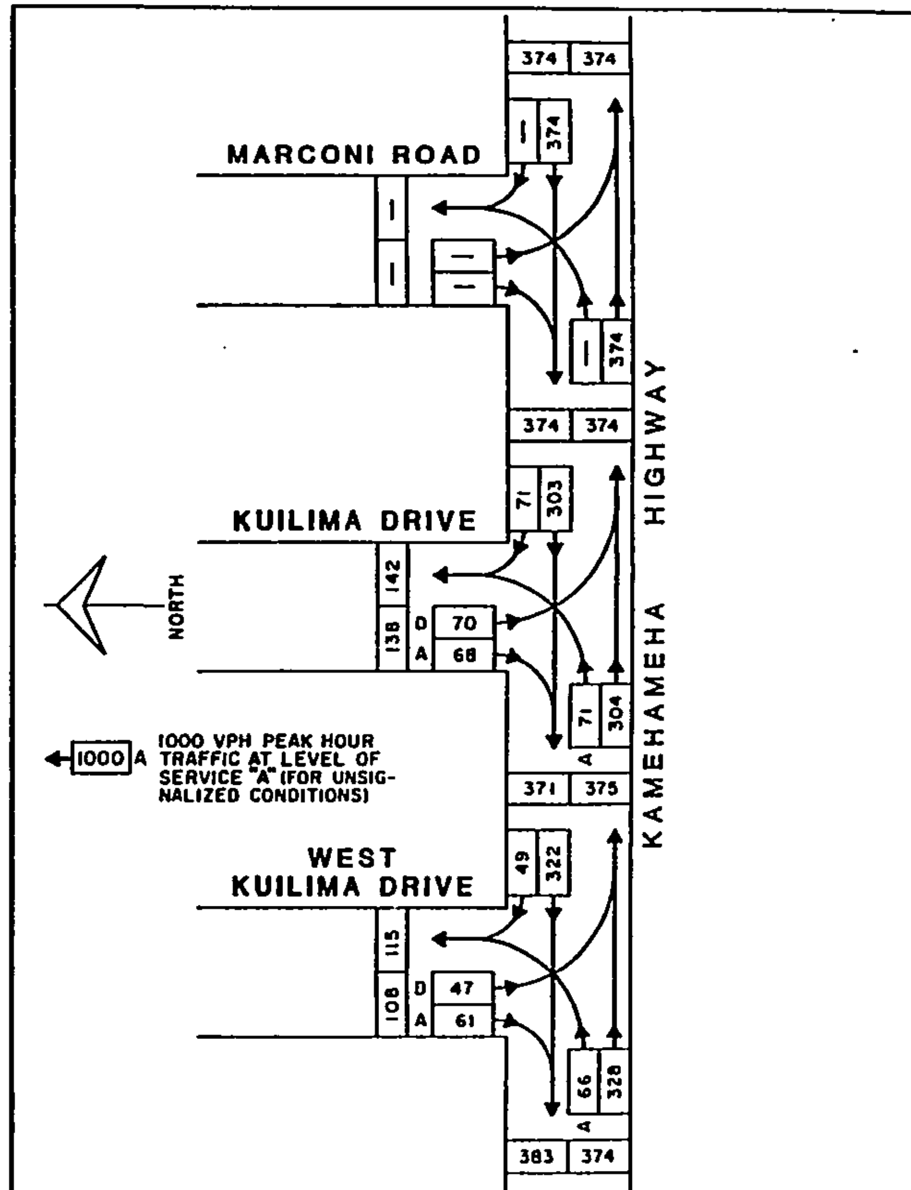


KUILIMA DEVELOPMENT COMPANY
TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT
KUILIMA, OAHU, HAWAII

ATA AUSTIN, TSUTSUMI, & ASSOC., INC.

PHASE I
PM PEAK PERIOD

EXHIBIT 7



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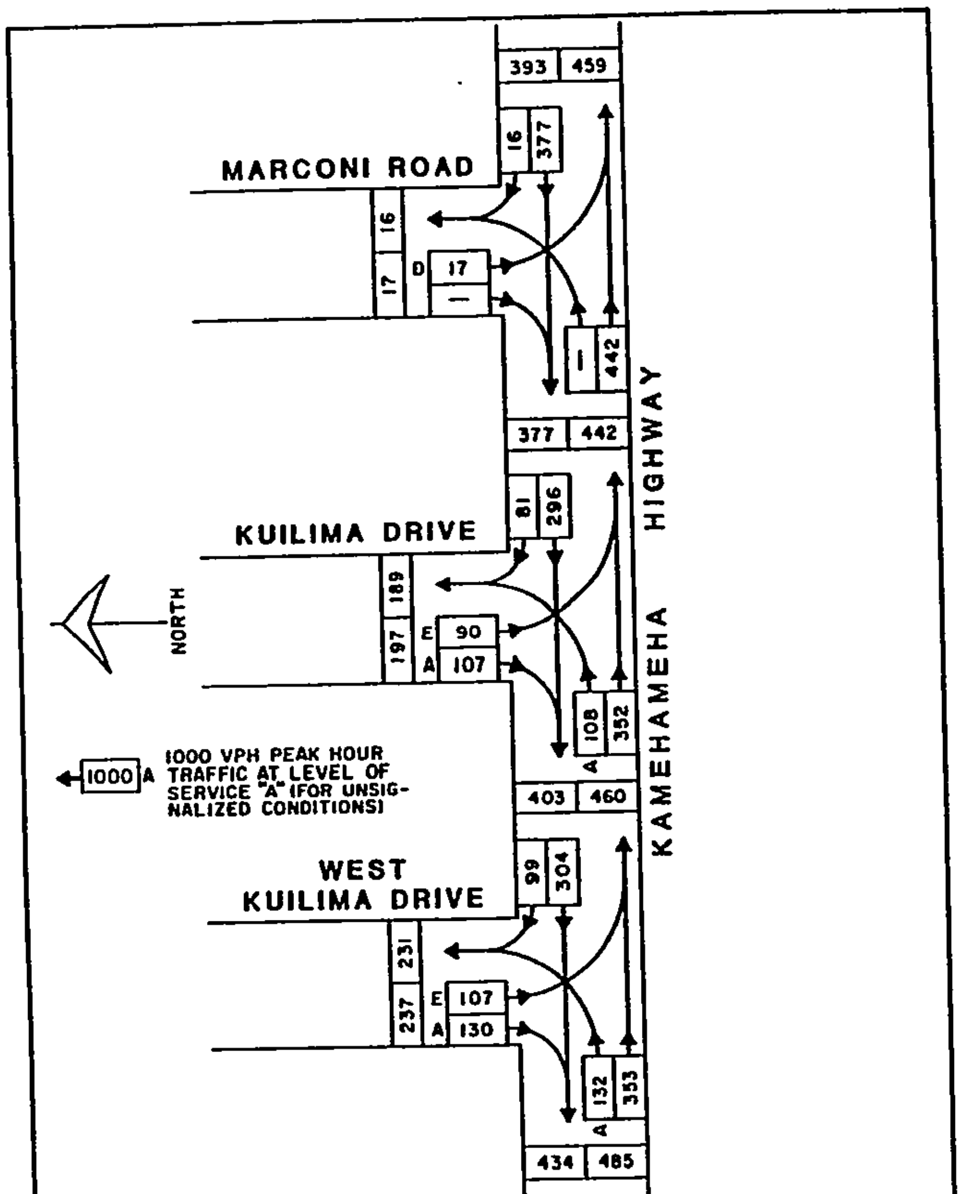
TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT
KUILIMA, OAHU, HAWAII

ATA AUSTIN, TSUTSUMI, & ASSOC., INC.

PHASE I
SATURDAY PEAK PERIOD

EXHIBIT 8



KUILIMA DEVELOPMENT COMPANY

TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT

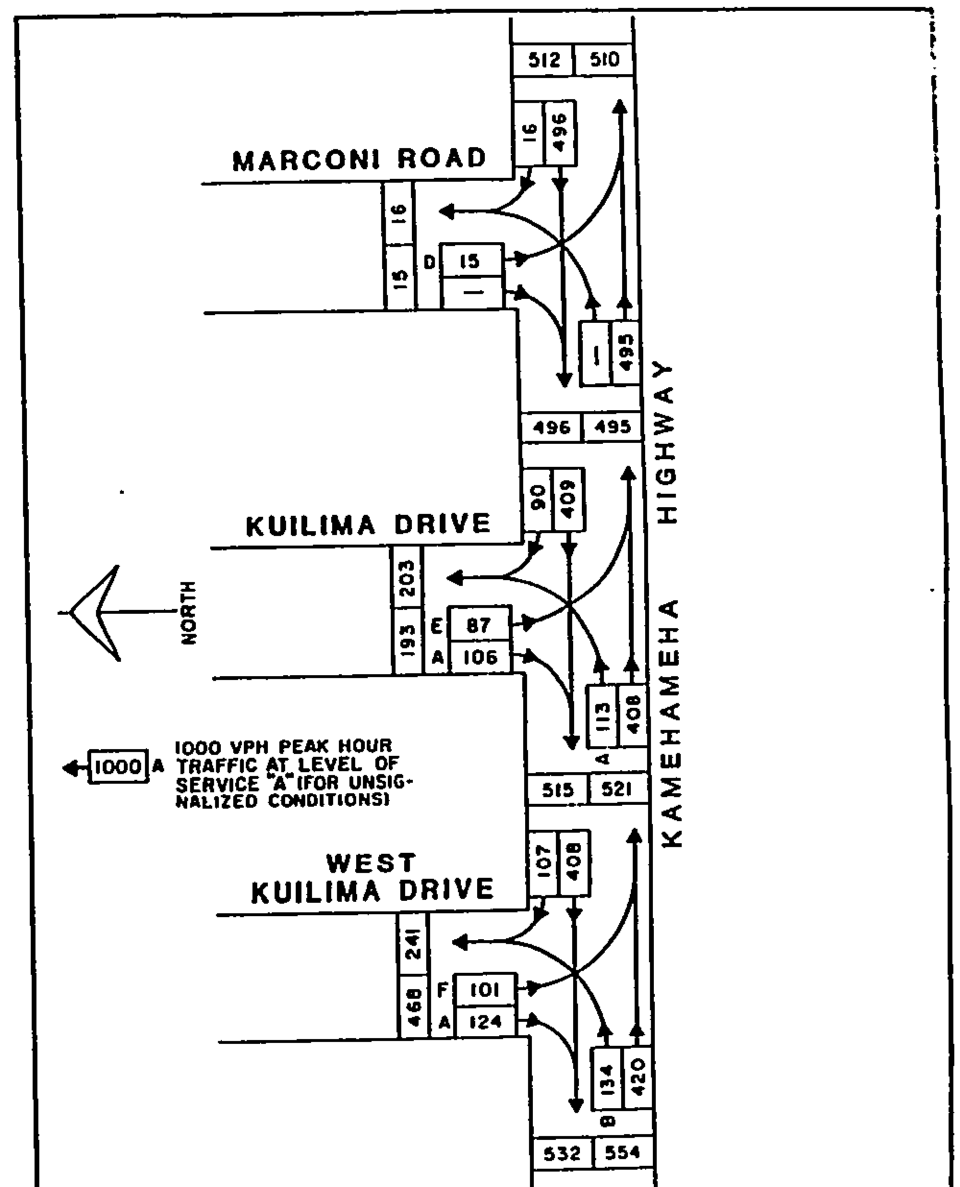
KOOLAULOA, OAHU, HAWAII

ATA AUSTIN, TSUTSUMI, & ASSOC., INC

PHASE II

PM PEAK PERIOD

EXHIBIT 9



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TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT

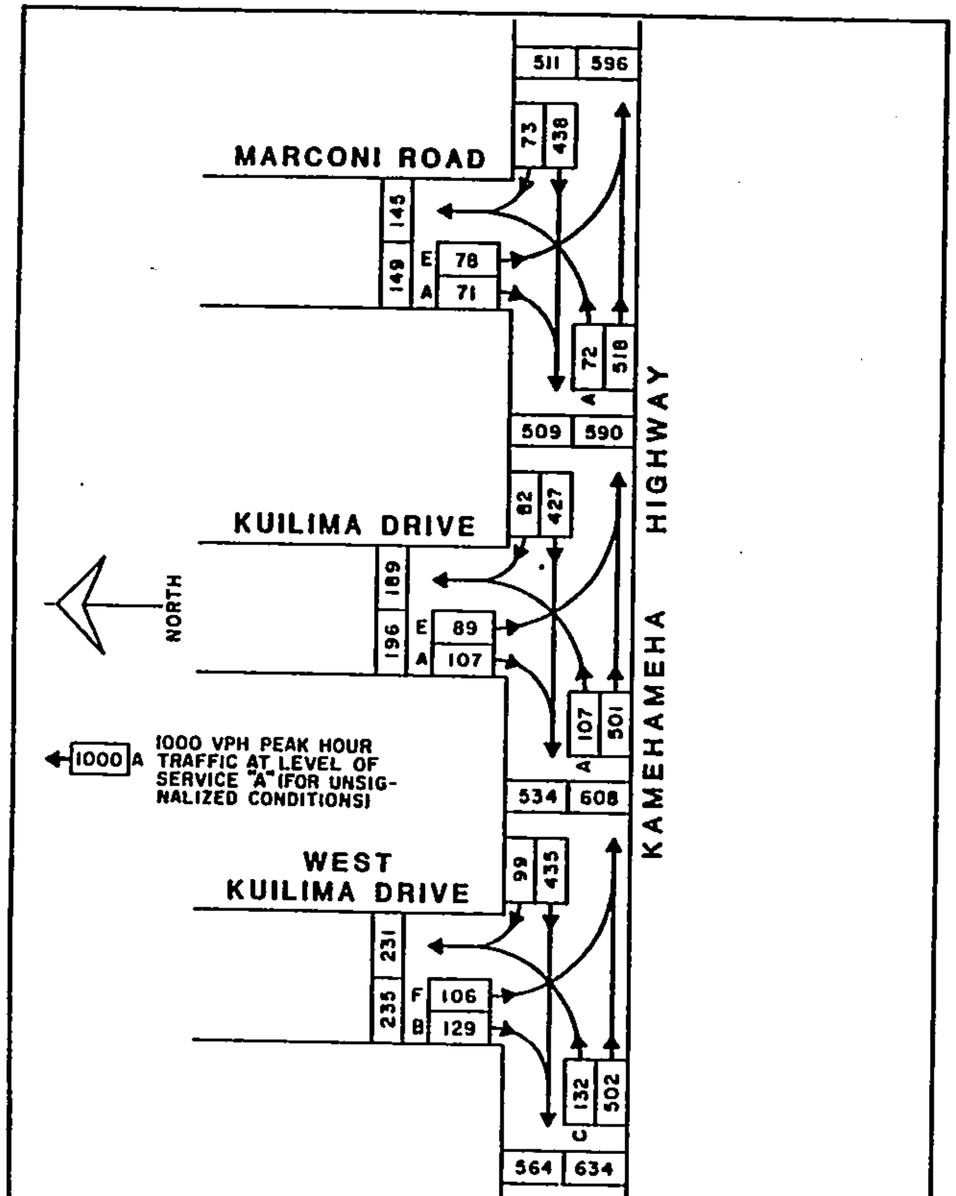
KOOLAULOA, OAHU, HAWAII

ATA AUSTIN, TSUTSUMI, & ASSOC., INC

PHASE II

SATURDAY PEAK PERIOD

EXHIBIT 10



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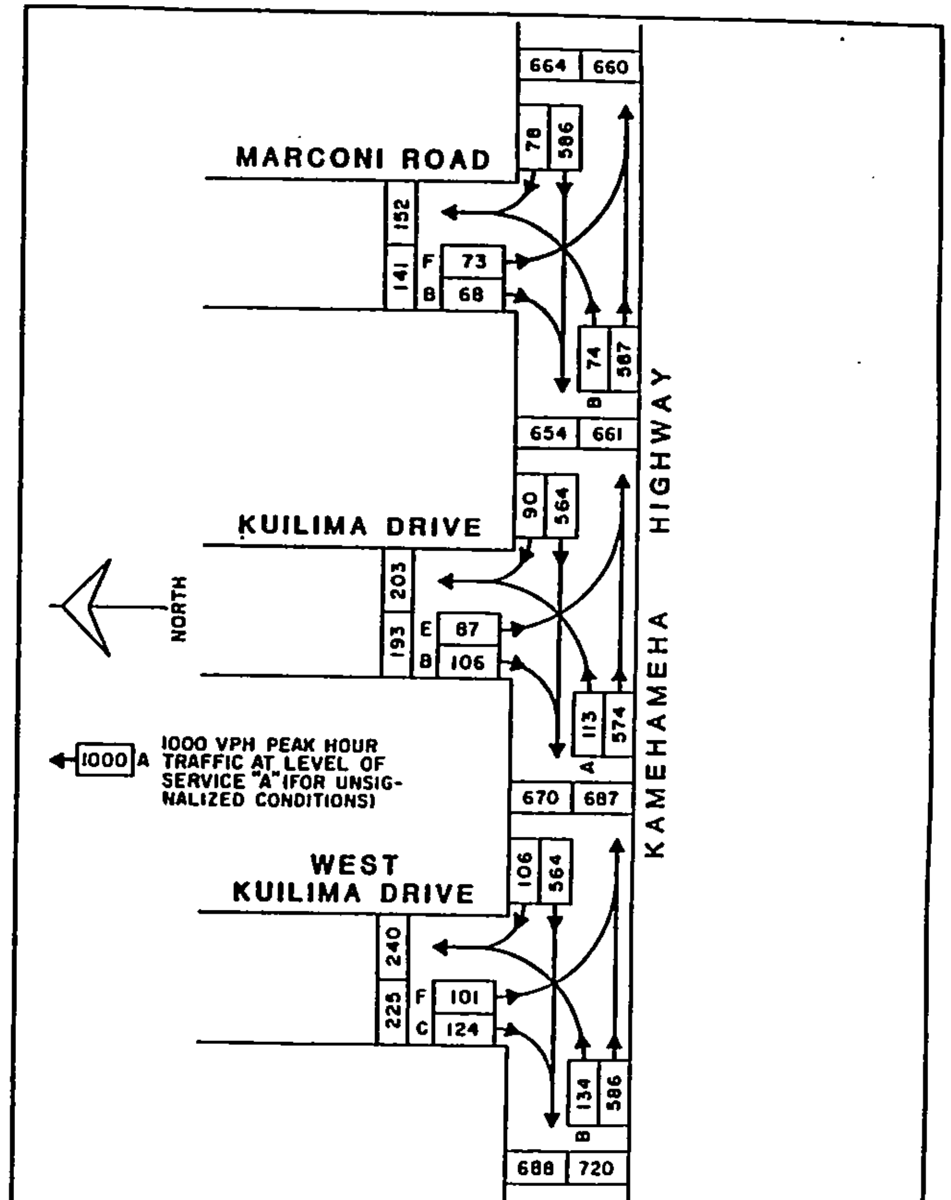
TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT
KOOLAULOA, OAHU, HAWAII

ATA AUSTIN, TSUTSUMI, & ASSOC., INC.

PHASE III
PM PEAK PERIOD

EXHIBIT
11



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TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT
KOOLAULOA, OAHU, HAWAII

ATA AUSTIN, TSUTSUMI, & ASSOC., INC.

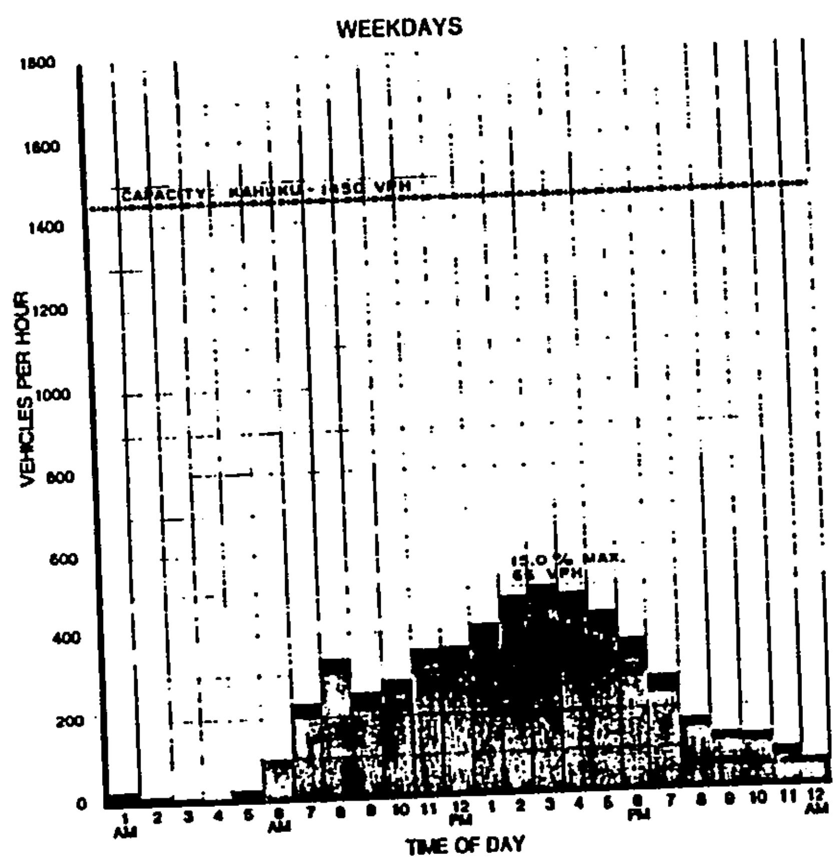
PHASE III
SATURDAY PEAK PERIOD

EXHIBIT
12

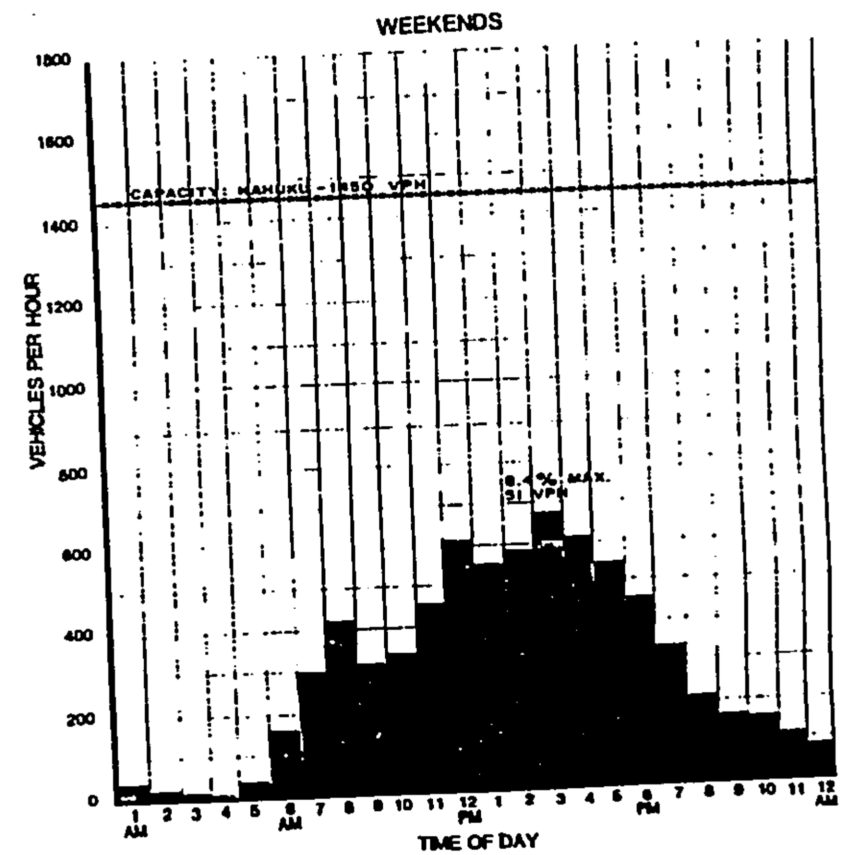
KAHUKU

LEGEND

- (black) PHASE I TRAFFIC (VPH)
- (shaded) EXISTING TRAFFIC W/O PROJECT (VPH)
- 1% MAX. PERCENT INCREASE OVER PEAK HOUR TRAFFIC W/O PROJECT
- 100 VPH PROJECT-GENERATED TRAFFIC DURING THE PEAK HOUR



EXISTING



EXISTING

GRAPHICS BY GROUP 70

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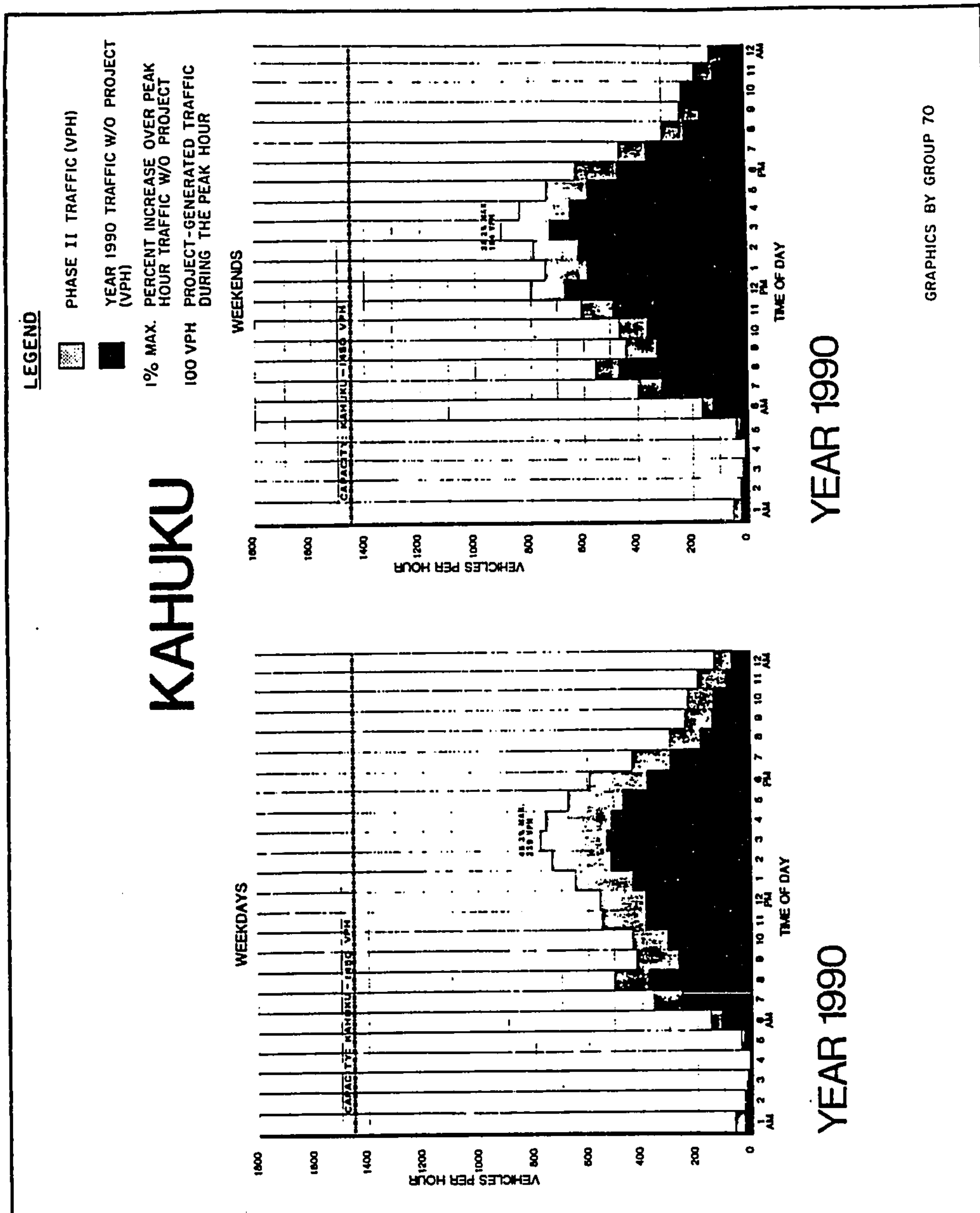
TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT

KOOLAULOA, OAHU, HAWAII

AUSTIN, TSUTSUMI, & ASSOC., INC.
ENGINEERS SURVEYORS · HAWAII GUAM

PHASE I TRAFFIC PROJECTIONS
KAHUKU

EXHIBIT 13



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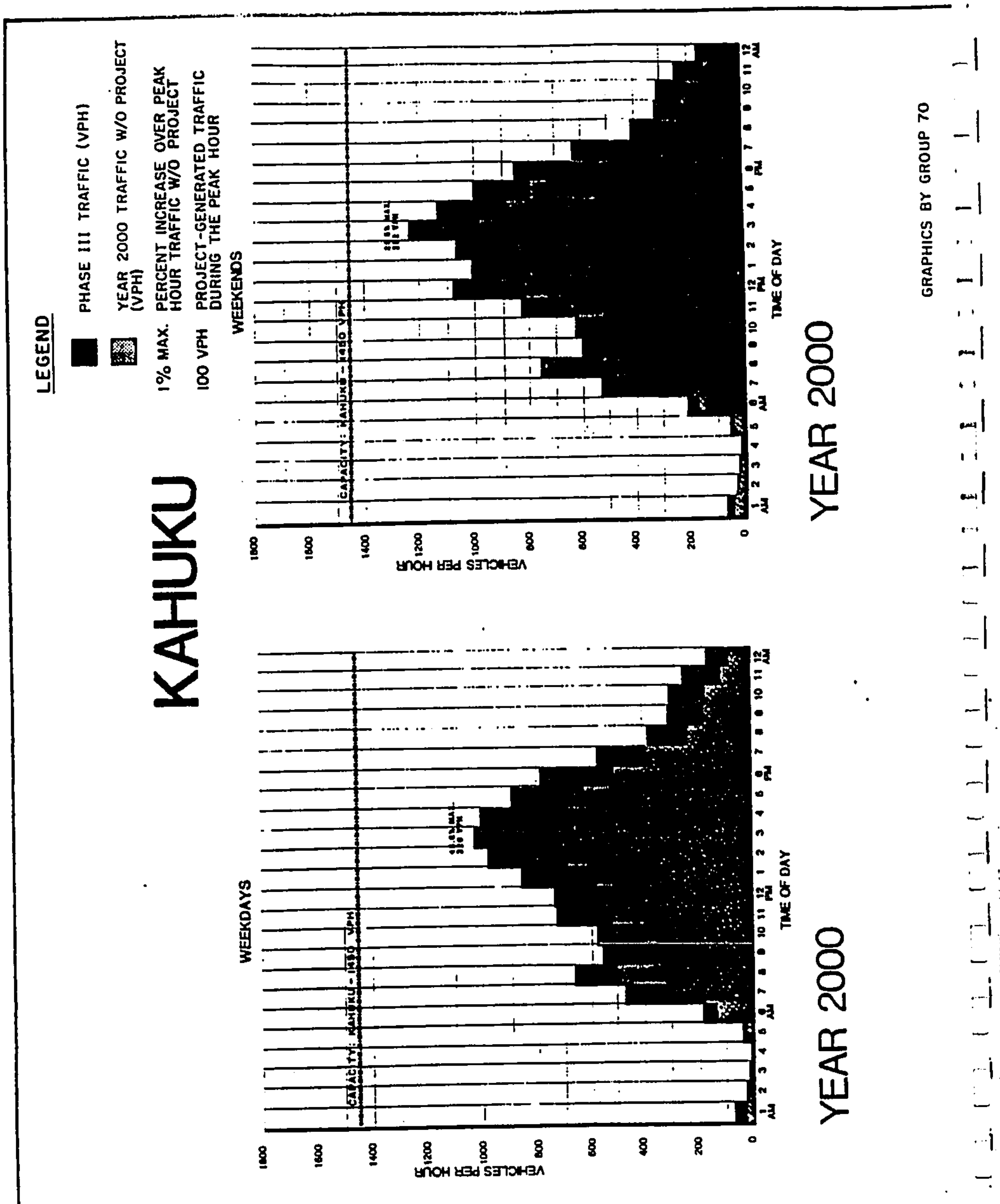

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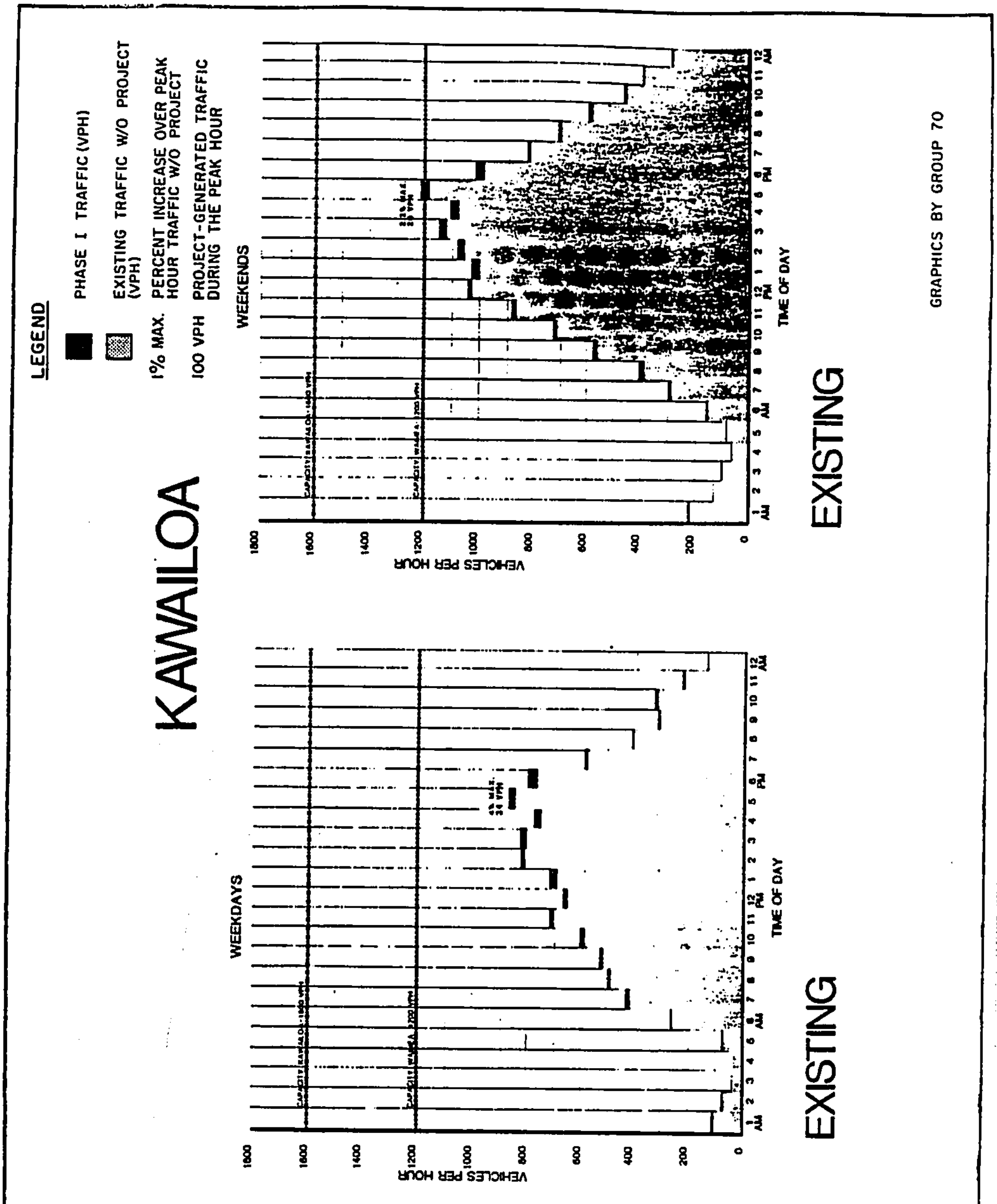

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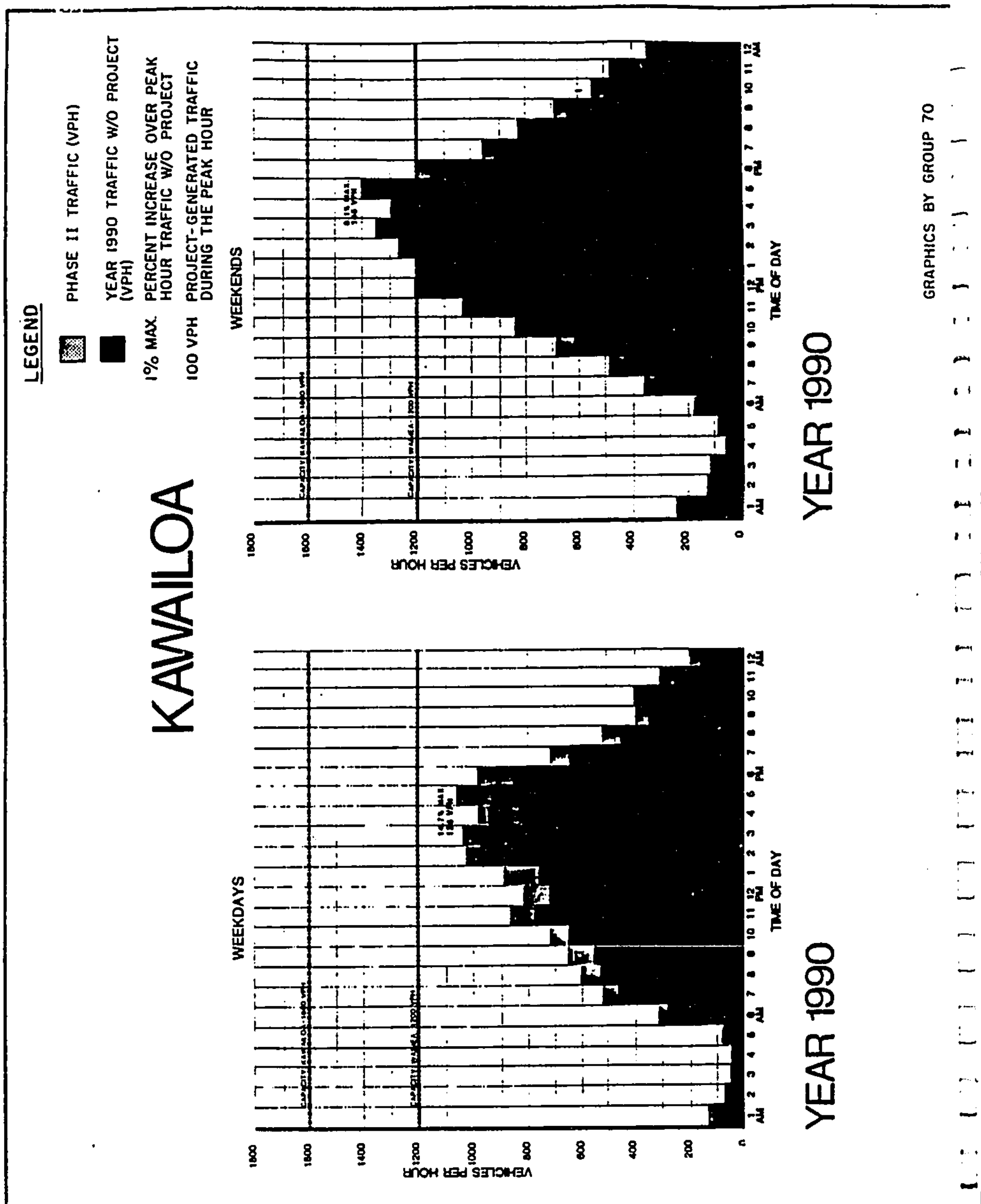

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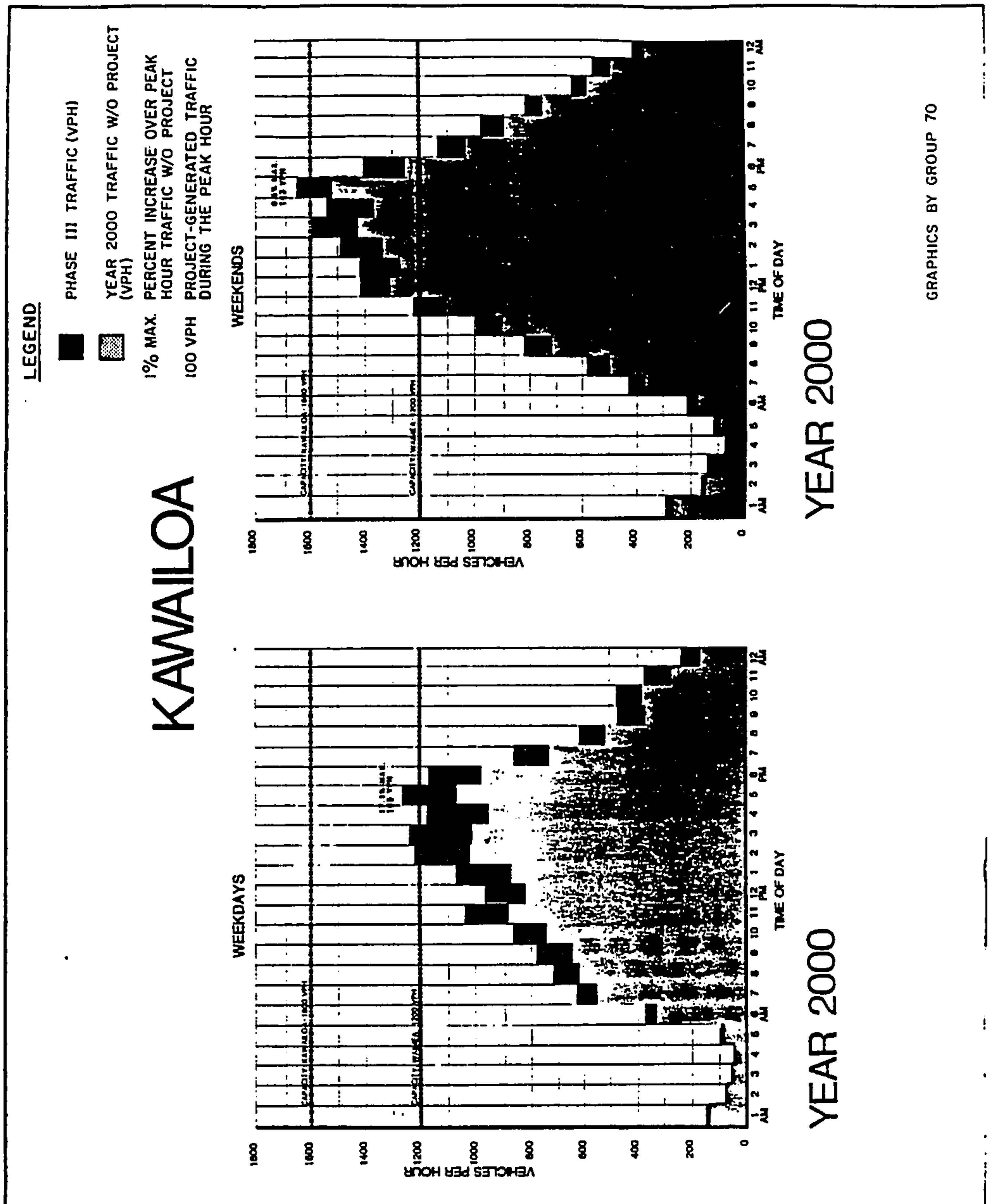
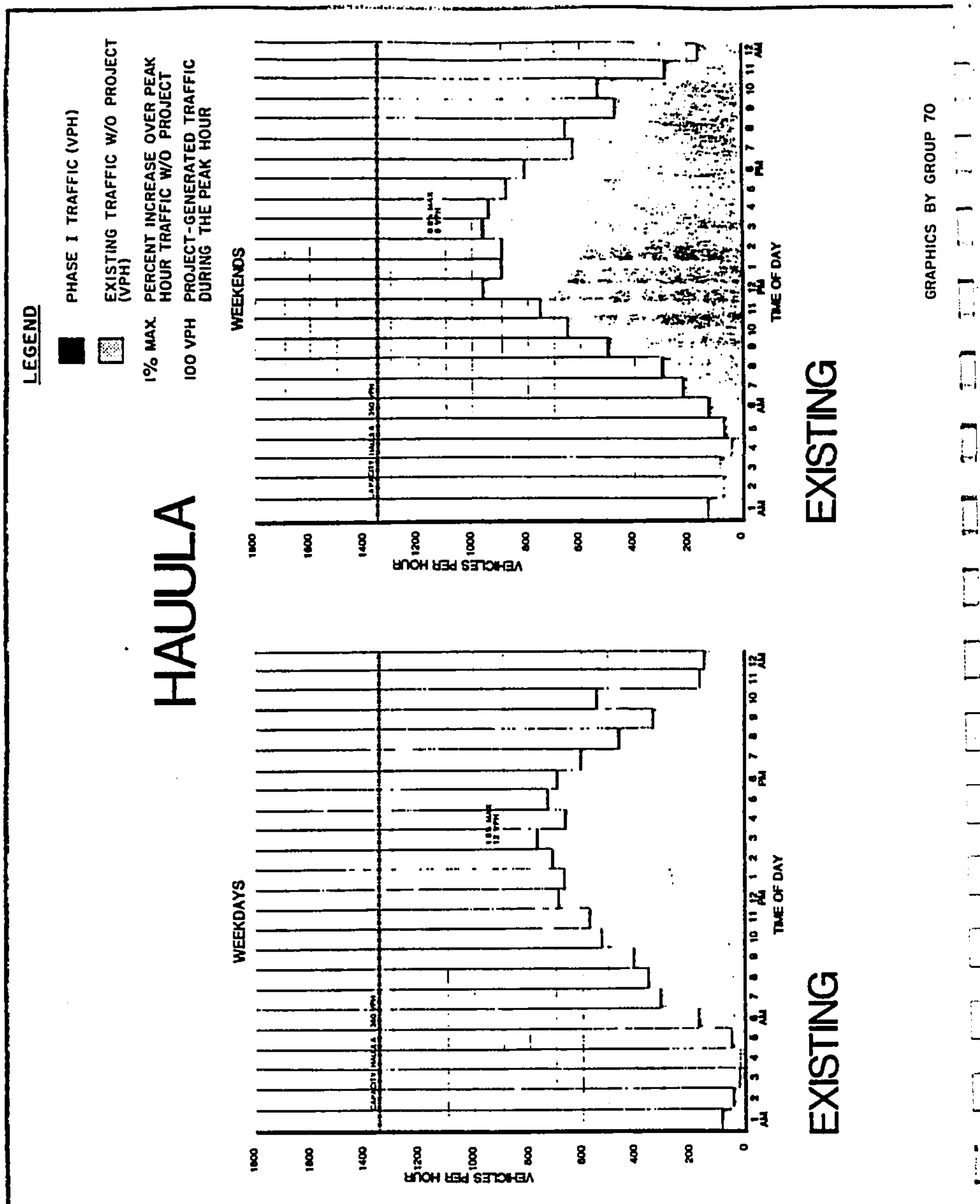


KUILIMA DEVELOPMENT COMPANY	AUSTIN, TSUTSUMI, & ASSOC., INC. ENGINEERS SURVEYORS · HAWAII GUAM	EXHIBIT
TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT	PHASE III TRAFFIC PROJECTIONS KAWAILOA	18
KOOLAULOA, OAHU, HAWAII		



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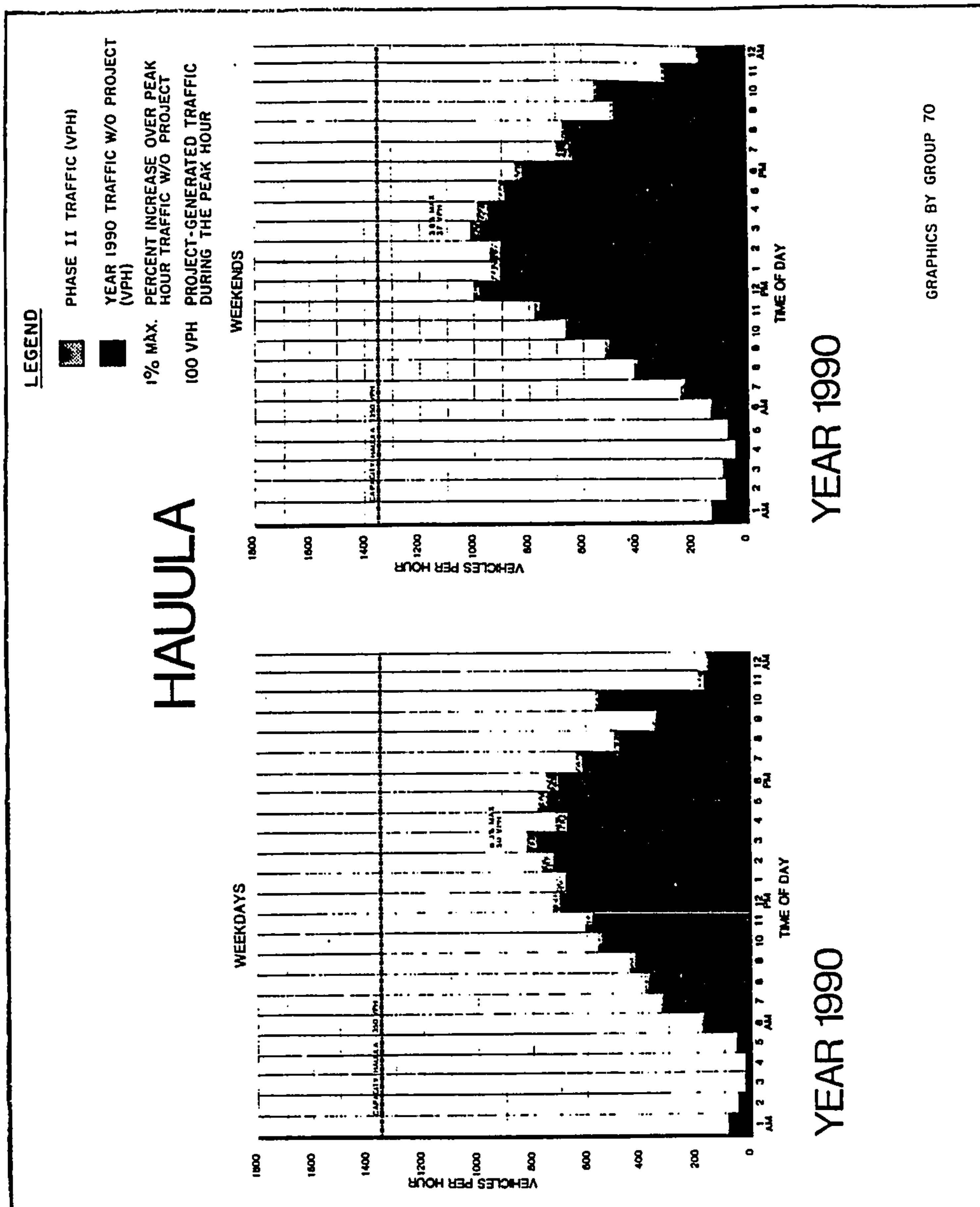

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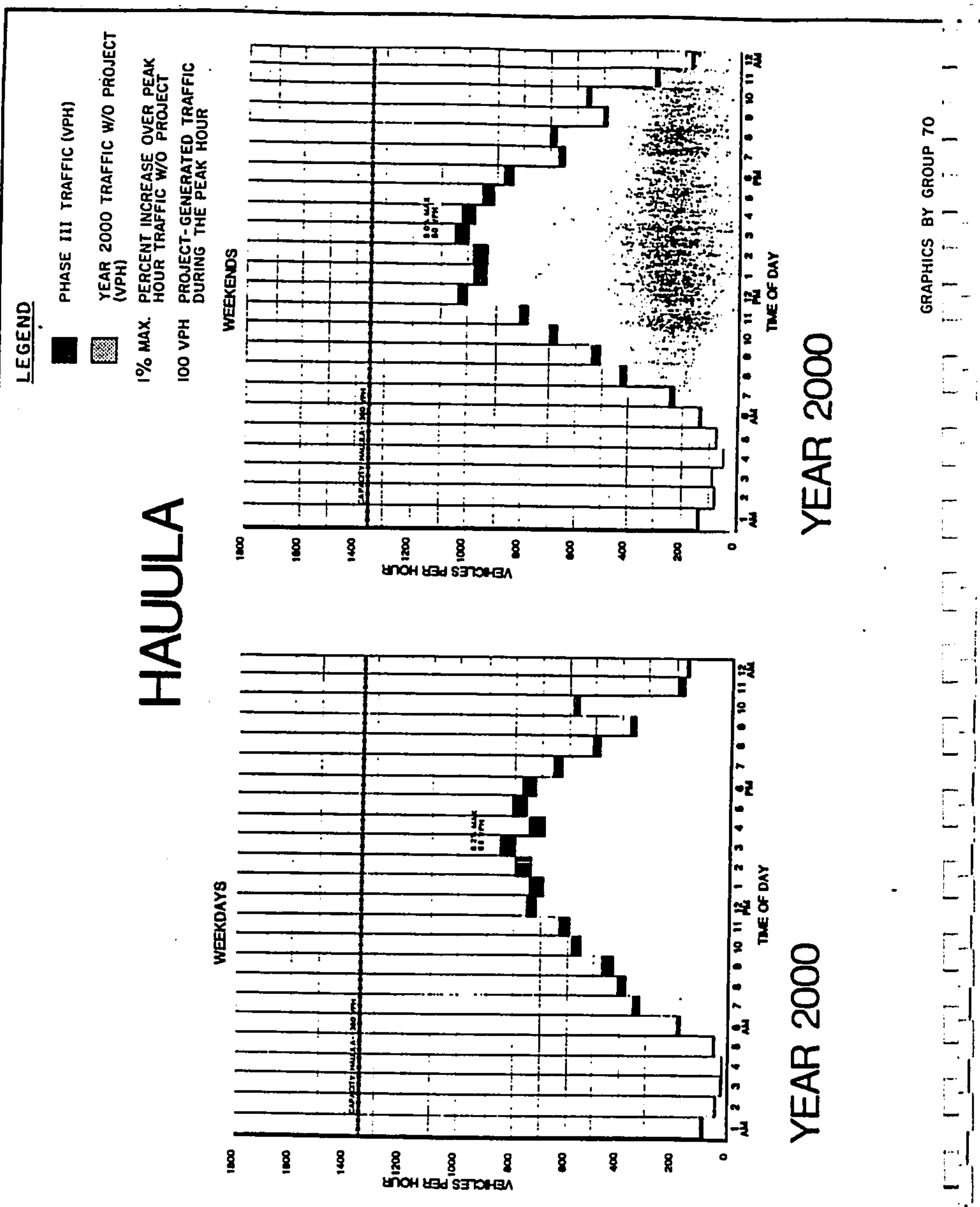

KUILIMA DEVELOPMENT COMPANY

TRAFFIC IMPACT REPORT FOR THE PROPOSED TURTLE BAY RESORT

KOOLAULOA, OAHU, HAWAII

AUSTIN, TSUTSUMI, & ASSOC., INC.
ENGINEERS SURVEYORS • HAWAII GUAM

PHASE III TRAFFIC PROJECTIONS
HAUULA

EXHIBI
21

conditions. For comparison purposes, the traffic projections without the proposed project are also shown.

As can be expected, the greatest increase of traffic occurs in Kahuku; however, the total peak period traffic is still well below the highway's capacity as shown on Exhibits 13 through 15. The most significant impact occurs at existing problem areas. While Kamehameha Highway at Kawailoa will not reach its capacity until the Year 2000, the section along Waimea Bay, which is almost at capacity on weekends under current conditions, will reach its capacity during the weekday by the Year 2000, as shown on Exhibits 16 through 18. The weekend conditions at Waimea Bay by the Year 2000, will reach proportions similar to those experienced on holidays. Exhibits 19 through 21 show very little effect of the proposed project on Kamehameha Highway in Hauula.

As discussed earlier, main highway traffic is generally unaffected by side street demand at unsignalized intersections. However, side street access is affected by main highway traffic. Turning onto and off Kamehameha Highway will become more and more difficult as mainline traffic increases.

VIII. ACTIONS PROPOSED TO ALLEVIATE THE TRAFFIC IMPACTS

A. General

There are marked similarities between the proposed Turtle Bay Resort and the existing Kaanapali Resort in West Maui. The concept of the Resort developments, their size and remote location from the populated areas are strikingly similar. Even

Kaanapali-Lahaina Town interaction parallels the relationship between the Turtle Bay Resort and Haleiwa Town. Finally, the two-lane arterial configuration of Honoapiilani Highway and Kamehameha Highway functioning as primary access between the Resorts and the population centers are very similar. The situation on Maui can almost be a look-ahead for the proposed Turtle Bay Resort, except for some significant differences.

The Turtle Bay Resort is located at the farthest point from the population centers on Oahu whereas in West Maui, the areas north of Kaanapali are developed and have the potential for further growth. Furthermore, Honoapiilani Highway is not a continuous route around Maui, while Kamehameha Highway does make up part of a closed-loop system. Taking these two points together, the traffic that passes Kaanapali has origins and destinations on both sides of the development. On the other hand, traffic passing the Turtle Bay Resort is relatively lower, composed of primarily leisure trips. A mass transit system, such as TheBus serving the North Shore, is non-existent on Maui. Therefore, traffic projections for Kamehameha Highway, with the Turtle Bay Resort, should not even approach the kind of traffic volumes currently experienced in West Maui. Finally, the proposed internal road network for the Turtle Bay Resort, with three access points on Kamehameha Highway, provides for better access to the Resort than the situation at Kaanapali, where Kaanapali Parkway is the primary access.

B. Site-Specific Improvements

1. Phase I

The Phase I impact analysis indicates only moderate levels of congestion not significant enough to lower the existing operating conditions. West Kuilima Drive should be designed for full channelization for signalization in the future.

2. Phase II

The implementation of Phase II worsens the already deteriorating conditions under the "no-build" scenario. The left-turn movements from Kuilima and West Kuilima Drives worsen to Levels of Service "E" at both locations. The development of Phase II requires signalization of at least one of the two intersections, preferably Kuilima Drive, to serve all the eastbound motorists leaving the Resort. Along with this improvement, a left-turn deceleration/storage lane should be constructed at both Kuilima and West Kuilima Drives.

3. Phase III

Most of the traffic impact resulting from Phase III occurs at Marconi Road. It is recommended that the Kamehameha Highway/Marconi Road intersection be fully upgraded with left-turn deceleration/storage lanes on Kamehameha Highway. It is also recommended that Kamehameha Highway at Marconi Road and West Kuilima Drive both be signalized.

4. Summary of Site-Specific Improvements

The improvements discussed above are based solely on operation. Other design criteria may provide a higher quality facility. Installing a median on Kamehameha Highway provides a more aesthetic and safe design; however, it does not significantly improve the operation. Right-turn deceleration lanes on Kamehameha Highway provide for a safer design and more efficiency at signalized intersections and should be considered during the traffic signal design phase of the intersection improvements. Finally, right-turn acceleration lanes on Kamehameha Highway are generally not recommended as cost-effective or functional. Generally, for motorists turning onto a major highway from a side street, either from a stop-controlled condition or a "right-turn-on-red", there is a tendency to wait for a gap in traffic then pull directly into the through lane rather than utilize the acceleration lane by first making the turn, then accelerating and merging into through traffic.

Table 3 shows the proposed improvements by phase.

TABLE 3. SUMMARY OF PROPOSED IMPROVEMENTS

Phase		Improvements
I	-	Construct channelized intersection of West Kuilima Drive and Kamehameha Highway.
II	-	Construct left-turn deceleration/storage lanes on Kamehameha Highway at Kuilima and West Kuilima Drives.
	-	Signalize Kamehameha Highway at Kuilima Drive.
III	-	Fully upgrade the Kamehameha Highway-Marconi Road intersection with a left-turn deceleration/storage lane on Kamehameha Highway.
	-	Signalize Kamehameha Highway at Marconi Road and at West Kuilima Drive.

C. Regional Improvements

1. General

Site-specific highway improvements are recommended in this report and the responsibility for implementation should fall upon the developer; however, the regional needs over the long term are a governmental responsibility and not that of an individual developer. The objective of the regional improvements discussed herein is to provide for a high

quality, two-lane, arterial highway with upgraded intersections to serve the North Shore and Windward Oahu residents as well as the island population that frequents the area. This would require a full 24-foot wide traveled way, 6- to 12-foot wide paved shoulders, bridge widening to accommodate the full roadway width, bus turnouts, left turn lanes at key intersections and beach parks, and traffic signals at high demand intersections. The Haleiwa Bypass, which is an essential improvement to the regional system, is a prime example of the type of capital improvement program that should be undertaken by Government to satisfy the needs of the community.

2. Haleiwa Bypass

The Haleiwa Bypass, which is proposed by the State of Hawaii, would alleviate much of the congestion currently experienced in Haleiwa Town on weekends and holidays. Inasmuch as the Haleiwa Bypass is an important first step in the improvement of the regional highway system, it is, in fact, only a local improvement. By alleviating the "bottleneck" conditions in Haleiwa Town, it transfers the problem to the next "bottleneck" at Waimea Bay.

3. Waimea Bay

Both the BCA and PBQD studies concur on the need for improvement on Kamehameha Highway at Waimea Bay. They also agree upon the monumental engineering task involved in widening the existing alignment by cutting a vertical rock face to the top of the ridge and the environmental impacts of widening on the Waimea Bay side of the existing highway. However, these studies were addressing a four-lane widening of Kamehameha Highway to accommodate the future growth in traffic. The reduced scale of the present Turtle Bay Resort Master Plan should require only "interim" type improvements to meet the highway's needs to the Year 2000, thereby delaying or eliminating the need for the large-scale improvements recommended in the BCA and PBQD studies. Such improvements would include:

a. Providing full 12-foot wide lanes, one in each direction.
b. Constructing left turn lanes to Waimea Bay Beach Park and Waimea Falls Park.
c. Widening or reconstructing the existing Waimea River Bridge to accommodate the roadway widening.
d. Providing a minimum 6-foot wide paved shoulders.
e. Restricting roadside parking along Kamehameha Highway.
f. Constructing a scenic lookout at Waimea Bay so that sightseeing motorists can safely pull off the highway to view its panoramic seascape.
g. Improve other beach parks in the region to alleviate some of the demand at Waimea Bay.

4. Kamehameha Highway Improvements

The remaining segments of Kamehameha Highway between the Haleiwa Bypass and Kaaawa should be upgraded to provide

paved shoulders, bus turnouts, left-turn deceleration/storage lanes and possible traffic signals at key intersections and bridge widening to accommodate the highway widening, similar to the improved portions of Honoapiilani Highway in West Maui. Two-lane segments of Honoapiilani Highway carry over 33,000 vehicles per day and over 2,500 vehicles per hour during the peak hour, according to State Department of Transportation traffic counts.

D. Other Mitigating Measures

In order to satisfy the transportation needs of the Resort population, special shuttle service should be implemented by the Resort between the Honolulu International Airport and the Turtle Bay Resort to reduce arrival/departure trips. Furthermore, a local shuttle bus service or an expanded MTL operation on the North Shore could be implemented to accommodate tourist trips to and from destinations between the Polynesian Cultural Center and Haleiwa Town. Finally, a jitney service within the Resort will further minimize the visitor's need for a personal automobile.

IX. CONCLUSIONS

Traffic problems along the North Shore currently occur on weekends and holidays at specific areas such as Haleiwa Town, Waimea Bay and at Sunset Beach. The remainder of Kamehameha Highway operates under a relatively high quality of flow. Even under heavy traffic conditions the average operating speeds are at or near the posted speed limit.

Previous studies have recognized the highway alignment problems at Haleiwa and Waimea Bay and the need for upgrading the existing Kamehameha Highway. Construction of the Haleiwa Bypass, followed by geometric improvements at Waimea Bay, and finally upgrading the overall facility between Haleiwa and Kaaawa, should meet the arterial highway needs for the North Shore through the Year 2000.

The Turtle Bay Resort, in itself, is a secondary destination for most round-the-island motorists. Although this characteristic may not generate additional traffic on Kamehameha Highway, it does have an impact at the Resort's access points.

Travel behavior surveys have indicated that trip-making during the stay at the Resort is confined to the North Shore vicinity. While the increased traffic generated by the proposed Resort is significant when compared to the projected background conditions, it is not beyond the carrying capacity of an upgraded, high quality two-lane arterial. Furthermore, the trip generation characteristics are based upon the existing Turtle Bay Hilton. The concept of the Turtle Bay Resort Master Plan is envisioned as a self-contained resort community providing most of the needs of its guests. Therefore, much of the trip-making activity should be confined to the Resort. The trip generation characteristics developed in this study can be considered to be conservative, that is, the derived trip rates overstate what might actually be generated from a full-scale resort community which would provide many more amenities, activities and services than the existing Resort.

The master planning and development of the Turtle Bay Resort represents the commitment of resources by the private sector in a responsible manner, so that government can proceed in a timely fashion to provide the necessary regional infrastructure to satisfy the needs of the North Shore and Windward communities, as well as Oahu as a whole.

A P P E N D I X

ATA AUSTIN TRISTBURN & ASSOCIATES INC

APPENDIX

LEVEL OF SERVICE DEFINITIONS[1]

1. **GENERAL**

"Level of Service" (LOS) is a term which, broadly interpreted, denotes any one of an infinite number of differing combinations of operating conditions that may occur on a given lane or roadway when it is accommodating various traffic volumes. Level of Service is a qualitative measure of the effect of a number of factors, which include speed and travel time, traffic density, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs.

Each "Level of Service" definition has two applications; the first is for continuous uninterrupted flow on a highway; the second is for unsignalized intersection.

2. **LEVEL OF SERVICE "A"**

A. Level of Service "A" describes completely free-flow conditions. The operation of vehicles is virtually unaffected by the presence of other vehicles, and operations are constrained only by the geometric features of the highway and driver preferences. Vehicles are spaced at an average of 440 feet, or 22 car lengths, at a maximum density of 12 passenger cars per mile per lane (pc/mi/ln). The ability to maneuver within the traffic stream is high. Minor disruptions to flow are easily absorbed at this level without causing significant delays or queuing.

B. At Level of Service "A", minor street traffic experiences little or no delay.

3. **LEVEL OF SERVICE "B"**

A. Level of Service "B" is also indicative of free flow, although the presence of other vehicles begins to be noticeable. Average travel speeds are somewhat diminished from LOS "A", but are still generally over 42 mph on sections with 50 mph design speed.

[1] Excerpts taken from the Highway Research Board Special Report 87, Highway Capacity Manual 1965, the Transportation Research Circular Number 212, Interim Materials on Highway Capacity, January 1980, and Transportation Research Circular Number 281, Proposed Chapters for the 1985 Highway Capacity Manual, June 1984.

Vehicles are spaced at an average of approximately 264 feet, or 13 car lengths, at a maximum density of 20 pc/mi/ln. Minor disruptions are still easily absorbed at this level, although local deterioration in LOS will be more obvious.

B. At Level of Service "B" minor street traffic experiences short delays.

4. LEVEL OF SERVICE "C"

A. Level of Service "C" represents a range in which the influence of traffic density on operations becomes marked. The ability to maneuver within the traffic stream, and to select an operating speed, is now clearly affected by the presence of other vehicles. Average travel speeds are reduced to about 39 mph on 50 mph design speed sections, and the average spacing of vehicles is reduced to approximately 175 feet, or 9 car lengths, at a maximum density of 30 pc/mi/ln. Minor disruptions may be expected to cause serious local deterioration in service, and queues may form behind any significant traffic disruption. Severe or long-term disruptions may cause the facility to operate at LOS "F".

B. Level of Service "C" represents average delay for minor street traffic.

5. LEVEL OF SERVICE "D"

A. Level of Service "D" borders on unstable flow. Speeds and ability to maneuver are severely restricted because of traffic congestion. Average travel speeds are approximately 35 mph on 50 mph design speed sections, while the average spacing of vehicles is 125 feet, or 6 car lengths, at a maximum density of 42 pc/mi/ln. Only the most minor of disruptions can be absorbed without the formation of extended queues and the deterioration of service to LOS "F".

B. At Level of Service "D" minor street traffic experiences long delays.

6. LEVEL OF SERVICE "E"

A. Level of Service "E" represents operations at or near capacity, and is quite unstable. At capacity, vehicles are spaced at only 80 feet, or 4 car lengths, at a maximum density of 67 pc/mi/ln. This is the minimum spacing at which uniform flow can be maintained, and effectively defines a traffic stream with no usable gaps. Thus, disruptions cannot be dampened or dissipated, and any disruption, no matter how minor, will cause queues to form and service to deteriorate to LOS "F". Average travel speeds at capacity are approximately 30 mph.

B. At Level of Service "E", minor street traffic experiences very long delays.

7. LEVEL OF SERVICE "F"

A. Level of Service "F" represents forced or breakdown flow. It occurs at a point where vehicles arrive either at a rate greater than that at which they are discharged, or at a point on a planned facility where forecasted demand exceeds the computed capacity. While operations at such points (and on immediately downstream sections) will appear to be at capacity or better, queues will form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing short spurts of movement followed by stoppages. Average travel speeds within queues are generally under 30 mph, with densities higher than 67 pc/mi/ln.

B. Level of Service "F" indicates that the demand on the minor street exceeds its capacity. This may result in extremely long delays, continuous queuing on the side street or left-turn lane on the main highway, traffic safety problems, and disruption of main highway traffic flows.

APPENDIX M

PRELIMINARY ACTION PLAN FOR EMPLOYMENT RESOURCE CENTER

DRAFT

8/1/85

PRELIMINARY ACTION PLAN

TURTLE BAY RESORT

EMPLOYMENT RESOURCE CENTER

Kuilima Development Company
North Shore Career Training Corporation

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I. OVERVIEW OF PROPOSED PROGRAM

The "Turtle Bay Employment Resource Center" is proposed to meet the goal of maximizing North Shore resident economic benefits (particularly employment) from the expanded Turtle Bay Resort (TBR). This section presents an overall picture of the proposed program, with individual components discussed in more detail in following sections.

A. Components

Eight program components are envisioned. The first two and the last two listed below are relatively independent, while components #3 - #6 are highly interrelated. (SEE FIGURE 1.)

1. Research, Design, and Start-Up

Personnel recruitment; purchase or lease of equipment and space; preliminary contacts with relevant other agencies.

2. Construction Phase Activities

Special activities to maximize resident economic benefits from major TBR construction phases. The nature of feasible activities is still being explored, and the following are still both conceptual and tentative:

- o Publicizing opportunities for (a) employment, and (b) construction subcontracts.
- o Negotiations with contractors to maximize resident employment.
- o Negotiations with unions to increase resident access to training and apprenticeship programs.

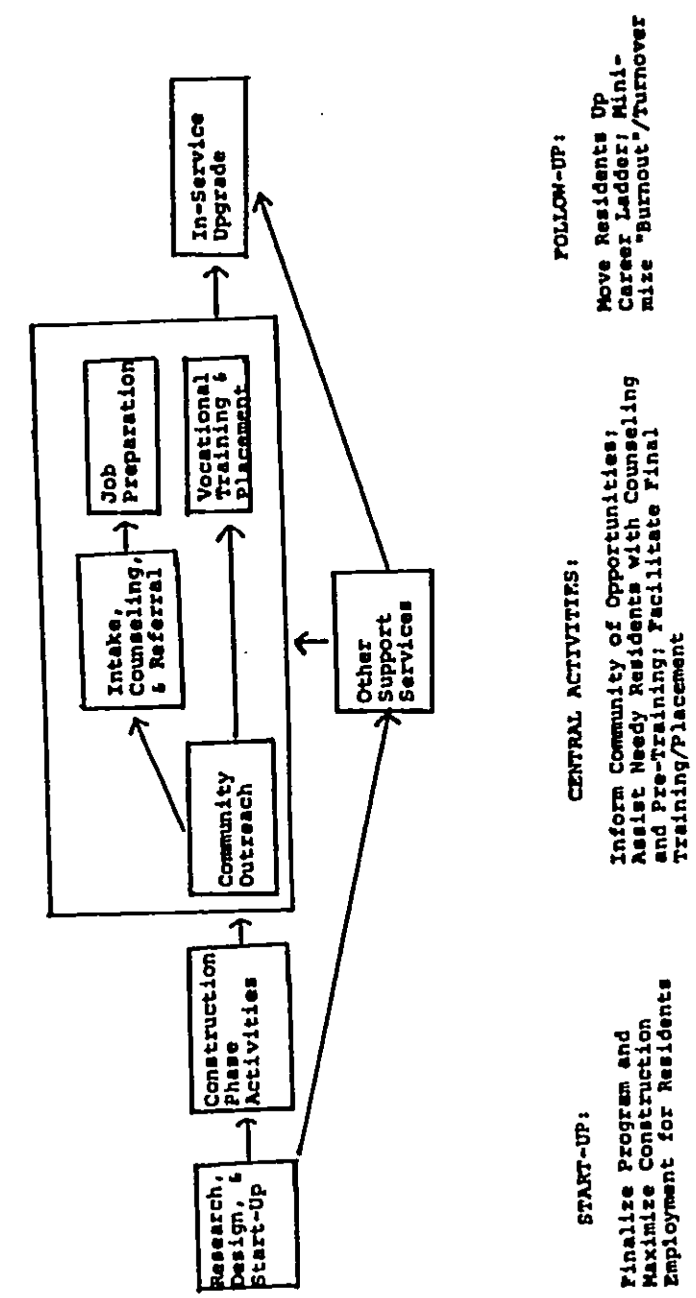
3. Community Outreach and Education

These are activities designed to increase resident awareness and interest in economic benefits (both employment and entrepreneurial), including efforts to counter any negative attitudes toward visitor industry jobs. Information would be disseminated about both TBR and the Employment Resource Center, although the two would not necessarily be linked.

- o General community awareness — use of local news media and slide presentations to community groups and Neighborhood Boards; ongoing linkages with them.

Figure 1

IMPLEMENTATION OF PROGRAM COMPONENTS



- o Establish and maintain linkages with labor supply sources (particularly intermediate and high schools).
- o Linkages with groups providing information on visitor industry employment.

4. Intake, Counseling, and Referral

These are activities which would take place at the Center itself, to provide residents with needed detailed information about job or business opportunities, required skills, and resources for obtaining those skills.

- o Personalized assessment and counseling.
- o Information/referral for education and training.
- o Maintenance of a list of potential Resort job applicants (including former residents) to be "banked" for later reference at hotel start-up times.
- o Information and referral services for potential entrepreneurs, possibly including ideas for new businesses.

5. Job Preparation

These activities are for disadvantaged North Shore residents who require some sort of remedial assistance prior to job-specific training.

- o Networking with other agencies to strengthen existing efforts to provide "basic skills" training (remedial reading, writing, math, etc.).
- o Networking with such agencies to strengthen or introduce programs designed to instill work ethic and ability to function in hierarchical work settings.
- o Direct provision of mini-courses in job search and job interview skills.
- o Working with State or private agencies to encourage development of a contingency plan for retraining surplus or displaced agricultural workers to join the Resort work force.

6. Vocational Training and Placement

The Center is a potentially valuable resource for new hotels or Resort commercial operations at start-up time,

although it is not currently known to what extent they might wish to use this resource. After start-up, the Center would be a liaison with the local community for the Resort's ongoing labor needs.

- o If requested, assist hotels and/or trainers in planning start-up training activities, and facilitate the search for North Shore space or other needed resources.
- o If requested, recruit and/or screen job applicants at start-up time.
- o Coordinate with schools and Resort operators to institute internship and job shadowing programs.
- o Network with State Employment Service and area employers to maintain a list of current job openings.
- o Assist school counselors and State Employment Service in vigorous personalized efforts to place job-seekers, by providing continuous linkage with Resort employers.
- o Coordinate Resort efforts to provide Travel Industry Management scholarships for local high school graduates.
- o Help establish -- and perhaps provide part-time staff for -- a volunteer committee to facilitate technical and financial assistance for new North Shore businesses.

7. In-Service Upgrade Training

As opening time approaches for each new hotel, an effort must be made to ensure that employees of existing hotels are prepared to advance to higher positions. In more normal times, the purpose is to minimize turnover and keep resident employee skill levels up to changing demands.

- o Provide promotion-oriented upgrade training classes for employees of all existing hotels at crucial times.
- o Determine in-service training needs common to all Resort hotels and provide such classes -- primarily through a single instructor employed by the Center, but sometimes through facilitation of outside resources.

8. Other Support Services

These would be services determined to be of value in removing obstacles to local resident employment.

- o Conduct ongoing informal needs assessment.
- o Network with other agencies to meet needs.

B. Priority and Phasing of Components

While numerous components and activities have been proposed, it should be noted that different activities would have priority at different times. Depending upon what is happening at the Resort, certain components or activities would require more attention while others would diminish in priority.

This means that the program can be carried out by a relatively small staff and with a reasonable annual budget (as detailed shortly).

Basically, priorities will shift depending upon whether the Resort is preparing for a new hotel start-up or whether the situation is one of maintaining and strengthening status quo operations. The Employment Resource Center will also undergo its own start-up period, during which there will be tasks that will require little repetition later.

- o Center Start-Up: Priority will go to completion of program Research and Design; finalization of construction-phase component; general community information programs; and initial linkages with other agencies.
- o One-Year Periods Prior to New Hotel Start-Up: Priority will go to training and placement activities; promotion-oriented in-service upgrade training; and job preparation activities relating to attitudes and job interview skills.
- o Other Periods: Priority will go relatively more to personalized counseling and referral; general job preparation; normal in-service training; and individualized job placement help.

C. Center Organization from Job Applicant Perspective

Most North Shore residents served by the Employment Resource Center would be persons seeking a permanent job at the Resort. This discussion is focused upon their experience

with the Center, and thus omits the construction worker or employee involved in upgrade training.

Figure 2 shows the various services and activities which such a person might encounter.

Residents will be made aware of the Center through community outreach efforts or referrals from schools, employment services, private agencies, etc. They may simply leave their names on mailing lists for future information and/or notification as a hotel start-up time approaches ... or they may request more immediate assistance.

This immediate assistance could involve information and referral for individuals with a good idea of their needs, or it could involve counseling for those needing more extensive assistance. Job preparation courses would be available, some at the Center itself, some through referral to other agencies.

If or when an applicant is ready for job-specific training or vocational education, that would usually be provided by referral (although the Center may facilitate special classes at hotel start-up time). The Center works to place job applicants in one of two ways -- indirectly, by teaching self-directed job search skills as part of the job preparation training, or directly, through ongoing contacts with Resort or other employers.

D. Implementing Organization

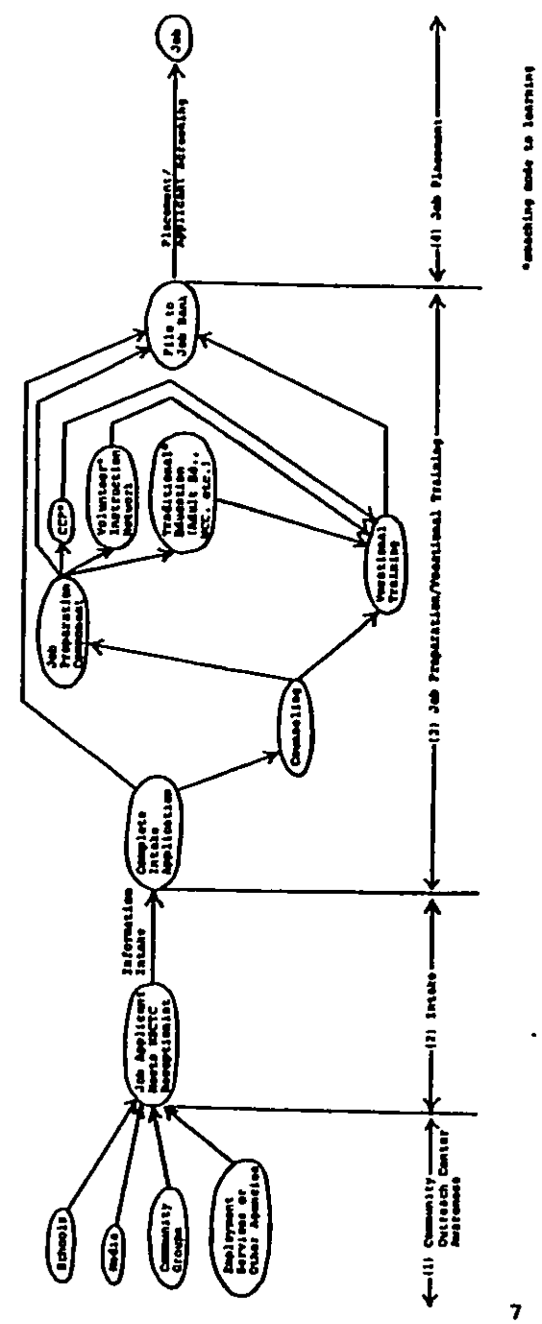
There are two organizations which could potentially implement the proposed program: (1) the North Shore Career Training Corporation (NSCTC) or (2) the still-to-be-created Turtle Bay Resort Association of major hotel and commerical operators, which would normally be focused primarily on marketing but which could also have a community orientation as well.

At this point, we are recommending that the NSCTC operate this program. Because the NSCTC is an independent organization, TBR would have less control over its activities, but we believe a number of other factors outweigh this concern. The NSCTC is existing, experienced in the target community since 1978, and would not dilute the community economic goals with other activities. It was essentially created for this sort of program, and has been funded by the Kuilima Development Company (KDC) itself (to the level of $**,**** in 1985) for North Shore job training.

Past NSCTC programs have served some 5,000 clients, emphasizing (1) job information and placement assistance; (2) on-the-job training; (3) career guidance and counseling;

Figure 2

EMPLOYMENT RESOURCE CENTER - APPLICANT PERSPECTIVE



(4) short-term employment; and (5) post-secondary vocational education. It is governed by a six-member Board of Directors (including one seat for KDC), and the current executive director is Robert F. Comeau. A more detailed report on the NSCTC is appended.

The NSCTC appears to be the logical choice of an implementing organization. However, the future Turtle Bay Resort Association could be a "fall-back" organization for the program.

E. Organization and Accountability

This section specifies the relationship among (a) KDC; (b) other potential funding sources; (c) the NSCTC; and (d) the community in designing the Employment Resource Center.

Considerations which lead to the following recommended organizational structure include these:

- The NSCTC's job training goals are ultimately broader than KDC's goals, which focus on the Resort. Both KDC and the NSCTC will be seeking other funding sources for activities or components not funded through KDC. However, KDC's search for other funds will be focused on its Employment Resource Center, while NSCTC's interests could involve either Resort- or non-Resort-related job training activities.

- KDC will be ultimately accountable for the success or failure of the activities which it funds. Therefore, KDC must have powers of review and approval over the Resort-oriented activities of the Center.

- Members of the Kuilima North Shore Strategy and Planning Committee (K/NSSPC) have expressed a desire to formalize this ad hoc committee and to have ongoing advisory input into all Resort aspects which affect the community -- particularly the Employment Resource Center.

With this in mind, the following organization is recommended:

(1) KDC will contract on an annual basis with one or more organizations to carry out Resort-oriented employment training activities. As indicated in the foregoing Section D, it is currently assumed that the sole initial contracting organization will be the NSCTC, where most or all physical aspects of the Employment Resource Center would be located. However, KDC could later make additional contracts or direct grants to other organizations, if warranted.

(2) In order to assure ultimate responsibility and accountability for the Turtle Bay Employment Resource Center, KDC will establish a nonprofit subsidiary corporation -- which will be referred to in this document as "Resort Training, Inc." (An alternative would be simply to have an additional KDC employee carry out the functions listed in paragraph #4 below. However, this would preclude the community and hotel operator input discussed in paragraphs #5 and #6 below.)

(3) Resort Training, Inc. will have a single employee, who will function as contracts officer, program planner, community ombudsman, and accountant/auditor. This person will maintain close contact with the Center and will be responsible for specifying measurable program objectives and carrying out evaluations of the Center's performance in meeting those objectives. However, the individual in this position will work from separate offices to assure an independent perspective. The "ombudsman" aspect will require frequent community contacts to ensure that any resident concerns or suggestions about the program are being communicated. The Resort Training, Inc. officer will prepare each year's program activity and budget for submission to his/her Board of Directors (see below).

(4) The Board of Directors for Resort Training, Inc. will consist of representatives from KDC (chair) and major Resort employers, particularly hotels. Each hotel will receive a seat on the Board when it contracts with KDC to operate a hotel (or to purchase a hotel site), whether or not the hotel has yet been constructed. Hotels and other employers will be encouraged to appoint their personnel officers to sit on the Board. This Board will have responsibility for hiring/firing the previously mentioned employee and for approving each year's budget and contracts.

(5) <u>Community Input</u>: It is assumed that the K/NSSPC will have by this time taken steps to formalize its existence, whether by incorporation or other steps. A subcommittee of the K/NSSPC (preferably including at least one member of the NSCTC's Board of Directors) will be invited to meet with Resort Training, Inc.'s Board at least twice a year to participate in open discussion about major program, budget, and staffing decisions. Although this K/NSSPC advisory subcommittee would not have voting power over KDC's funds, it would be in a position to influence decisions and to assure that community concerns are communicated. Additionally, this subcommittee

would be provided with results of the annual program evaluation report prepared by the Resort Training, Inc. officer.

(NOTE: Community input to the NSCTC's overall program comes through the NSCTC Board of Directors. There have been proposals recently to expand the size of this Board to permit greater community input.)

In summary, the NSCTC's broad mandates for career training program development on the North Shore would be served by assurance of initial contracts from KDC and Resort Training, Inc. to carry out activities which would be central to an even larger jobs training effort. These funds and activities will likely attract supplemental funds from other sources, for both the Turtle Bay Resource Center itself and for other NSCTC goals. KDC's need for accountability and control over the Employment Resource Center would be served by its subsidiary Resort Training, Inc., which would provide independent evaluation and maintain the active planning authority of an organization which contracts for services (as opposed to an agency which approves grant proposals). Resort employers will be assured of adequate input through the Resort Training, Inc. Board of Directors. And the community will have its advisory input through both the K/NSSPC subcommittee (for Resort-oriented training activities in particular) and the NSCTC Board of Directors (for the overall Employment Resource Center).

The lines of organization and accountability are illustrated graphically in Figure 3.

F. Start-Up Date

Target date for start-up is January 1, 1986, with all components to be operating by the end of that year (see further discussion in Section IV).

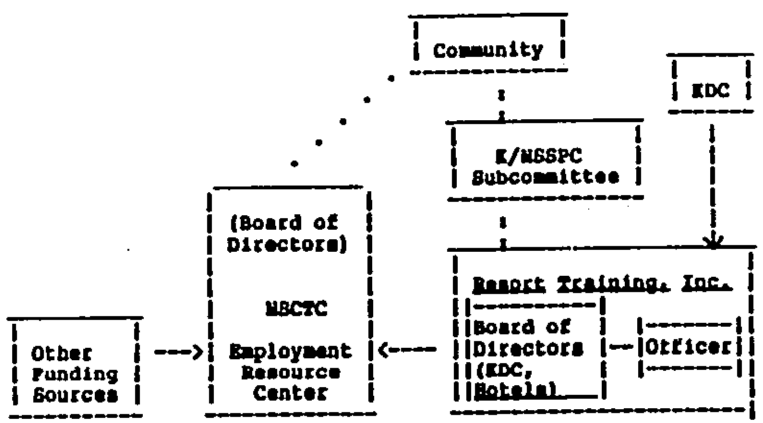
G. Staffing and Budget

[FULL DISCUSSION TO BE INSERTED HERE LATER]

Personnel, space needs, dollars, etc. This would include discussion of "Discretionary Contingency" vs. "Nondiscretionary Contingency Funds" (see following).

Figure 3

RELATIONSHIPS AMONG EMPLOYMENT RESOURCE CENTER PARTICIPANTS



(Dotted lines indicate advisory relationship.)

"Discretionary Contingency Fund" would be a relatively small amount of dollars set aside for discretionary use by Director, who would be expected to account for their use at the end of each year.

"Nondiscretionary Contingencies" is a term referring to major one-time expenditures which would have to be justified and approved in advance of each budget year. If, for example, the Director believes that it would further the aims of the program to provide seed money for a demonstration employee child care project, a proposal would have to be made for a certain number of "Nondiscretionary Contingency Funds" for the following year.

* *

The remaining sections of this proposal provide elaborated discussions of the eight components listed in the first part of this section.

II. RESEARCH, DESIGN, AND START-UP COMPONENT

A. Purpose

An initial period is required for standard administrative activities before any major project can effectively begin operations. This component specifies the preliminary and preparatory actions needed before other components can be begun.

B. Design

There are three broad types of activities which characterize this component: (1) additional research on needs assessment; (2) establishing measurable objectives for later program evaluation; and (3) administrative start-up.

(1) Needs Assessment Survey -- As mandated by the K/NSSPC (Minutes, 2/8/85, p. 4), a needs assessment survey would be carried out to validate scientifically current information about the North Shore's employment training needs. It is expected that the needs assessment survey will substantiate, to a measurable degree, present input and reflections of community needs.

Two separate needs assessment efforts are recommended: (a) a compilation by the NSCTC of available in-house information about overall job training needs on the North Shore; (b) an independent effort by KDC's Resort Training, Inc. to survey both North Shore households and employers regarding awareness, interest, and involvement dimensions for Resort jobs and/or potential training activities.

(2) Specification of Measurable Program Objectives -- Again, it is recommended that parallel and complementary actions be taken by the NSCTC and KDC's Resort Training, Inc. NSCTC's objectives would pertain to the overall Employment Resource Center effort. Resort Training, Inc. would specify objectives for the Resort-oriented training activities to be contracted out to the NSCTC's Employment Resource Center. Some or all of the latter objectives would be incorporated in the contract between Resort Training, Inc. and the NSCTC, and would form the basis for eventual monitoring and evaluation efforts by Resort Training, Inc.

(3) Administrative Start-Up Activities -- These include incorporation of Resort Training, Inc.; finalizing

a contractual relationship between Resort Training, Inc. and the NSCTC; personnel hiring for both Resort Training, Inc. and the Employment Resource Center; locating and renovating office space; purchasing needed equipment and supplies.

III. CONSTRUCTION PHASE ACTIVITY COMPONENT

A. Purpose

The first employment opportunities to be generated by Resort expansion will involve construction of infrastructure and the second hotel. The purpose of this component will be to make the maximal possible efforts to accomplish the following ideal goals: (1) increase the qualifications of local residents for such jobs; (2) facilitate the hiring of qualified residents; and (3) facilitate construction subcontract awards to local businesses.

Practically, however, our initial explorations suggest there may be limits on our ability to achieve these goals due to union hiring pracitices. On the other hand, ongoing communication with the construction labor unions is also giving us some reason to hope for progress, as initially rigid positions appear to soften somewhat with time.

B. Design

As of this writing, we are still exploring what is and is not feasible in the way of maximizing resident economic benefits from construction activities. Both general contractors and construction labor unions have standard practices and legitimate considerations of cost control and/or fairness to longtime employees, business associates, and union members. Continued exploration and negotiations are expected through at least the first year of Employment Resource Center operations.

While exact component plans and activities will depend on the outcome of these negotiations, three broad paths suggest themselves at this time:

(1) At a minimum, extensive publicity about opportunities for upcoming employment and construction subcontracts can be generated in the community. Such general publicity should be coupled with information and referral activities at the Center itself to direct interested persons to more specific resources for training or procedures for making application. Ongoing communication with chosen general contractors and unions will be essential.

(2) As a maximum, a "Project Agreement" could be negotiated between KDC or other Resort developers and the general contractor for each major construction project. This agreement would specify certain actions to be taken by the general contractor, ranging from a good-faith effort in hiring to specific requirements for allocating a given

percentage of jobs to qualified local residents. Remaining for the future are determinations about the feasibility of the concept itself or various aspects -- e.g., what requirements could realistically be imposed? can the need for such a Project Agreement be successfully communicated to (or required of) a hotel or condominium land purchaser arranging for its own construction contracts?

(3) The possibilities for training North Shore residents in construction skills must be explored. Because most such training is carried out on a union apprenticeship basis, it appears that the Employment Resource Center should not attempt to create direct training programs itself. Rather, the Center could be more cost-effective by facilitating linkages between schools or other labor supply sources and union apprenticeship or pre-apprenticeship training programs.

It would not be desirable to train residents for construction jobs which will fade away after the Resort is completed. Any training efforts should focus on trades which will be both numerous during the Resort construction period and also still in demand in following years. A preliminary assessment suggests that carpenter trades best fit this description.

IV. COMMUNITY OUTREACH AND EDUCATION COMPONENT

A. Purpose

A prerequisite for maximizing community economic benefits is maximizing community awareness that the benefits exist. An informational effort must focus on:

- o creating positive attitudes toward resort industry jobs and other activities, and addressing negative perceptions in a realistic fashion;
- o developing awareness of, interest in, and a sense of involvement with employment opportunities at various levels (particularly among young people or other major potential sources of labor supply);
- o developing awareness of, interest in, and a sense of involvement with business opportunities associated with nearby resorts;
- o publicizing the Employment Resource Center itself.

It is intended that such publicity efforts focus primarily on the substance of job training and other components, as opposed to public relations activities intended to generate political support. It is also important that community contacts involve listening as well as talking, so that the overall program can remain sensitive to community issues and concerns.

B. Design

To some extent, activities in this component will be in response to changing events and issues. For example, after several years the project staff may feel a new slide show is needed (and would then initiate a request for some "Nondiscretionary Contingency" funds for the following year). Or a flare-up in labor union problems might require a temporary shift in attention.

However, three general types of activities will clearly be needed both in the early stage and at various later times on an ongoing basis:

(1) General community contacts -- Project staff will use local media to disseminate information regarding the various topics listed earlier under "Purpose." For example, materials providing accurate information about tourism jobs or pointing out future business opportunities will do few people much good if they remain unused in the office; an

active effort must be made to publicize some of the facts and to invite people to come into the Employment Resource Center for more information.

However, the North Shore is a very personal place, and there are numerous clubs and organizations. Trust is based in part on familiarity. The intent is to be sensitive to these community characteristics and to have appropriate project staff attend many community meetings, in both a speaker's and an observer's role. During the start-up phase, a slide show and written materials will be developed to publicize various aspects of Resort employment and the Employment Resource Center. Even when not speaking, the staff members would continue to attend selected organizational meetings in order to maintain close community contacts.

Through both the news media and also the contacts with groups such as the Neighborhood Boards and PTA's, an effort will be made to influence parents' awareness and attitudes regarding Resort job opportunities, so that they may encourage their older children to explore these opportunities.

(2) Linkages with labor supply sources -- The project staff must establish close ties with schools, employment services, labor unions, etc. Most of these linkages would soon be directed into specific activities for other components (e.g., job preparation or training programs).

However, communication with schools would serve a purpose in addition to identifying high school seniors for Resort jobs. First, project staff should sometimes serve as a liaison between schools and the Resort to ensure that local youths (even elementary and intermediate students) receive positive exposure to the Resort through field trips and other programs, so that the idea of working at the Resort becomes natural to them. Second, linkages with counselors and vocational programs are important because few such school programs now orient students toward service industries. The emphasis is still on the agricultural past. The educators must be educated about the Employment Resource Center if it is to succeed.

(3) Linkages with groups providing information on visitor industry employment -- The Employment Resource Center must help disseminate information to counter negative attitudes about tourism jobs, but it cannot take on the burden of developing such information. Rather, it should establish close contacts with groups such as the Visitor Industry Education

Committee, which provides such materials on request. It may also be appropriate to stay in touch with State agencies and academic organizations which do research and print information which could be of practical use to local residents in their job decisions.

V. INTAKE, COUNSELING, AND REFERRAL COMPONENT

A. Purpose

The purpose of this component would be to follow up on community outreach efforts with personalized services at the Center itself. Basically, the name of the component refers to the three inter-related services available to the resident who walks into the Center for the first time:

- o <u>Intake</u> has to do with logging each individual in, determining needed assistance, assessing the individual's skills or resources, and perhaps recording the person's interest for retrieval at a later and more appropriate time.

- o <u>Counseling</u> is a dynamic and purposeful relationship between two or more persons. Exact procedures may vary, but there is always mutual participation by the counselor and the individual, with focus on self-understanding, self-determination, and action by the individual.

- o <u>Referral</u> involves directions to appropriate agencies for specific training or other assistance. (One of the "appropriate agencies" might be another component of the Employment Resource Center itself.)

B. Design

Intake services would be designed to serve a broad range of residents, in terms of their job preparedness. Many potential Resort job applicants will be fully job-ready and can be referred directly to an appropriate job. Others, however, will lack some level of skills or face other barriers, and these would need to be addressed prior to job referral.

The basic types of services to be offered would include the following:

(1) <u>Personalized assessment and counseling</u> -- People interested in job assistance would first fill out an employment information form listing education, work history, desired type of work, and other information needed to determine job readiness. Applicants would then meet with the vocational counselor, who would review the form and elicit more detailed information (particularly about work history and habits).

It the vocational counselor and the individual agree that the individual is "job-ready" or simply needs information and referral, then one or both of the next two services (see below) would be offered. In some cases, however, an intensive assessment of vocational interests and aptitude would be needed prior to any referrals. Standard techniques would be used for this purpose.

(2) Information/referral for education and training -- The Employment Resource Center would provide detailed information about those agencies which can assist people needing additional skills. The challenge on the North Shore is to provide such information in a form which can be understood by the various types of people and is of actual use to them. We would expect our staff to work with community advisors to ensure that written and oral communications are of appropriate form for the South Pacific islander, the Filipino immigrant, the Hawaii-born high school dropout, etc. This may mean preparing several alternative forms of the same information.

"Referral" in some cases will mean not only telling people where to go, but making the necessary calls and personal introductions on their behalves.

(3) "Banking" of job applicants and openings -- The NSCTC is eager to explore the feasibility of two computerized information "banks."

The first of these, called a "Skills Bank," would store information about all of those who have expressed interest in specific Resort jobs -- both those people evaluated as "job-ready" and also those who are working toward this status. Center staff would translate each individual's job goal into one or more codes from the Dictionary of Occupational Titles (DOT). When there is a need to find people for a job vacancy, the appropriate DOT code could be used to pull out names and matching information about work history, training status, interests and aptitudes, etc.

The second of these would be a "Jobs Bank," which would simply be a list of available and/or anticipated jobs by DOT code. The use of the DOT code would allow the two systems to function in an integrated fashion, thus providing a service both to job-seekers and employee-seekers.

In one sense, these two functions duplicate services or activities which can be expected to exist anyway -- i.e., Resort personnel functions and public or private employment service functions. However, the Center's system would provide

efficient linkages which would not otherwise exist. The feasibility of these concepts will depend on the interest of the other agencies (particularly the Resort personnel offices) in such efficient linkage, which will in turn depend on the quality of the Director's networking efforts.

(4) Client follow-up -- To assure a sense of accountability to job-seekers who utilize the Center, a follow-up procedure will be instituted to require staff to maintain contact with clients at specified intervals after counseling or referral sessions.

(5) Information/referral for business development -- In addition to printed or oral information, the Center will make efforts to incorporate on-site participation by other agencies (such as the Oahu Private Industry Council or the Hawaii Entrepreneurship Training and Development Institute), if such groups are interested.

VI. JOB PREPARATION COMPONENT

A. Purpose

The purpose of this component would be to provide remedial assistance to area residents who lack basic skills to enter a vocational program or to secure employment, or who lack work habits, attitudes, and related behaviors considered important by employers.

Thus, the thrust of this component is to prepare residents who would otherwise not be truly ready for job-specific training.

B. Design

Four activities or aspects of this component are envisioned:

(1) Networking with agencies involved in providing "basic skills" -- NSCTC staff believe lack of basic skills to be the single most important barrier to employment for disadvantaged North Shore residents. The Center will identify and network with all existing providers of basic skills and other remedial education service providers on the North Shore. The intention is not only to make referrals, but also to help coordinate and strengthen existing services, which are judged to be scattered and inadequate.

Three separate but complementary methods for improving basic skills have been identified -- linkages with the traditional education system; a volunteer instruction network; and a new instructional "package" which could be provided directly at the Employment Resource Center.

The traditional education system offers remedial training through Adult Education, community colleges, and possibly modifications of vocational education programs worked out through the high schools. Private organizations with targeted client groups -- e.g., Kamehameha Schools, which serves part-Hawaiians -- also could play an important role. The intent is to seek coordination, resources, and possibly even supplemental funding from such sources.

A second approach would be attempts to establish a North Shore volunteer instruction network, to provide one-on-one tutoring for individuals who do not fare well in classroom settings or who might

not cope with the computerized system described in the following paragraph. The possibilities of "piggybacking" on existing networks -- e.g., the Hawaii Literacy Program -- would be explored before any completely new effort is attempted.

Finally, the NSCTC and Windward Community College are eager to find a way to bring a basic skills package called the Comprehensive Competencies Program (CCP) to the North Shore. CCP is a partially computerized package which allows people to work on an individualized basis at their own rates, thus avoiding the "shame" of failure in a group context which inhibits educational efforts for many of Hawaii's cultural groups. It is described in more detail in an appendix. However, it should be noted here that the program covers both academic skills (reading, writing, math, etc.) and functional skills (consumer economics, government, health, etc.).

CCP would require a considerable investment in equipment and personnel. There have been indications that other agencies may be interested in participating in some jointly-funded program. The Center would attempt to foster and coordinate that interest. It is probable that some "Nondiscretionary Contingency Funds" would soon be sought to provide seed money -- hopefully on a matching basis -- to establish a CCP facility in or near the Center.

(2) Networking and/or direct provision of instruction in work habits and attitudes -- Resort personnel offices interviewed by KDC consultants have said that, for entry-level jobs, the major deficits found in rural Hawaii populations have to do with attitude and work ethic. Some groups in this state have cultural values which encourage a noncompetitive, egalitarian approach to work and life, resulting in conflict when they enter typical Western hierarchical employment settings.

Parallel to the efforts to provide "basic skills" must be efforts to bridge such cultural gaps. This objective could well prove more difficult, and different agencies may be involved -- e.g., the State Department of Education will play a major role in remedial education, but there must be more contact with ethnic self-help groups in order to narrow the cultural gaps. Some attention should also be paid to educating Mainland-trained hotel managers about "local style." (At the same time, it should be noted that cultural differences are not the only element to be considered.)

One possible approach for instilling habits and attitudes would be to expand the "functional skill" aspects of CCP to deal with cultural and motivational issues. Additionally, cooperative efforts with school and social service agency counselors must also be considered, along with the possibility of using the previously-mentioned volunteer instruction networks to address attitudinal as well as educational deficits.

(3) Provision of mini-courses in job search or job interview skills -- While it is also proposed in the next component that the Center staff take a vigorous role in helping to place area job-seekers in Resort positions, we also propose something which will have more long-term benefit: direct "mini-courses" in job search and/or job interview skills, so that residents will not be dependent on others to find jobs for them.

The purpose here is to teach job-seekers how to prepare resumes, fill out application forms, dress for interviews, and conduct themselves in such a way as to favorably impress the interviewers. A number of effective job search program models have been developed and are available on a non-proprietary basis. These program models are being reviewed in terms of their appropriateness to the needs of North Shore residents.

The Employment Resource Center would teach such skills on a direct-service basis, but there is also some possibility of assistance from other agencies. For example, State Labor Department personnel who are based in public schools (e.g., the Waialua High School Transition Center staff) are available for services to the wider community during summers.

(4) Contingency planning for retraining agricultural workers -- Increasing mechanization and cutbacks in productive acreage have sometimes resulted in the displacement of agricultural workers in Hawaii. Near Kuilima, the Waialua Sugar Plantation has had to lay off all workers for short periods each year, reflecting economic difficulties faced by all plantations in the current world sugar market. Many of these 400 or so sugar workers are foreign immigrants with limited English and work experience outside the plantation. A well-thought-out retraining program may thus be in order as a contingency preparation for possible future displacements among these workers.

We propose making careful preliminary contacts with the plantation (and, conceivably, the union and local government at a later time) to explore the need for a contingency plan. One should probably be drawn up simply for the Center's own sake, but the extent of detail and resources committed to it would depend on the attitude of the plantation management or the other institutions involved.

VII. VOCATIONAL TRAINING AND PLACEMENT COMPONENT

A. Purpose

The purpose of this component would be to assure the provision of specific vocational skills to fill a particular job, and/or then to help a job-ready individual obtain a desired position at the Resort.

B. Design

This component is anticipated to consume much of the Center staff's time and resources, and the activities are varied. At the same time, they are particularly simple to describe:

- Existing vocational education service providers and programs would be identified and linkages developed. Some of these providers would be the Cooperative Education Program at Waialua High School, the Career Resource Centers at various area high schools, and the State's Adult Education program.

- Specific training needs of hotel operators would be identified through an analysis and matching of job openings in the Jobs Bank with qualified residents listed in the Skills Bank. A lack of a significant number of qualified applicants would indicate a need for recruitment and training.

- If requested, Center staff would work with hotel management and service providers to develop programs tailored specifically to meet start-up training needs.

  Staff would have the capability of functioning as broker between management and service providers, facilitating all aspects of the process, arranging training sites in the community, and ensuring referral to training of adequate numbers of qualified area residents.

- If requested, the Center staff could even assume selected personnel office functions, such as recruitment and/or screening of applicants at start-up times.

- The Center would develop a cooperative agreement with the State Employment Service (and network with area employers) to maintain an expanded list of area job openings in the Jobs Bank.

- However, in addition to these computerized placement methods, it is also expected that staff would "get their hands dirty" (or, more accurately, their telephones) by staying in constant touch with employers and labor supply sources. If a school counselor has a qualified student with a need for a Resort job, Center staff would work vigorously and personally to find an opening. If a Resort operator has an upcoming opening for an entry-level person, the Center staff would work equally hard to call schools or other labor sources to find an area resident to fill that opening.

- Assuming the availability of scholarship funds from KDC and/or Resort operators, the Center would help develop a scholarship program for local high school graduates to attend college in Travel Industry Management.

- The Center staff would help establish -- and perhaps provide part-time staff for -- a volunteer committee to facilitate technical and financial assistance for new North Shore businessmen. Committee members would be recruited from expertise available in the area (e.g., bankers).

VIII. IN-SERVICE UPGRADE TRAINING COMPONENT

A. Purpose

In-service upgrade training refers to programs for established resort employees which upgrade current skill levels and/or provide new abilities needed for promotion.

Facilitating promotion is a particularly sensitive issue in Hawaii, where there is a frequent perception that local residents are trapped in "dead-end" jobs while outsiders take the managerial and even mid-level supervisory positions. (In actuality, a number of Hawaii hotel operators, including the Turtle Bay Hilton, report local residents often resist taking positions of authority -- for a variety of cultural reasons -- but this does not negate the poor social conditions and consequent poor community relations which can result when too few of the "bosses" are local residents.)

Given KDC's plans to open all three new hotels in a relatively short period of time, there may be some reason for concern that the demand for supervisory and management labor could exceed the locally-available supply. This could result, at least in some hotels, in a situation where many lower-level employees are longtime local residents but their superiors have been imported from outside. The hotels most affected would probably be the first ones, since their supervisory/management employees are particularly likely to find opportunities for advancement at the newer hotels. The challenge is to make sure that motivated lower-level employees at the older hotels are provided with the opportunity to acquire the skills needed to fill the expected vacancies above them.

Even those in-service training programs designed only to sharpen skills for current jobs (rather than promotions) are important to the goal of maximizing resident employment. Employee boredom or incompetence can lead to turnover, and too much turnover will exhaust the local labor supply and lead to inmigration.

Thus, there are a number of ways that in-service upgrade training programs relate to the overall objective of minimizing turnover and/or need to import labor:

(1) preventing employee "burnout" and community backlash through opportunities for local residents to earn promotions;

(2) preventing employee "burnout" simply by providing new experiences and growth opportunities in current positions;

(3) preventing employee "burnout" by providing new experiences and growth opportunities in higher-

skilled positions in departments other than the one in which the employee currently works;

(4) preventing inmigration of supervisory personnel during the crucial new hotel start-up phases; and

(5) minimizing local employee attrition as changing conditions lead to demands for new skills in the same jobs (e.g., need to master new languages as the mix of visitors shifts).

B. Background Perspective

Unlike many hotel personnel directors, the current Director of Human Resources at the Turtle Bay Hilton has a strong training background and provides many in-service courses and programs for employees. These include both a three-year apprenticeship program in conjunction with Leeward Community College for employees wishing to enter positions requiring specialized skills (e.g., maintenance or specialty cooks), as well as shorter courses taught in the hotel and dealing with topics such as:

- Japanese language
- guest relations
- supervisory skill development
- communications seminars
- hotel law
- report writing for security personnel
- energy management
- CPR/first aid
- "human resources training" (e.g., stress management)

Most of these courses are taught by in-house personnel, with occasional outside instructors paid largely by bartering free vacation time at the hotel. However, the Director of Human Resources reports that these classes represent a significant strain on her time and resources (and that of her staff). While some other hotels have "training coordinator" positions, many do not, and she believes that the North Shore Career Training Corporation could provide valuable assistance to both the hotels and the community by supplying some of this training on a resort-wide basis as additional hotels come on line.

C. Design

The basic need is simply for one qualified individual who can handle many of the training programs him/herself, plus arrange space and facilities when an outside instructor (e.g., a foreign language teacher) must be called in. During the period when new hotels are about to start up, there may also be a need to involve outside academic institutions (e.g., Windward Community College, BYU Hawaii) with special capabilities in teaching managerial skills. Thus, the individual must also be able to communicate successfully with such institutions, as well as hotel personnel offices.

When new hotels are starting up, the primary emphasis would be on preparing groups of employees for upcoming promotion opportunities. At other times, or after all hotels are built, relatively more emphasis would go to courses which sharpen skills and enhance satisfaction with current positions (and/or higher-skilled positions in other departments). The in-service training specialist would be a resource person for hotel personnel directors in designing their training program. This individual may also serve as a sort of roving career counselor, getting to know employees throughout the resort and encouraging capable ones to aspire and train for higher positions.

Start-up costs would include purchase of some audio-visual equipment and perhaps some standardized training modules. (For example, the Turtle Bay Hilton's "supervisory development" course consists of the Zenger/Miller package of 25 lessons.) Thereafter expenditures would generally be limited to purposes such as transportation, facility rental, and occasional lecturer fees. It is possible that some additional "Nondiscretionary Contingency" funding might be requested for the intensive training periods anticipated in the six-month periods before each of the three new hotels come on line.

IX. "OTHER SUPPORT SERVICES" COMPONENT

A. Purpose

As the Employment Resource Center develops, we would expect to encounter community needs and problems which interfere with the overall goal of maximizing the Resort's economic benefits for North Shore residents. The purpose of this component would be to provide a vehicle for attacking such problems through staff time and occasional "seed money" for selected demonstration projects.

The types of issues to be addressed would need to have a direct bearing on Resort-related employment or business opportunities. No such issues have been definitively established as of this time, but several ideas have been suggested which will be further explored in the future -- e.g., child care facilities (to allow more mothers of young children to enter the labor force) and transportation assistance to the Resort area.

B. Design

This component is intended to be a very flexible and discretionary aspect of the overall program. It would not have a fixed design.

As earlier noted, there are essentially two resources which can be brought to bear on obstacles to local resident benefits: staff time and money.

If the Director believes that serious progress can be made by devoting time (for example, lobbying with government agencies), then this would usually be the preferred alternative. Of course, the Director may have to defend such a decision in any annual accounting should other activities suffer. Using child care as an example, we would expect that the Center's first reaction to requests for assistance would be to devote staff time for (1) establishing that a link exists to Resort employment, and, if so, (2) contacting appropriate private or public agencies to address the problem.

Should it become apparent that existing agencies cannot or will not solve the problem, the Director may apply for some "Nondiscretionary Contingency Funds" in the following year's budget to take temporary action. Again using child care as an example, the request might be to provide seed money for a North Shore nonprofit group (or even KDC itself) to run a demonstration employee child care facility for a year or two. (The Center would not itself operate such facilities, nor would it be involved in any such activity on a permanent basis.)

Funding requests would have to be accompanied by documentation of the need and its relevance to employment, and any proposed solution should also be accompanied by proof of community interest and acceptance.

APPENDICES

[To be prepared later —]

- o Background on North Shore Career Training Corp.
- o Information on CCP.