

1990-Oahu-FEIS-

Country Courses
Malaekahana II

FILE COPY

Final

Environmental Impact Statement

**COUNTRY COURSES
AT KAHUKU**

Malaekahana

Kahuku, Koolauloa, Oahu

VOLUME II

THE ESTATE OF JAMES CAMPBELL

Tax Map Keys:
5-6-06: 2 and Portion of 6

Prepared By:
William E. Wanket, Inc.

May 1990

FINAL
ENVIRONMENTAL IMPACT STATEMENT
VOLUME II
**THE COUNTRY
COURSES AT KAHUKU
(MALAEKAHANA)**
Kahuku, Oahu

May 1990

Submitted pursuant to Chapter 343, Hawaii
Revised Statutes, Environmental Impact
Statement Regulations.

Prepared For: **THE ESTATE OF JAMES CAMPBELL**
For Submittal To: **DEPARTMENT OF GENERAL PLANNING**

Prepared by: **WILLIAM E. WANKET, INC.**



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VOLUME II

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MALAEKAHANA SITE**

Smith, Young & Associates, Inc.

APPENDIX A

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MALEKAHANA

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Malaekahana

SOILS REPORT

FOR

THE COUNTRY COURSES AT KAHUKU

MALAEKAHANA SITE

PREPARED FOR

THE ESTATE OF JAMES CAMPBELL

PREPARED BY

DAMES & MOORE

1144 10TH AVENUE

HONOLULU, HAWAII 96816

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APRIL 1990

APPENDIX DM-1
MALAEKAHANA GOLF COURSE

SOILS

INTRODUCTION

This Appendix presents our findings regarding soil conditions for the proposed development of an 18-hole golf course in the vicinity of Kahuku on the North Shore of Oahu. The approximate location of the site is shown on the Map of Area, Plate M-1.

This report addresses the following:

- a. Site Conditions
- b. Geology
- c. Soil Classifications
- d. Anticipated impacts and mitigative measures.

SITE CONDITONS

The project site exhibits varying terrain, consisting of many low-lying, elongated knolls and hills range in elevation from 20-40 feet to 100-150 feet above mean sea level (MSL). The highest elevations occur at the northwest corner of the site. A number of elongate, discontinuous, low-lying knolls and small round-topped ridges form transverse to the site; they trend mostly northwest to southeast (NW-SE). These elongate ridge-like features alternate with smooth flat-lying pasture lands. Surface slopes range from 1-3 to 10 percent over most of the central-mauka protions of the site. Steepest slopes occur around isolated peaks, escarpments, and along the margin of the Malaekahana Stream where slopes of 20 to 30 percent occur. The northern boundary is dominated by a wide, moderately shallow stream valley. Upland and mauka of the site, several narrow gulches feed into the Malaekahana Stream.

GEOLOGY

REGIONAL GEOLOGY

The Koolau Volcano forms the eastern two-thirds of Oahu, and is the erosional remnant of a deeply dissected large-volume tholeiitic lava-shield in an oceanic intraplate tectonic environment. The regional rock types include gently-dipping, thin-bedded a'a and pahoehoe flows cut by numerous narrow near-vertical dikes of similar basaltic material.

The site located along the northern extension (windward Oahu) of the Koolau lava dome adjacent to the bordering coastal plain region (Plate M-1). The rocks associated with the lava dome in this region are chiefly thin-bedded a's and pahoehoe type tholeiitic (primitive) basalts with little or no pyroclastic ash deposits. This portion of the lava dome is less deeply eroded than the southeastern portion near Kaneohe and Kailua, with the exception of long, meandering river valleys, narrow gulches and associated cliffs. In the Kahuku and Laie areas, beds of reef limestone are intercalated with other non-marine (terrigenous) sediments indicating the complexity of the goeologic

history in this region. The occurrence of consolidated ancient wind blown eolian (dune) deposits at elevations greater than 200 feet above mean sea level (MSL) have added to the complexity of the geology this area.

SITE GEOLOGY

The Malaekahana site is located approximately one mile northeeast (windward side) of the main northwest dike-complex (Plate M-1).

Basaltic lava flows in varying stages of weathering, along with their associated alluvial deposits outcrop in the highland areas along the northwest corner of the site. These deposits occupy approximately one-quarter to one-fifth of the site surface area. The lowlying elongate knolls are composed mainly of consolidated, calcareous, eolian dune deposits and can reach elevations greater than 100 feet at the site. These deposits occur throughout the central region of the site, and account for approximately one-fourth of the surface area. Unconsolidated noncalcareous alluvial deposits infill the smooth flat-lying valleys and cover approximately half the site. In general, there are very few good exposures of unweathered basalt rock outcrops within the site. At higher elevation, some weathered basalt outcrops were noted in the heavily vegetated areas to the northwest. Consolidated, calcareous, eolian dune deposits occur within the heavily vegetated lowlying elongate knoll areas that run diagonally across the central portion of the site (in the south and southeast region).

SOIL CONSERVATION SERVICE CLASSIFICATION (SCS)

MALAEKAHANA GOLF COURSE SITE

According to the U. S. Department of Agriculture Soil Conservation Service (SCS), soils in the Malaekahana area consist of mainly clay, silty clay, coralline sandstone and varying degrees of weathered basalt rock outcrops. Based on the SCS soils survey, the Malaekahana site can be divided into four major categories. They are: Jaucas Series, Kawaihapai Series, Keaau Series, and Lahaina Series. Based on the SCS soils map, many of the major categories are broken up into a number of subseries, and will be discussed in the following sections and outlined in Table 1 and shown on Plate M-2.

The Jaucas Series consists of excessively drained calcareous soils that occur as narrow strips on coastal plains. In a representative profile, the soil is pale brown to very pale brown fine-grained sand. In many places, the surface layer is dark brown.

A brief description of the subseries soil type follows:

- a. Jaucas Sand, saline, 0-12 percent slopes (JaC). This soil occurs near the ocean in areas where the water table is shallow and salts have accumulated. On this soil, permeability is rapid, runoff is very slow to slow, and erosion hazard is severe when lacking vegetative cover. This soil covers approximately 10 acres or 5 percent of the site.

Kawaihapai Series consist of well-drained soils in drainage-ways and on alluvial fans. These dark brown clay soils form an alluvium derived from basaltic rock in humid uplands. Elevations range from near sea level to 300 feet.

- a. Kawaihapai Clay Loam, 0-2 percent slopes (K1A). This soil occupies smooth slopes. It is dark brown clay loam that grades into a silty gravelly sand that is slightly plastic and slightly sticky. Permeability is moderate, runoff is slow, and erosion hazard is slight. This soil covers approximately 8 acres or 4 percent of the site.

Keaau Series consist of poorly drained soils on lowlands on coastal plains. They develop in alluvium deposited over reef limestone of consolidated calcareous sand. They are nearly level to gently sloping and occur at low elevations that range from 5 to 40 feet.

- a. Keaau Clay, 0-2 percent slopes (KmA). This soil is very dark grayish-brown clay. It has a subangular and angular blocky structure, with a white to very pale brown reef limestone or consolidated calcareous sand substratum. Permeability is slow, runoff is slow, and erosion hazard is slight. This soil is very sticky and very plastic, with high shrink-swell potential. This soil covers approximately 18 acres or 9 percent of the site.

The Lahaina Series consist of well-drained, dark reddish brown silty clay. These silty clay soils contain cobbles (of cemented calcareous dune deposits and weathered basalts) on the surface in the upland areas, and near the coastal plains. They commonly contain coralline fragments (stones, gravel, or sand). These soils show a strong effervescence with hydrogen peroxide, which is directly related to the abundance of fine-grained calcareous material that is contained within.

- a. Lahaina Silty Clay, 3-7 percent slope (LaB). This soil occurs on smooth upland areas and locally contains considerable cobbles of mainly recemented and/or recrystallized calcareous dune sands (eolian deposits). In some places, particularly along the coastal plains, just north of Kamehameha Highway, these silty clay soils are underlain (below 30 inches) by consolidated (beach sand) eolian dune deposits that show varying degrees of calcite recrystallization. Permeability is moderate, runoff is slow, and erosion hazard is slight. This subseries make up the second largest single soil type found at Malaekahana site. It covers approximately 26 acres or 13 percent of the site.
- b. Lahaina Silty Clay, 7-15 percent slope (LaC). This soil occurs on steep slopes where only a few cobbles are on the surface. Runoff is medium and erosion hazard is moderate. Those soils cover approximately 70 acres or 35 percent of the site.

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)

The ALISH classification system consists of identification of three broad classes mapped as agricultural land based, in part, on the criteria established by the Soil Conservation Service (SCS) soil survey. The State Department of Agriculture classifies approximately 46 acres or 23 percent of Malaekahana Site as Prime Agricultural Land, 76 acres or 38 percent as the Other Important Agricultural Land, and 78 acres or 39 percent as land that has not yet been classified. Based on the ALISH classification system, none of the Malaekahana Site is considered as Unique Agriculture Land or Existing Urban Development Lands (Refer to Table 2 and Plate M-3).

DETAILED LAND SURVEY BUREAU CLASSIFICATION (LSB)

the Land Study Bureau (LSB) classifies soils by land type in which categories are provided for an overall crop productivity rating, with and without irrigation, and for selected crop productivity ratings for seven crops. LSB overall ratings range from A to E, with A being the best. Capability classifications within the Malaekahana site are shown on Table 3, and soil type are shown on Plate M-4.

LAND EVALUATION AND SITE ASSESSMENT SYSTEM (LESA)

The LESA Commission's findings, conclusions, and recommendations concerning development of the State of Hawaii's "Important Agricultural Lands" (IAL) was presented in its final report dated February 10, 1986.

This report presents a classification system by which State of Hawaii lands were identified, and a process to review request for a change in designation of specific parcels from IAL to "urban" or to "other uses" and vice versa.

Lands identified as "important agricultural lands" can be reclassified by the State or rezoned by the Counties only after meeting the criteria established by the State Legislature and approved by a two-third vote of the body responsible for the reclassification or rezoning action.

Two categories of "agricultural lands" were established as a consequence of implementing the LESA standards, criteria, and procedures. They are: (1) Important agricultural lands; (2) other than important agricultural lands.

In checking with the Hawaii State Department of Agriculture, only generalized maps illustrating the application of the LESA system exist at this time. No detailed studies or maps using the LESA system have been made for the Kahuku area.

ENVIRONMENTAL ISSUES RELATED TO SOILS THAT COULD IMPACT OR ENHANCE THE GOLF COURSE

- o The site has very little expansive soils with high shrink-swell capacity.
- o Approximately 10 to 15 percent of the site contains soils with abundant dense consolidated lithic fragments rich in coarse-grained cobbles and boulders of cemented fine-grained dune sands. These materials may be of poor quality as top soil for golf course development.
- o Based on the LSB soil classification system, none of the soils at this site is considered as Type "A" soils. However, 59 percent of the site is the next best choice for agricultural land class "B". Based on the ALISH classification, approximately 23 percent is considered as Prime Agriculture Land.
- o There are very few unweathered basalt outcrops at the site. Only an isolated small elongate knoll composed chiefly of coralline sandstone may pose difficulty to excavation and grading.

TABLE 1: SOILS CONSERVATION SERVICE CLASSIFICATION (SCS)
 GOLF COURSE AT MALAKAHANA SITE
 FOR THE ESTATE OF JAMES CAMPBELL
 JOB NUMBER 07597-020-011

SOIL TYPE	DESCRIPTION	APPROXIMATE ACREAGE (%)	PERCENT TOTAL (%)	PERCENT SLOPE (%)	DRAINAGE RUNOFF	EROSION HAZARD	CAPABILITY CLASSIFICATION NONIRRIGATED	CAPABILITY CLASSIFICATION IRRIGATED
CR	Coral outcrop (coraline sand dunes)	68	34	0 to 15	slow	slight	VIIIa	-
JeC	Jucas Sand (calcareous collan deposits)	10	5	0 to 12	very slow to slow	severe	VIe	IVs
KeA	Keou Clay (dark brown, bottled clay)	18	9	0 to 2	slow	slight	W	IIIv
KIA	Kowihopei Clay Loam (dark brown)	8	4	0 to 2	slow	slight	IIc	I
LeB	Lahaina Silty Clay (coral sandstone frags.)	26	13	3 to 7	slow	slight	IIIc	IIe
LeC	Lahaina Silty Clay (coral sandstone frags.)	70	35	7 to 15	medium	moderate	IIIe	IIIe
TOTALS =		200	100					

TABLE 2: AGRICULTURE LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)
 PALAEXAHANA SITE
 ESTATE OF JAMES CAMPBELL
 JOB NUMBER 07597-020-011

LAND USE CLASSIFICATION	APPROXIMATE ACREAGE	PERCENT OF TOTAL (%)	DESCRIPTION
Prime Agricultural Land	46	23	Land with the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed according to modern farming methods.
Other Important Agricultural Land	76	38	Land with special combination of soil quality, location, growing season, moisture supply, and is used to produce sustained high quality and/or high yields of a specific crop when treated.
Unclassified Agricultural Land	78	39	Land not yet classified by Department of Agriculture, State of Hawaii.
TOTALS =	200	100	

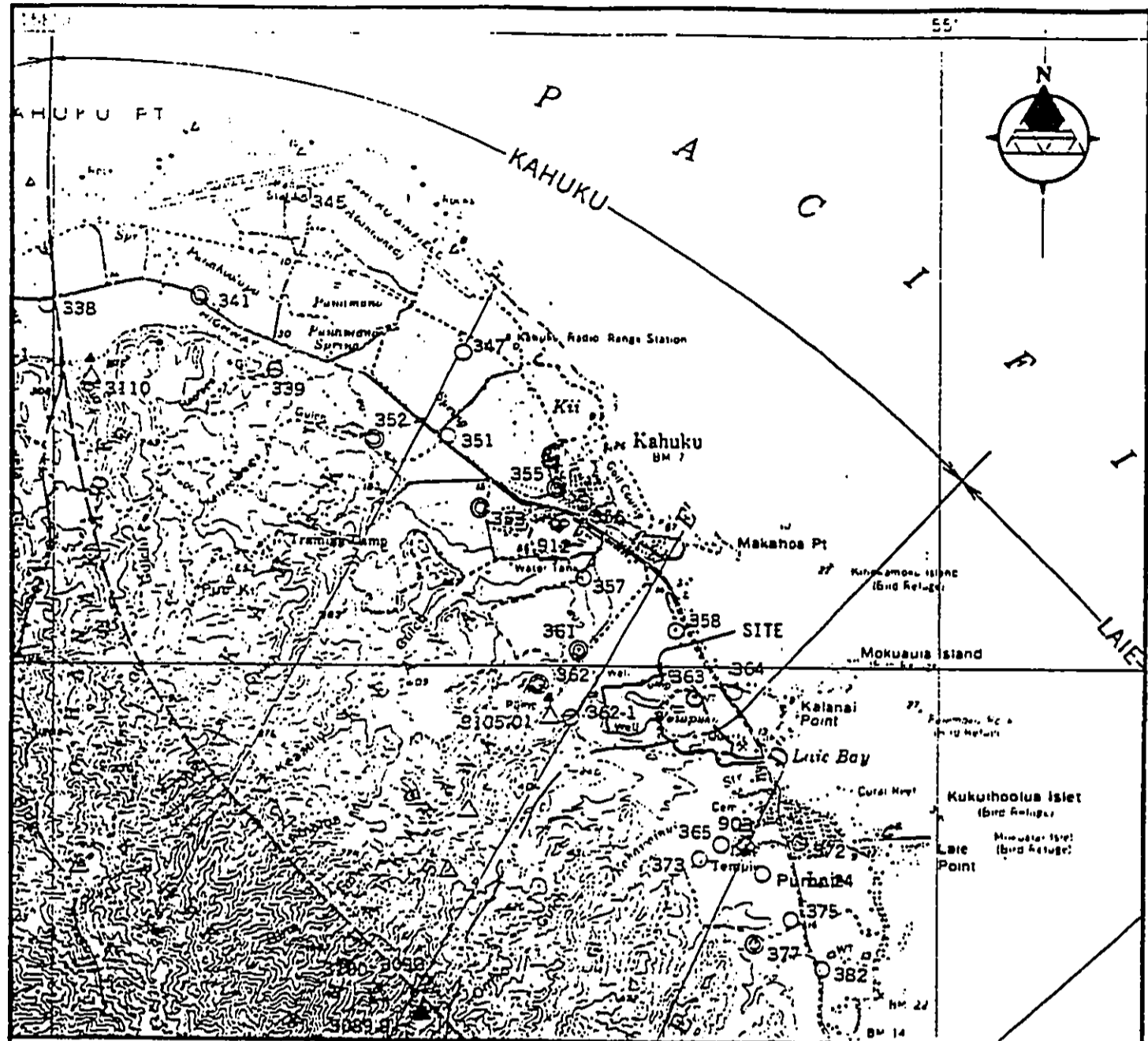
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

TABLE 3: LSB LAND CAPABILITY CLASSIFICATION
 MALAEKAHANA SITE
 ESTATE OF JAMES CAMPBELL
 JOB #07597-020-011

Soil Type	Approximate Acreage	Percent Total (%)	Capability Classification	
			Nonirrigated	Irrigated
B13	6	3	C	B
B24	54	27	C	B
B25	8	4	D	B
B27	40	20	C	B
C8	2	1	D	C
CS1	10	5	C	B
DB	8	4	D	C
E115	68	34	E	E(1)
U	2	1	-	-
Quarry	2	1	-	-
Total =	200	100		

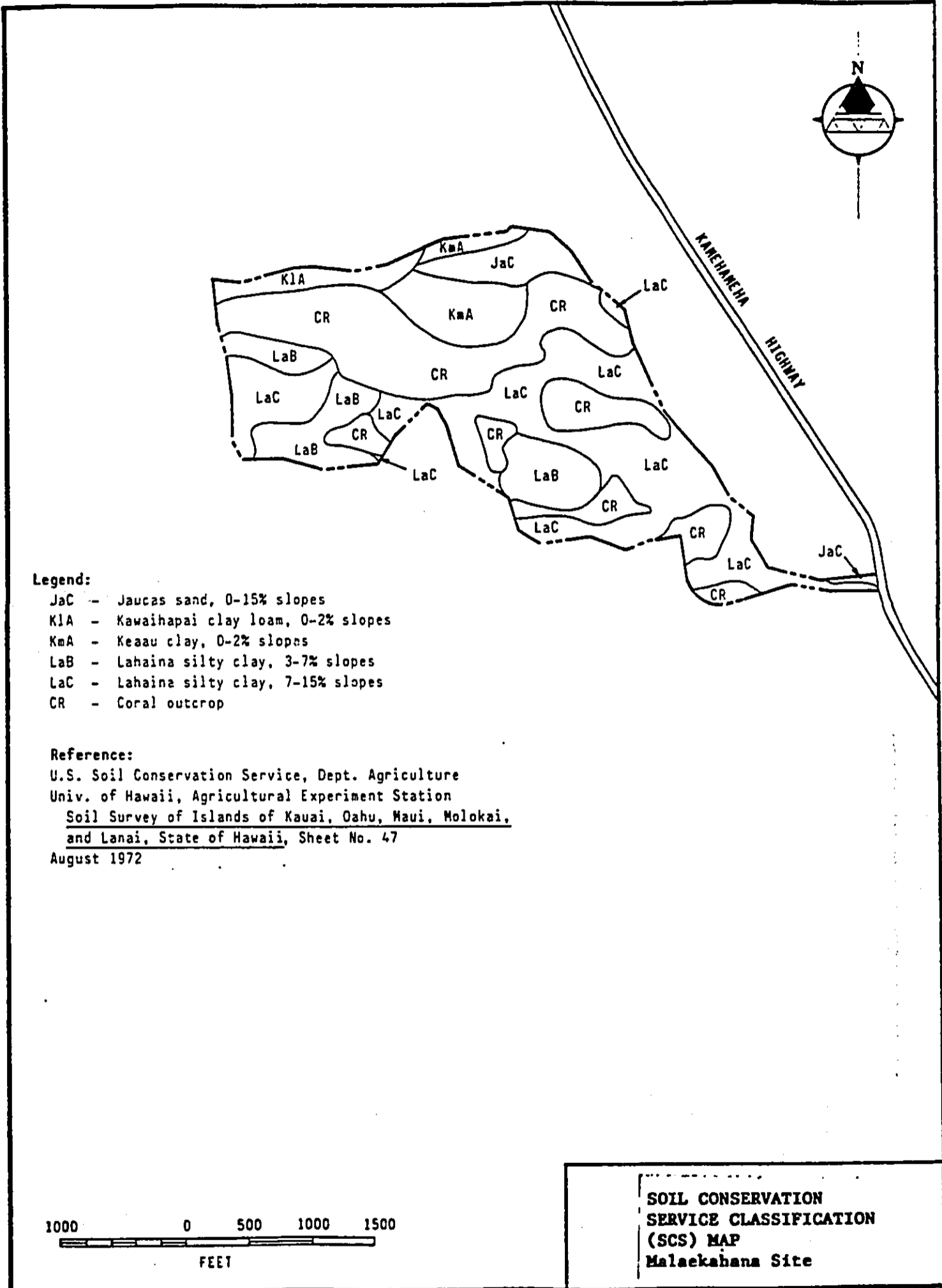
(1) Nonirrigated rating used when no rating is given for irrigation
 U = Urban

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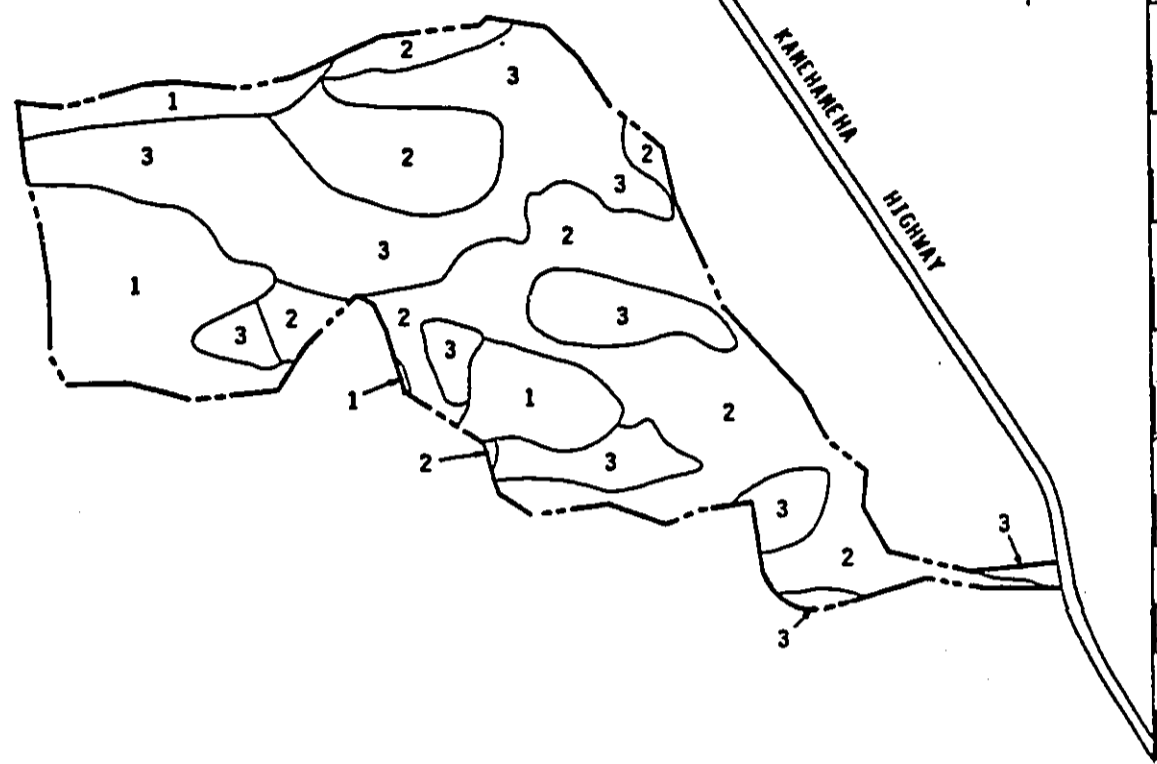
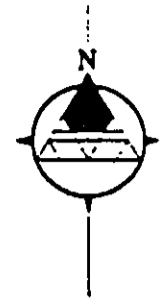
Reference:
 Department of Land & Natural Resources, State of Hawaii
 U.S. Geological Survey
 "Hydrologic Map of the Kahuku Area, Oahu, Hawaii"
 Water Supply Paper 1674, Plate 1, 1969.

PLOT PLAN
Malaekahana Site



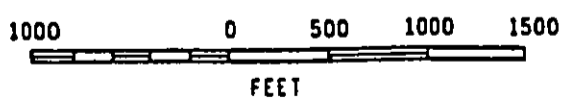
Legend:

- 1 - Prime Agriculture Land
- 2 - Other Important Agriculture Land
- 3 - Unclassified Agriculture Land

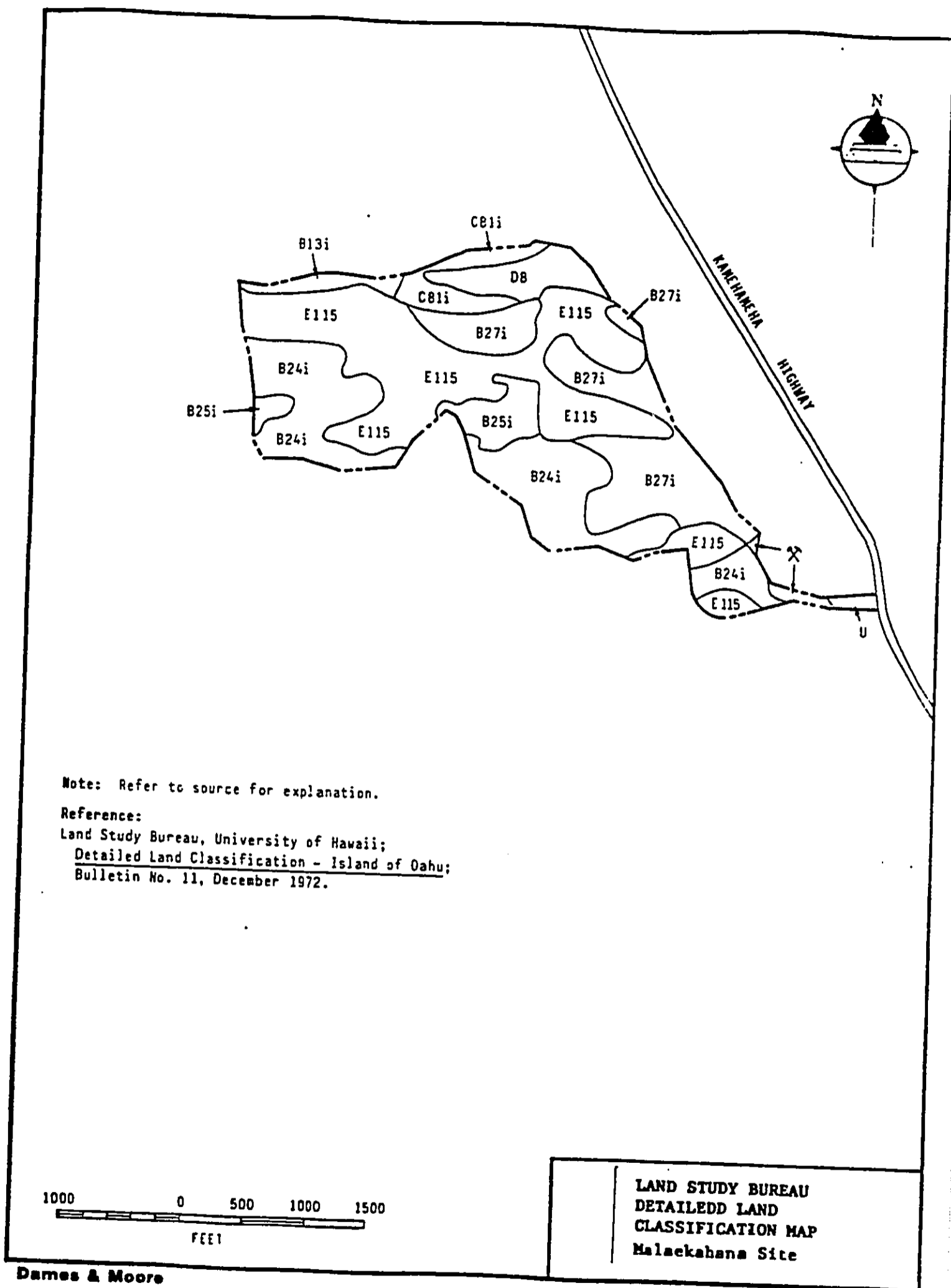


Reference:

Department of Agriculture, State of Hawaii
Map - Agricultural Lands of Importance to the State of Hawaii
Kahuku, Sheet 0-7
January 1977

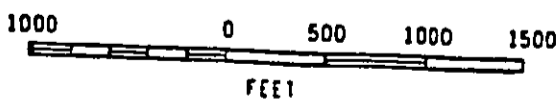


**AGRICULTURAL LANDS
IMPORTANT TO THE STATE
OF HAWAII (ALISH)
CLASSIFICATION MAP
Malaekahana Site**



Note: Refer to source for explanation.

Reference:
 Land Study Bureau, University of Hawaii;
Detailed Land Classification - Island of Oahu;
 Bulletin No. 11, December 1972.



LAND STUDY BUREAU
 DETAILED LAND
 CLASSIFICATION MAP
 Malaekahana Site

Dames & Moore

Sub-Appendix B

Malaekahana

Report
on
The Topography

For

The Country Courses at Kahuku

Malaekahana Site

prepared for

The Estate of James Campbell

prepared by

Smith, Young & Associates, Inc.

3049 Ualena Street

Honolulu, Hawaii

April 1990

Introduction

The Estate of James Campbell is proposing the development of an 18 hole golf course in the vicinity of Laie on the northeast shoreline of Oahu. The site, Malaekahana, lies mauka of Kamehameha Highway opposite the Malaekahana State Recreational Area and contains some 200 acres (Figure 1).

The objective of this report is to present information on the topography of the golfing site.

Specifically this report covers the following points of the proposed development:

- a. Existing site and site conditions
- b. Topographic information on the site

Site and Site Conditions

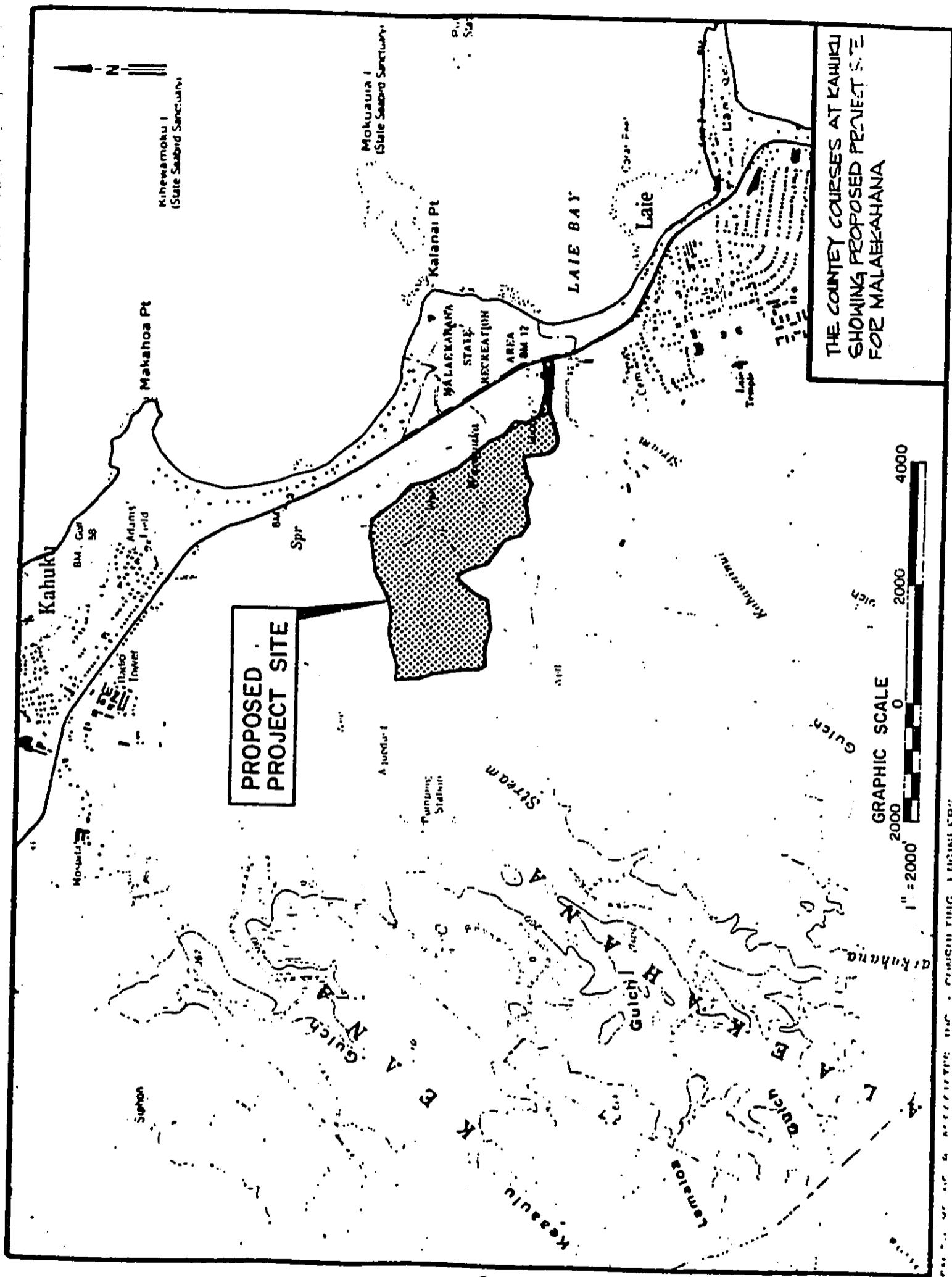
The property considered for development is located in the Koolauloa District, with the Tax Map Key designations TMK 5-6-05: Portion 7. The 200 acre site has been owned by The Estate of James Campbell since before the turn of the twentieth century.

The site is connected to Kamehameha Highway by a narrow strip of land extending mauka to the main body of the property. The site is currently vacant, with the exception of some grazing areas. The site was previously planted in sugar cane, but since the closing of Kahuku Plantation, the land has been returned to pasture. Some of the areas have become overgrown indicating the underusage of the site.

No stream or intermittent stream gulches cross the property. The site slopes upward from approximately 10 feet above sea level near Kamehameha Highway to some 80 feet near the mauka boundary. The general trend of site slope is from the southwest to the northeast. Several small hills and several depressions are found on the site. Concrete lined ditches cross parts of the site. These were used for irrigation purposes during the sugar cane years. They are now in disrepair and overgrown. Several barbed wire fences, placed by tenants to control the grazing animals, extend through the site.

Land uses of adjoining properties are agricultural, aquacultural, recreational, and vacant. The Malaekahana Recreational State Park lies across Kamehameha Highway to the east. The small City and County Corporation Yard is located between Kamehameha Highway and the proposed site, at its entrance leg (See Figure 2). To the south, Asahi Juken is proposing an additional golfing area. West and north from the site lie aquacultural and agricultural lands partially in use.

The site is presently designated an agricultural district by the State Land Use Commission. The Koolauloa Development Plan Land Use Map shows the site Agriculture, while the City and County of Honolulu's Zoning District classifies the site as Agriculture (AG-1/AG-2).



THE COUNTY COURSES AT KAHUKU SHOWING PROPOSED PROJECT SITE FOR MALAEKAHANA

PROPOSED PROJECT SITE

GRAPHIC SCALE
 1" = 2000'
 2000 0 2000 4000
 feet

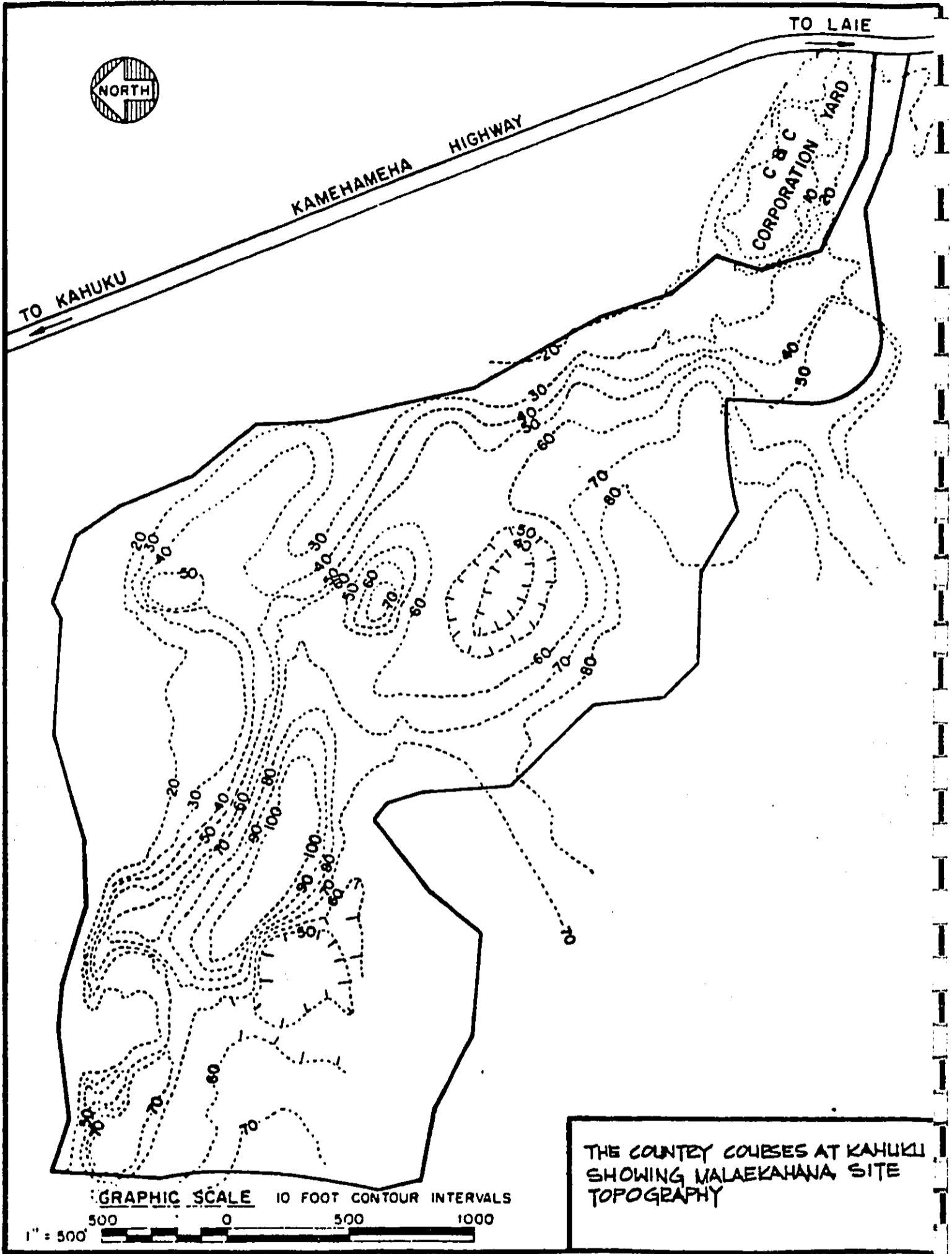


Figure 3 shows that the Malaekahana site lies between the 39" and 59" isohyetal lines of the Median Annual Rainfall Map, as published by the Department of Land and Natural Resources, State of Hawaii. The annual rainfall near the entrance at Kamehameha Highway may be around 40 inches while the upper reaches of the site will receive a possible 57" rainfall.

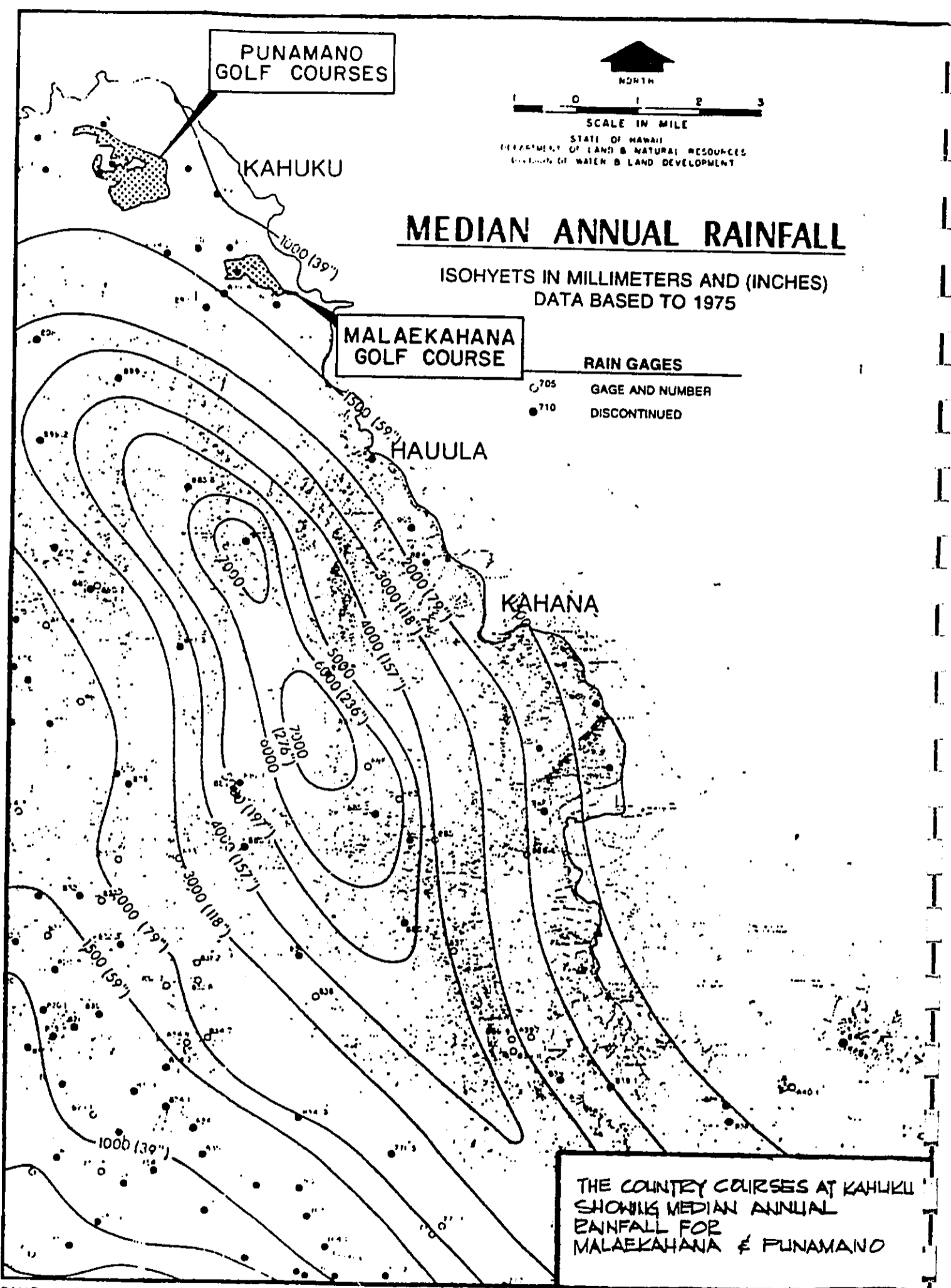
Topography

Figure 4 shows that the project site lies along the lower reaches of the Malaekahana watershed area close to the eastern extremity of the drainage area. Figure 2 shows the 10 foot contour intervals of the site topography. This information was obtained from the photogrammetric survey maps produced by R. M. Towill Corporation for the City and County of Honolulu Planning Department. The highest hill on the site reaches slightly above 100 foot elevation and the lowest elevation approaches 10 feet along the northermost boundary of the site. The slope is in a general northeasterly direction towards the mouth of the Malaekahana Stream and Malaekahana Bay.

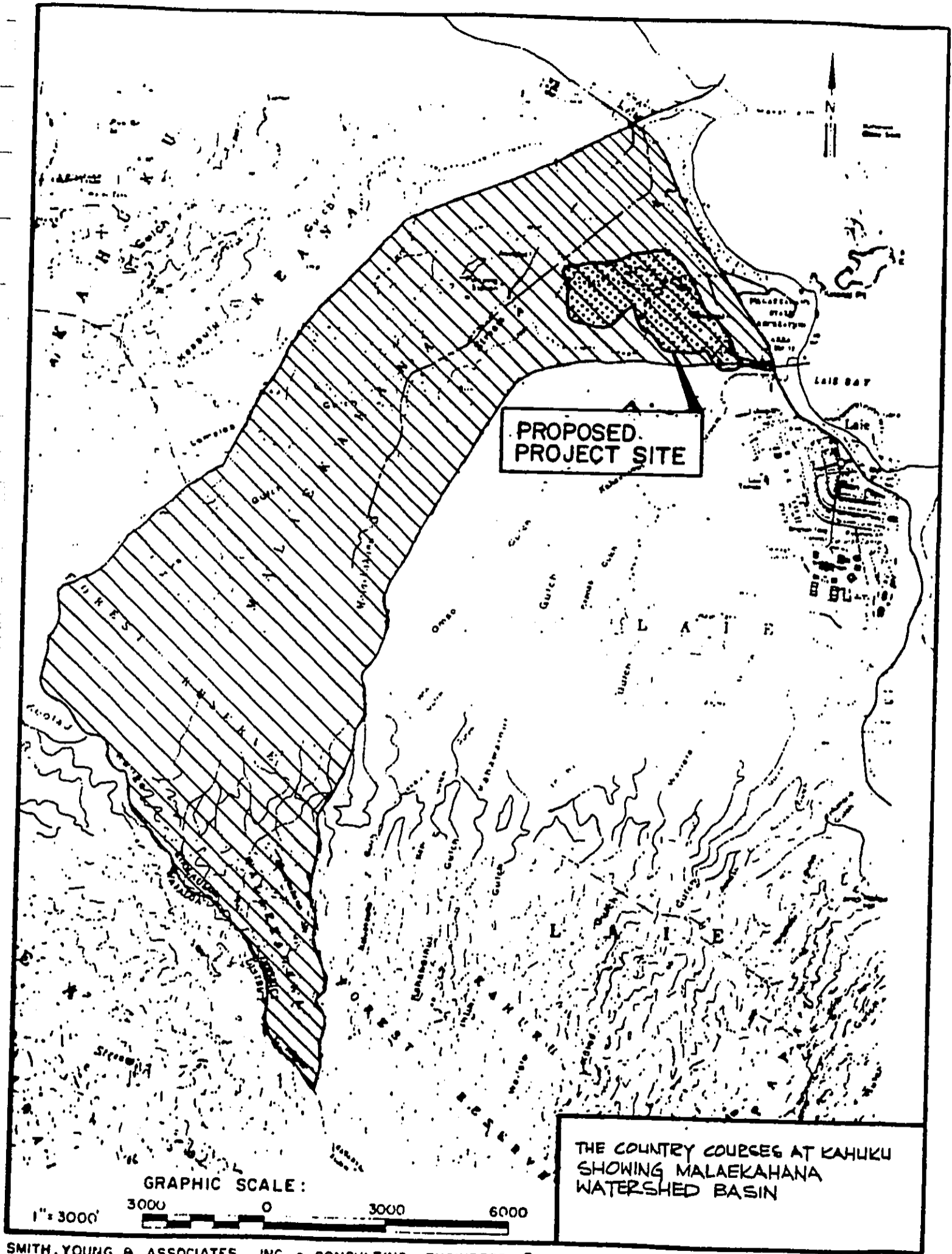
Slopes are, in general, some 5 to 10 percent with minor hillocks and two large shallow depressions within the site. Steeper slopes of 20 to 25 percent surround the single major hillock near the center of the site.

During the active years of Kahuku Plantation, this land had been planted in sugar cane.

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FIG 4

Sub-Appendix C

Malaekahana

Report

on

Climate

The Country Courses at Kahuku

Malaekahana Site

prepared for

The Estate of James Campbell

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3049 Ualena Street

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The objective of this report is to present the prevailing climate at the golfing site.

Specifically this report covers the following points of the proposed development:

- a. Existing site and site conditions;
- b. Rainfall and temperature data available for the area.

Site and Site Conditions

The property considered for development is located in the Koolauloa District, with the Tax Map Key designations TMK 5-6-05: Portion 7. The 200 acre site has been owned by The Estate of James Campbell since before the turn of the twentieth century.

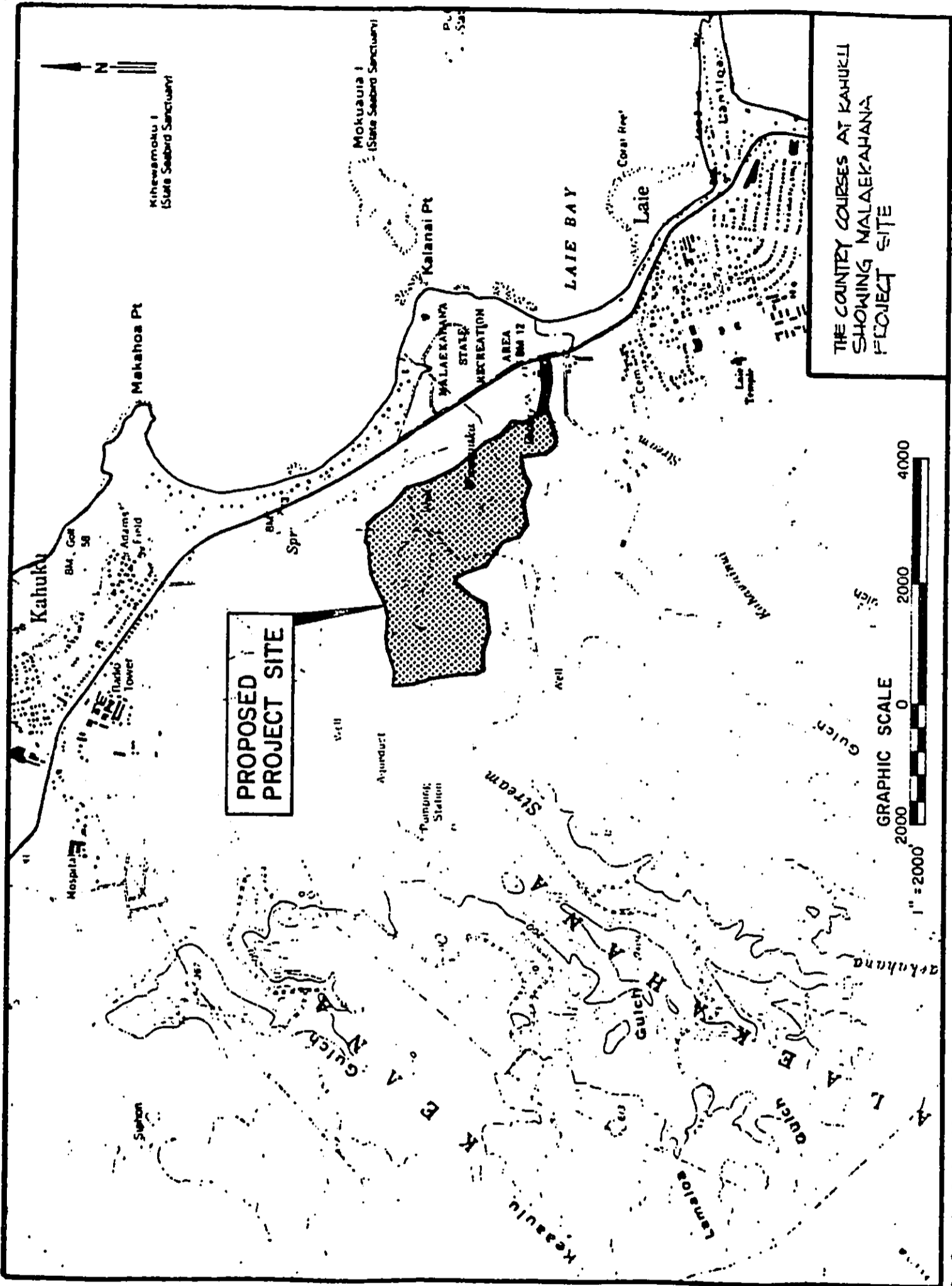
The site is connected to Kamehameha Highway by a narrow strip of land extending mauka to the main body of the property. The site is currently vacant, with the exception of some grazing areas. The site was previously planted in sugar cane, but since the closing of Kahuku Plantation, the land has been returned to pasture. Some of the areas have become overgrown indicating the underusage of the site.

No stream or intermittent stream gulches cross the property. The site slopes upward from approximately 10 feet above sea level near Kamehameha Highway to some 80 feet near the mauka boundary. Several small hills and several depressions are found on the site. Concrete lined ditches cross parts of the site. These were used for irrigation purposes during the sugar cane years. They are now in disrepair and overgrown. Several barbed wire fences, placed by tenants to control the grazing animals, extend through the site.

Land uses of adjoining properties are agricultural, recreational, and vacant. The Malaekahana Recreational State Park lies across Kamehameha Highway to the east. Immediately mauka of Kamehameha Highway lies the small City and County Corporation Yard. To the south, Asahi Juken is proposing an additional golfing area. West and north from the site lie agricultural lands only partially in use.

The site is presently designated an agricultural district by the State Land Use Commission. The Koolauloa Development Plan Land Use Map shows the site Agriculture, while the City and County of Honolulu's Zoning District classifies the site as Agriculture (AG-1/AG-2).

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THE COUNTRY COURSES AT KAHUKU SHOWING MALAEKAKAHANA PROJECT SITE

GRAPHIC SCALE
1" = 2000'
0 2000 4000

ENGINEERING & SURVEYING INC. • PUNCHING ENGINEERS

FIG. 1

Figure 2 shows that the Malaekahana site lies between the 39" and 59" isohyetal lines of the Median Annual Rainfall Map, as published by the Department of Land and Natural Resources, State of Hawaii. The annual rainfall near the entrance at Kamehameha Highway may be around 40 inches while the upper reaches of the site will receive a possible 57" rainfall.

Climate

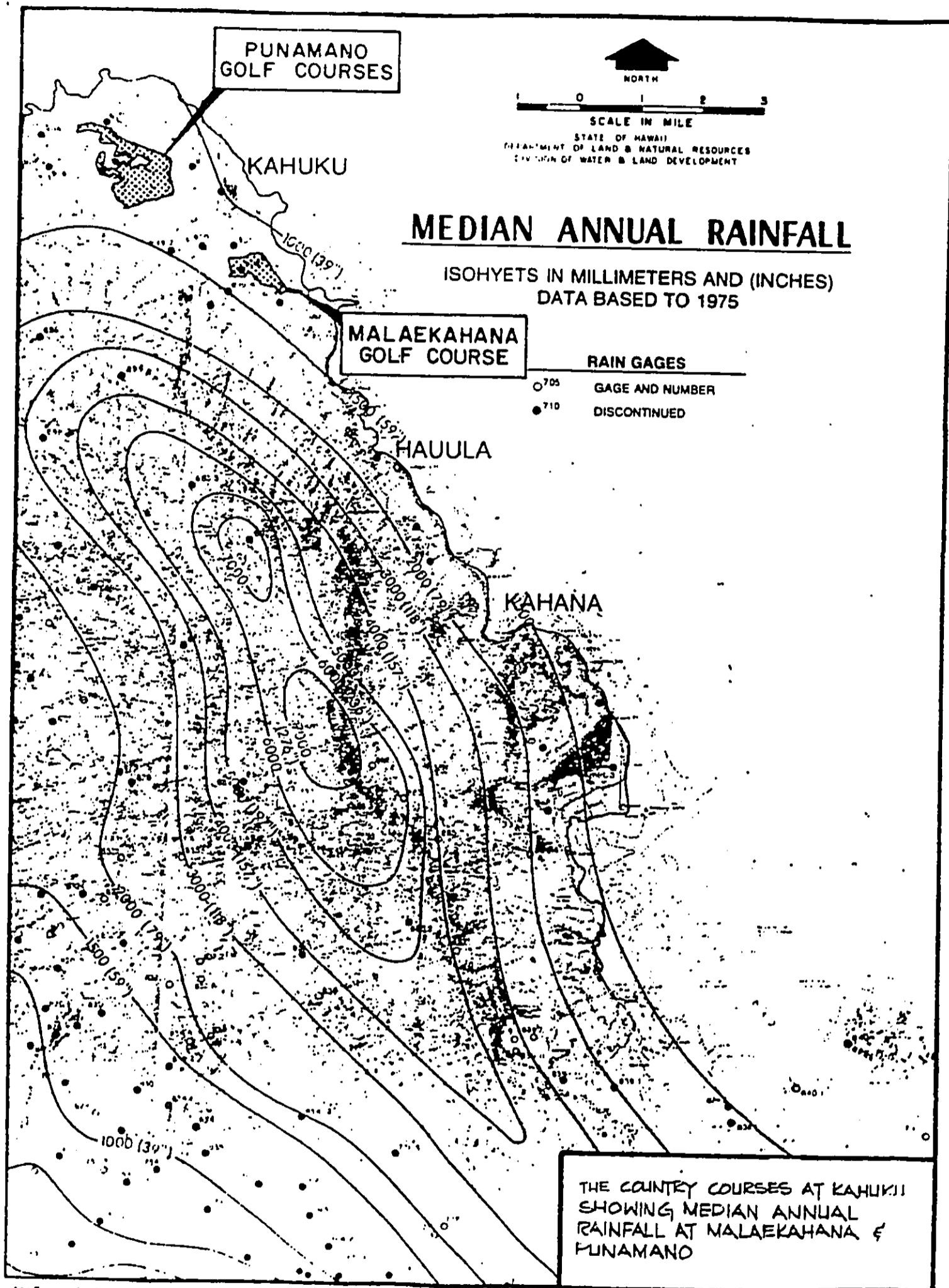
The Kahuku area is subject to tradewinds, which blow from the northeast and east northeast. These winds vary from light sea breezes to velocities of some twelve miles per hour on the average. Gusts up to twenty miles per hour do occur. As moisture laden clouds are shoved against the northernmost extremities of the Koolau Mountains, the uplift created by the winds cool the clouds sufficiently so that rainfall is intensified at the higher elevations. Rainfall some two miles southwest of the site exceeds 118 inches per year. This rainfall in the upper reaches of the Malaekahana watershed provides groundwater recharge to the underground aquifer and gives cloud coverage to the afternoon sunshine for a cooling effect to the proposed golf course site. The site is occasionally subject to "Kona winds" from the southerly direction. Normally these winds are mild clear weather winds unless they are associated with a major "Kona storm". At that time, the entire island of Oahu is subjected to heavy rains.



Although extremes in rainfall have been noted at the site, some 30 percent of the days are clear. Possibly one third of the time the sky is considered partly cloudy and another third is overcast. The climate is good for golfing activity.

The average monthly rainfall for the site has been taken from the isohyetal rainfall maps provided by the Rainfall Atlas of Hawaii, Report R76, published by the Department of Land and Natural Resources, State of Hawaii in 1986. These rainfall figures are tabulated in Table I below and are representative of the near sea level portion of the site. The temperature averages for each month have come from the Climatological Data - Annual Summary Hawaii & Pacific published in 1978 by the National Oceanic and Atmospheric Administration. The temperature readings were taken at Brigham Young University-Hawaii, located in Laie some two miles southeast of the site.

Taking into account that the tradewinds are stronger in the Kahuku area than in any other area of Oahu; that the rainfall tends to be less during the drier summer months when the temperature range is slightly higher, and combining this information with the evaporation data presented in Appendix J, Environmental Assessment of Fertilizer and Pesticide Use on the Proposed Country Courses at Kahuku); the need for irrigation of the proposed golf course is realized. Based on the fact that evaporation exceeds rainfall by some six inches during the month of June, the demand for irrigation water will reach about .75 mgd during that month falling to about .25 mgd during January and December. The average still will be the .5 mgd to .6 mgd discussed in Appendix A, Sub-Appendix F.

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 NORTH

 SCALE IN MILE
 STATE OF HAWAII
 DEPARTMENT OF LAND & NATURAL RESOURCES
 DIVISION OF WATER & LAND DEVELOPMENT

MEDIAN ANNUAL RAINFALL

ISOHYETS IN MILLIMETERS AND (INCHES)
DATA BASED TO 1975

RAIN GAGES

- 705 GAGE AND NUMBER
- 710 DISCONTINUED

THE COUNTRY COURSES AT KAHUKU
SHOWING MEDIAN ANNUAL
RAINFALL AT MALAEKAHANA &
PUNAMANO

Table I
MALAEKAHANA SITE

Month	Average Monthly Rainfall	Average Monthly Temperatures
	Inches	Degrees F
January	5.0	73.3
February	4.0	73.3
March	4.8	73.3
April	3.8	74.2
May	2.1	76.1
June	1.7	75.6
July	2.2	78.2
August	2.7	80.1
September	2.3	79.8
October	3.7	77.6
November	4.0	74.5
December	5.6	73.7
ANNUAL	41.9	75.8

From Table I it is very noticeable that the annual temperature differential varies only 4.3 degrees above and 2.5 degrees below the annual average. This minor variation provides for a pleasant climate throughout the twelve months of the year. Daily extremes may vary from the low 60's in the early morning hours to the mid 80's during the early afternoon hours. All in all, the climate is ideal for golfing and other recreational activities.

Sub-Appendix D

Malaekahana

GROUNDWATER RESOURCES

FOR

THE COUNTRY COURSES AT KAHUKU
MALAEKAHANA SITE

PREPARED FOR

THE ESTATE OF JAMES CAMPBELL

PREPARED BY

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DAMES & MOORE JOB NO. 07597-020-11

APRIL 1990

APPENDIX DM-2

MALAEKAHANA GOLF COURSE

GROUNDWATER RESOURCES

The Malaekahana site is located in the basal water zone in an area where streams are dry or intermittent. According to Takasaki and Valenciano (1969), basal water east of the dike zone is artesian wherever it underlies the coastal plain. Groundwater levels in the Kahuku Region range from about 9 feet to more than 18 feet above MSL. However, based on the August 1962 water-level contour map (Takasaki and Valenciano, 1969), we anticipate that water levels at the golf course site will be about 10 to 12 feet above MSL. This would mean that the fresh water lens would extend downward below sea-level some 400 feet.

The permeability of unweathered vesicular lava flows of the Koolau Volcanic Series is generally high. Structural features associated with lava flows determine permeability. For example, thin-bedded a'a flank flows tend to have the highest proportion of highly permeable clinker zones, voids between flow surface, and shrinkage joints and fractures. These features combine to make these rock types the most permeable. Takasaki and Valenciano (1969) suggest that there is a general tendency for permeability to increase with distance from the dike zone and that permeability is highest parallel to the lava's flow direction, where interflow voids and clinker zones are most continuous. Permeability of flows can be reduced considerably depending on the degree of weathering, which decreases the size of voids and fractures. Weathering is mostly confined to near-surface rocks and is rare at a depth of more than 100 feet outside of the valleys and gulches. Deep weathering is generally confined to valley floors, broad gulches, and flood plains, where poorly permeable weathered rocks at depths of 200 feet are common (Takasaki and Valenciano, 1969).

Along the coastal plain, the water-bearing properties of the sedimentary material (clay to stoney clay soils) range from nearly impermeable with slow drainage runoff in compact alluvium, to highly permeable in unconsolidated talus with moderate to rapid drainage runoff. Most of the areas of recent alluvium exhibit slow to moderate drainage runoff (refer to the SCS classification Map, Plate M-2 and Table 1).

Soil conditions and sedimentary textures differ substantially within the site, ranging from nearly impermeable clay to highly permeable solution pitted, consolidated calcareous dune sand and associated talus; thus, water-bearing properties are variable, too. Extremely calcified dune deposits (recrystallized eolian deposits), and weathered lava (saproelite zones) constitute rock masses that are less permeable than the underlying fresh lava, artesian conditions prevail in the fresh lava, as well as along permeable zones within the caprock itself.

Perennial streamflow only occur along the northern boundary of the site. However, along the upper and middle reaches of the gulches within the dike zone, perennial stream flow may occur due to persistent rainfall and, in part, because of dike impounded groundwater discharge. The Malaekahana Stream is considered a losing stream below elevation 400 feet (MSL) with dike-water levels at or near the surface at times between 400 and 60 feet MSL (Takasaki and Valenciano, 1969). At lower altitudes, streams are mostly dry within the site until they reach the coastal plain, where some flow perennially because of contributions by shallow ground water seepage.

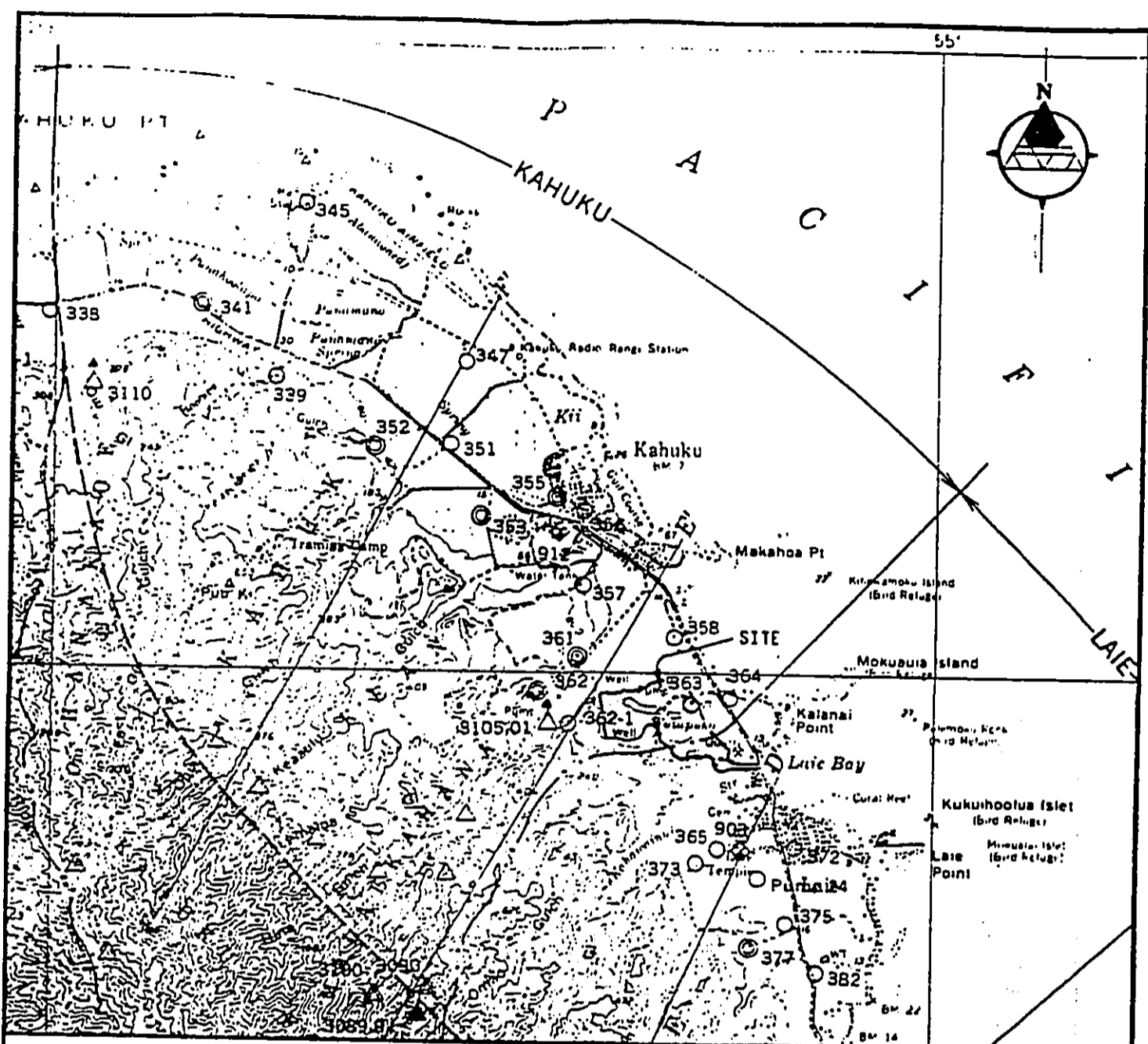
The perennial steam flow in the higher reaches Malaekahana Stream, from a combination of the high rainfall plus the impounded dike-water discharge, provides recharge to the basal groundwater lying east of the dike zone. This recharge water sinks below the caprock and forms the artesian, basal lens from which the fresh water supply is to be taken. The shallow water lens above the caprock is too brackish for potable use or even for effective irrigation).

During the Kahuku Plantation days, the Kahuku Region Aquifer was overpumped approximately 10 mgd. The chloride contents of some of the wells rose from the 300 mg/l content of 1930 to as high as 900 and 1200 mg/l in some wells. with much lowever pumping rates in the past 25 years and a constant underflow of the aquifer seaward, it is now possible to obtain basal lens water at the site area at 300 mg/l chlorides or less.

TABLE 1: SOILS CONSERVATION SERVICE CLASSIFICATION (SCS)
 GOLF COURSE AT MALAKKANNA SITE
 FOR THE ESTATE OF JAMES CAMPBELL
 JOB NUMBER 07597-020-011

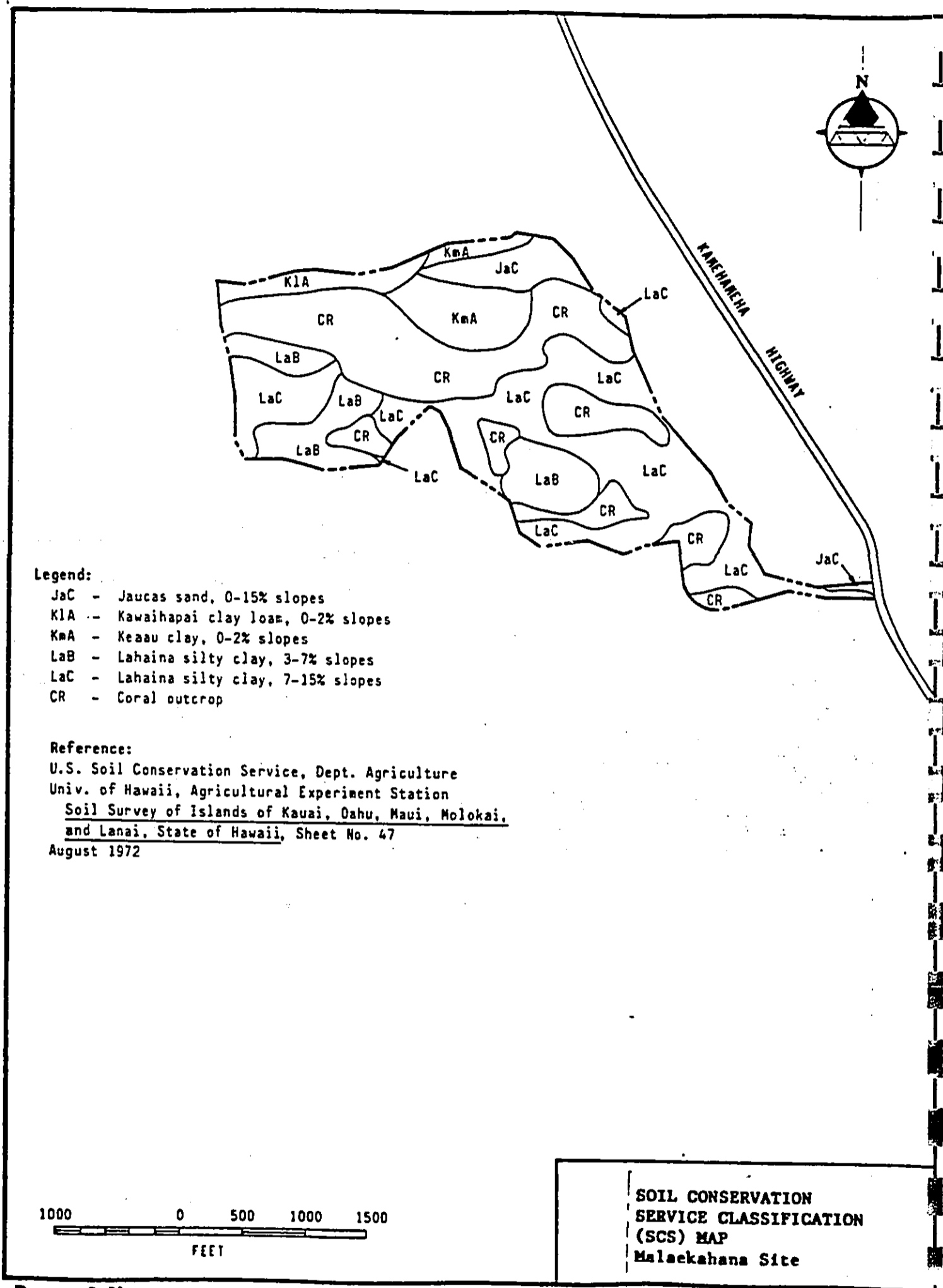
SOIL TYPE	DESCRIPTION	APPROXIMATE ACREAGE (%)	PERCENT TOTAL (%)	PERCENT SLOPE (%)	DRAINAGE RUNOFF	EROSION HAZARD	CAPABILITY CLASSIFICATION NONIRRIGATED	CAPABILITY CLASSIFICATION IRRIGATED
CR	Coral outcrop (coralline sand dunes)	68	34	0 to 15	slow	slight	VIIIc	-
JcC	Jacobs Sand (calcareous eolian deposits)	10	5	0 to 12	very slow to slow	severe	VIe	IVs
KcA	Kesau Clay (dark brown, mottled clay)	18	9	0 to 2	slow	slight	W	IIIu
K1A	Kewihopal Clay Loam (dark brown)	8	4	0 to 2	slow	slight	IIc	I
LcB	Lehaine Silty Clay (coral sandstone frags.)	26	13	3 to 7	slow	slight	IIIc	IIIe
LcC	Lehaine Silty Clay (coral sandstone frags.)	70	35	7 to 15	medium	moderate	IIIe	IIIc
TOTALS =		200	100					

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Reference:
 Department of Land & Natural Resources, State of Hawaii
 U.S. Geological Survey
 "Hydrologic Map of the Kahuku Area, Oahu, Hawaii"
 Water Supply Paper 1874, Plate 1, 1969.

**PLOT PLAN
 Malackahana Site**



Dames & Moore

PLATE N-2

Sub-Appendix E

Malaekahana

Drainage

and

Stormwater Runoff

Report

For

The Country Courses at Kahuku

Malaekahana Site

Prepared For

The Estate of James Campbell

prepared by

Smith, Young & Associates, Inc.

3040 Ualena Street

Honolulu, Hawaii

April 1990

Introduction

The Estate of James Campbell is proposing the development of an 18 hole golf course in the vicinity of Laie on the northeast shoreline of Oahu. The site, Malaekahana, lies mauka of Kamehameha Highway opposite the Malaekahana State Recreational Area and contains some 200 acres (Figure 1).

The objective of this report is to present the necessary planning and preliminary engineering for the drainage of the proposed golfing site and to discuss storm runoff quantities.

Specifically this report covers the following points of the proposed development:

- a. Existing site and site conditions;
- b. Background information on the proposed site development;
- c. Proposed development and resulting drainage changes;
- d. Impacts and mitigative measures to be undertaken at the site and overall watershed.

Site and Site Conditions

The property considered for development is located in the Koolauloa District, with the Tax Map Key designations TMK 5-6-05: Portion 7. The 200 acre site has been owned by The Estate of James Campbell since before the turn of the twentieth century.

The site is connected to Kamehameha Highway by a narrow strip of land extending mauka to the main body of the property. The site is currently vacant, with the exception of some grazing areas. The site was previously planted in sugar cane, but since the closing of Kahuku Plantation, the land has been returned to pasture. Some of the areas have become overgrown indicating the underusage of the site.

No stream or intermittent stream gulches cross the property. The site slopes upward from approximately 10 feet above sea level near Kamehameha Highway to some 80 feet near the mauka boundary (Figure 2). Several small hills and two large depressions are found on the site. Concrete lined ditches cross parts of the site. These were used for irrigation purposes during the sugar cane years. They are now in disrepair and overgrown. Several barbed wire fences, placed by tenants to control the grazing animals, extend through the site.

Land uses of adjoining properties are industrial agricultural, recreational, and vacant. The Malaekahana Recreational State Park lies across Kamehameha Highway. The City and County Corporation Yard lies at the site entrance on Kamehameha Highway. To the south, Asahi Juken is proposing an additional golfing area. West and north from the site lie agricultural lands partially in use.

The site is presently designated an agricultural district by the State Land Use Commission. The Koolauloa Development Plan Land Use Map shows the site Agriculture, while the City and County of Honolulu's Zoning District classifies the site as Agriculture (AG-1/AG-2).

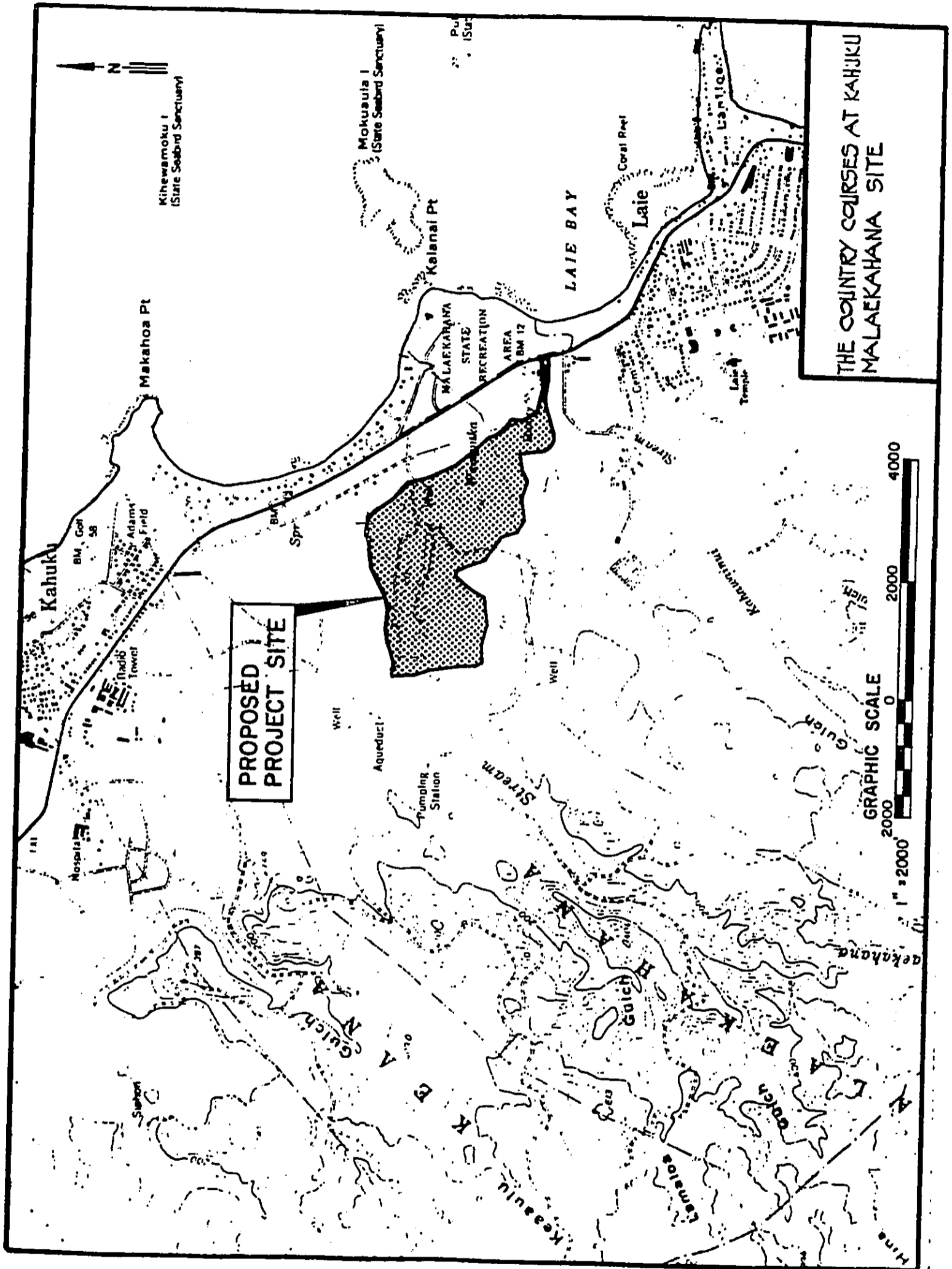
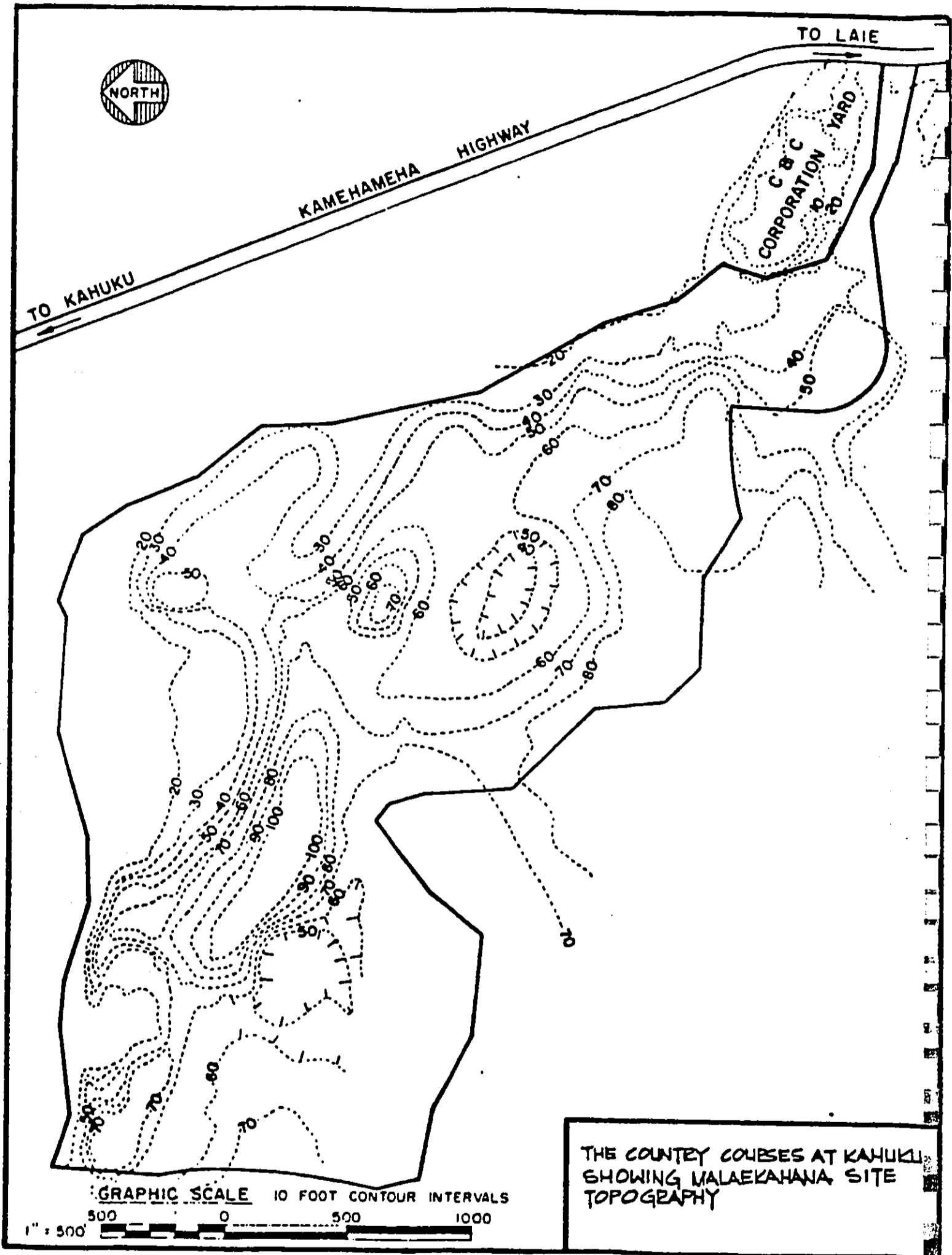


FIG. 1



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FIG 2

Figure 3 shows that the Malaekahana site lies between the 39" and 59" isohyetal lines of the Median Annual Rainfall Map, as published by the Department of Land and Natural Resources, State of Hawaii. The annual rainfall near the entrance at Kamehameha Highway may be around 40 inches while the upper reaches of the site will receive a possible 57" rainfall.

As far as site topography is concerned, the elevations range from 10 feet above sea level near Kamehameha Highway to some 80 feet along the mauka boundary (Figure 2). The highest elevation within the site is slightly over 100 feet. Slopes of 3 to 10 percent are found throughout the site with some steeper slopes of 25 percent around isolated hillocks. Two depressions lie within the site which would tend to hold some normal runoff at times of moderate to heavy rainfall. Aside from the two depressions, the drainage of the site is towards the north and northeast to the main course of Malaekahana Stream.

The project site is situated along the southern or southeastern portion of the Malaekahana watershed (Figure 4). The proposed golf course site represents slightly over 5% of the entire basin. Runoff from the Malaekahana drainage basin flows to the ocean by way of the Malaekahana Bridge at Kamehameha Highway.

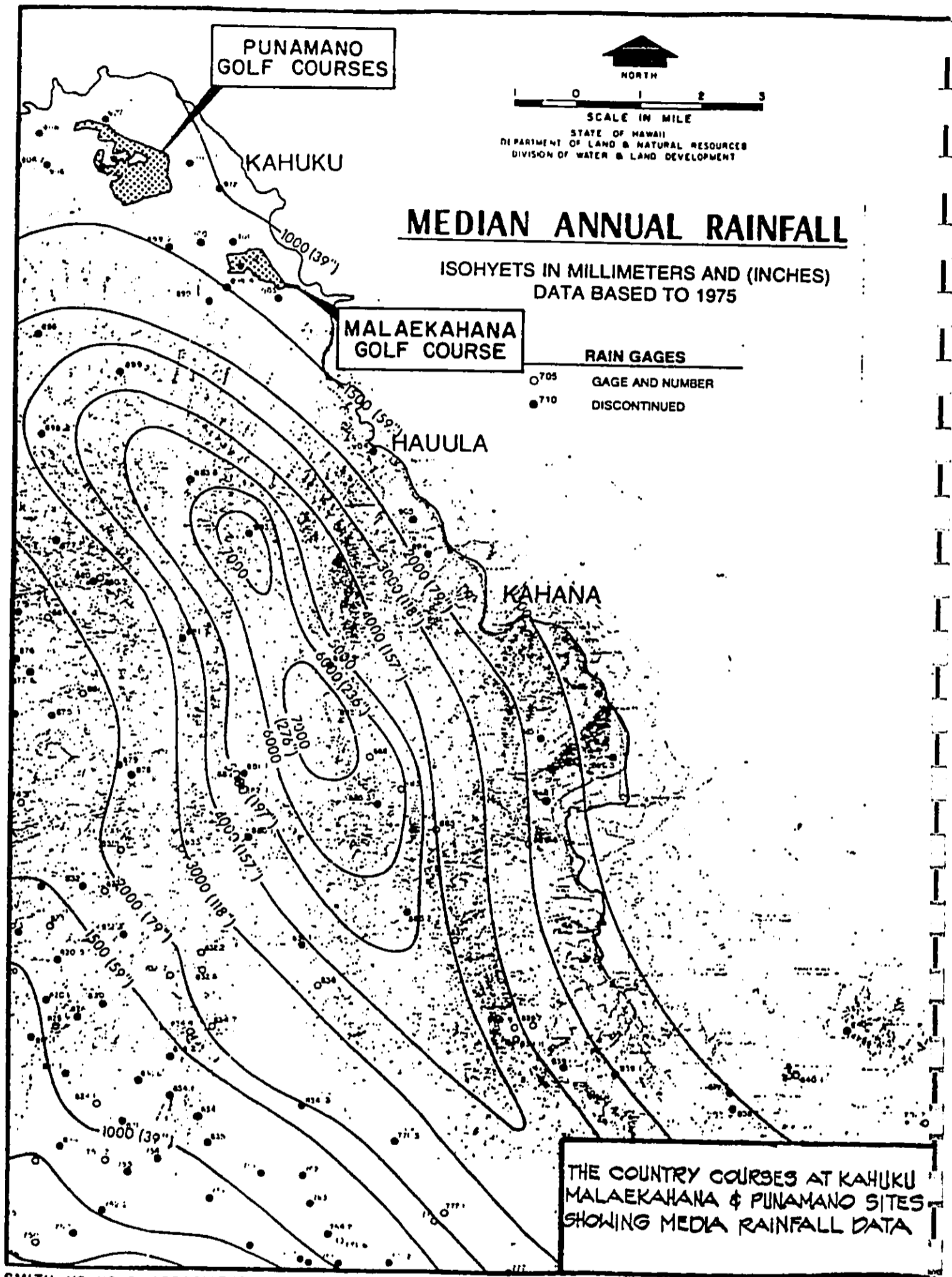
Calculations for runoff have been based on rainfall intensities of 2.5 inches per hour for 10 year storms and 3.5 inches per hour for the 100 year storms. Table I shows runoff quantities for the project site under existing conditions and also after development of the golf course. These conditions do not take into account the retention effect provided by the two large depressions on site. Table II shows total drainage basin runoff under existing and developed conditions.

Drainage Changes by Development

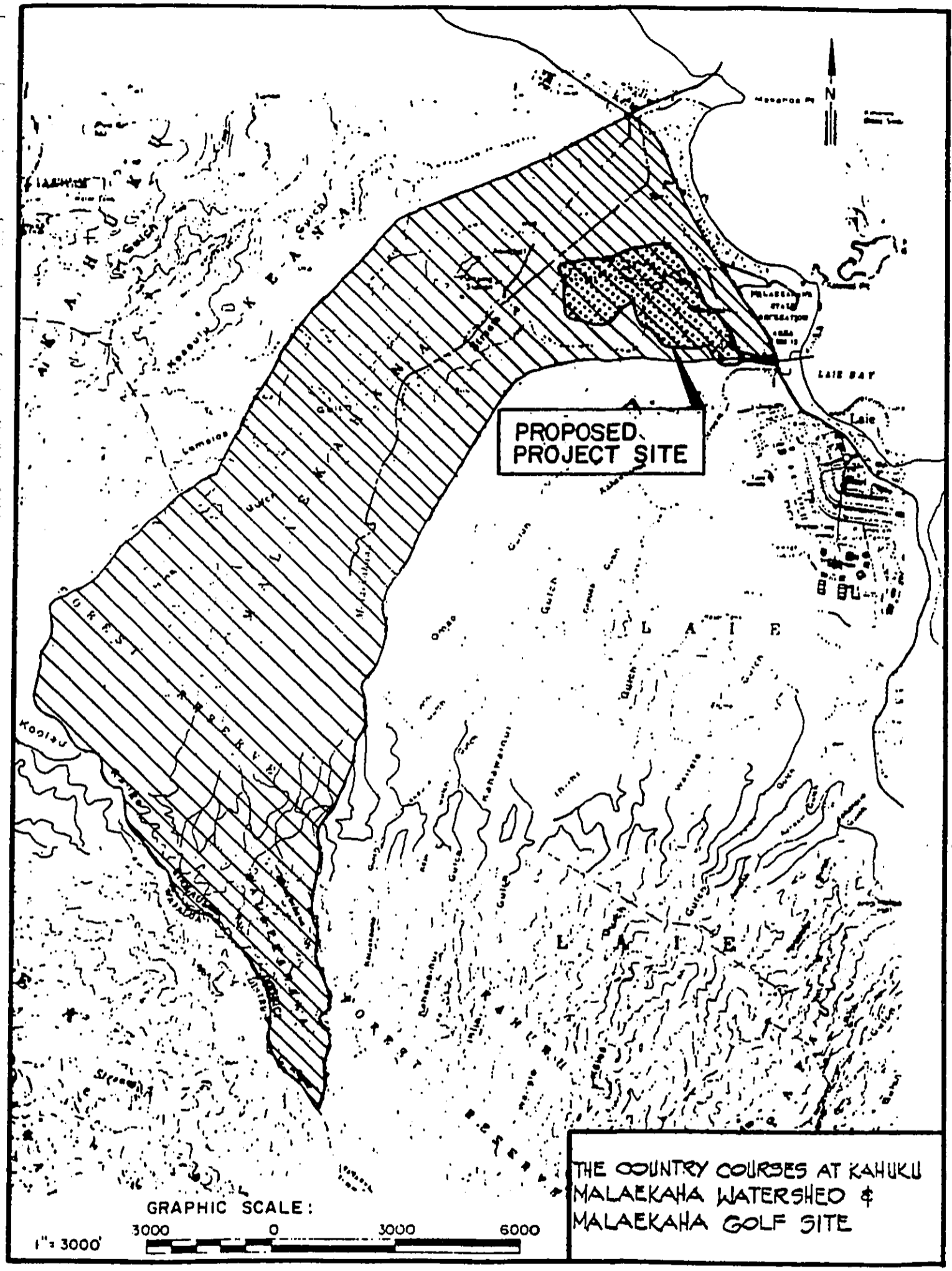
Development of a golf course will change the drainage characteristics of the 200 acre project site. The more dense vegetation found on site today will be replaced by a closely-cropped grass turf normally associated with golf courses. Roadways, parking lots, and buildings combined with the closely-cut grass will account for a higher runoff and a shorter time of concentration. These features will all tend to increase runoff. The net result is a potentially greater runoff from the project site after development of the golf course. The calculated runoff for the 10 and 100 year storms and the effect the development may have on the Malaekahana Drainage Basin are presented in Tables I and II.

The overall drainage patterns for the site will remain fairly much the same as before development. There will be additional ponding areas and swales will conduct minor surface flows around specific areas and to certain retention ponds or depressions. Areas not incorporated into the golf course will remain as they presently are in both vegetation and slope configuration.

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Impacts and Mitigation

Giving no consideration to retention capabilities of the two depressions shown in Figure 2, the increased drainage from the golf course site is seen to be 20.0% when the golf course is developed. However, runoff leaving the project site can be reduced to nearly zero when all mitigating measures are undertaken. The two depressions on the site will remain and additional sand traps, swales and ponds can be used to retain the increased runoff within the golf course property.

Table I

STORM WATER RUNOFF - MALAEKAHANA GOLF COURSE SITE

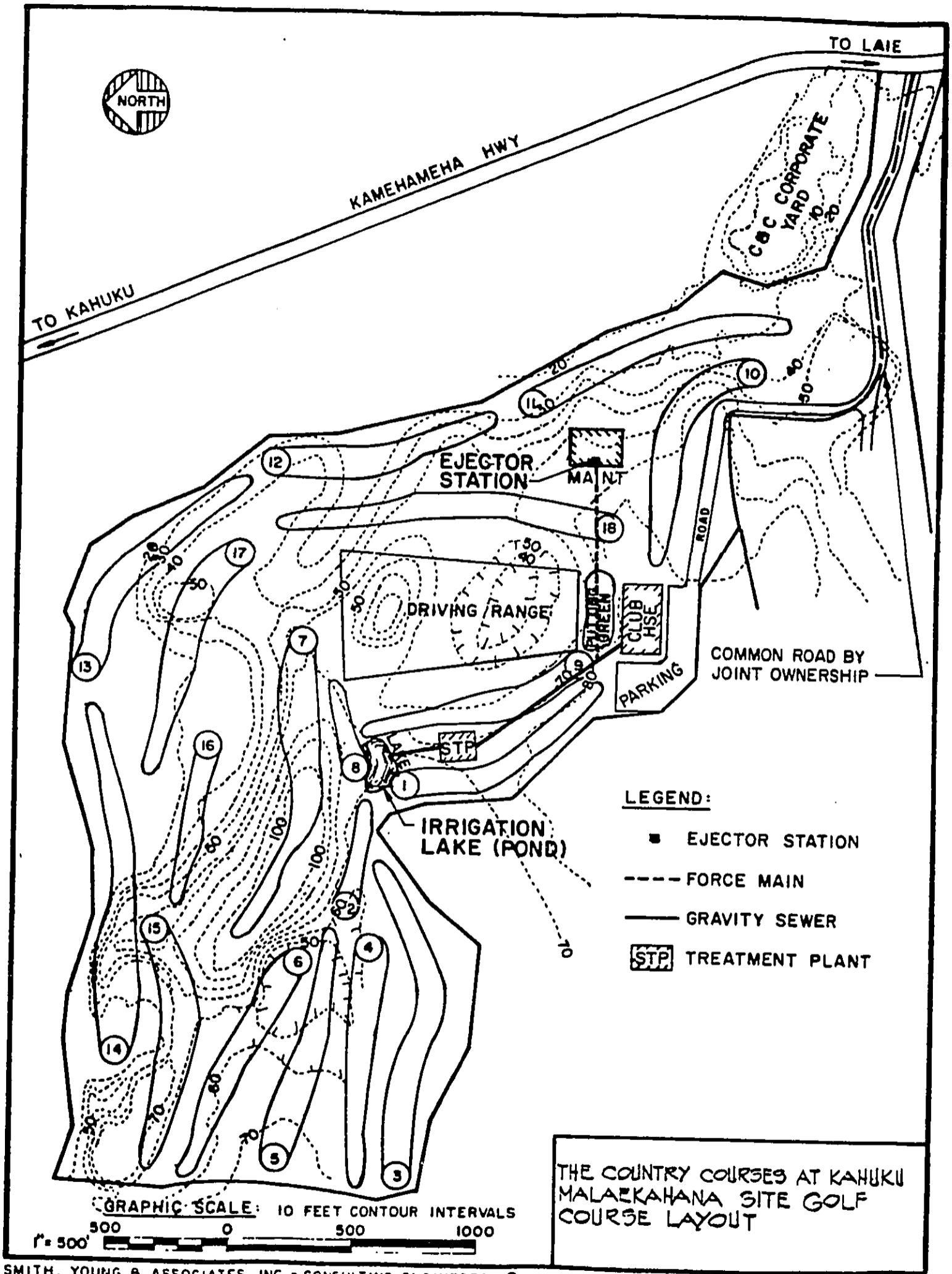
Storm Interval	Acerage	Existing Conditions (cfs)	Developed Conditions (cfs)	Percent Increase
10 years	200	425	510	20.0
100 years	200	595	714	20.0

Table II

STORM WATER RUNOFF - TOTAL DRAINAGE BASIN

Storm Interval	Acerage	Existing Conditions (cfs)	Developed Conditions (cfs)	Percent Increase
10 years	3400	3400	3485	2.5
100 years	3400	4760	4879	2.5

By directing parking area flows and clubhouse runoff to the large swale at the driving range, no increase of on-site runoff will occur from that sector. The second depression near the No. 6 green and No. 5 fairway will also remain an active retention basin for storm runoff. A third depression encompassing the 13th green and tees for holes 14 and 17 will retain sufficient ponding so as to offset all increased flows from the site. (Figure 6). A berm will be constructed along the east and north boundary of the site to contain the runoff and to direct much of it to the new sump. Referring to the soils map of Appendix A, it can be seen that the two existing basins lie in Lahaina silty clay areas which are underlain by consolidated beach sand.

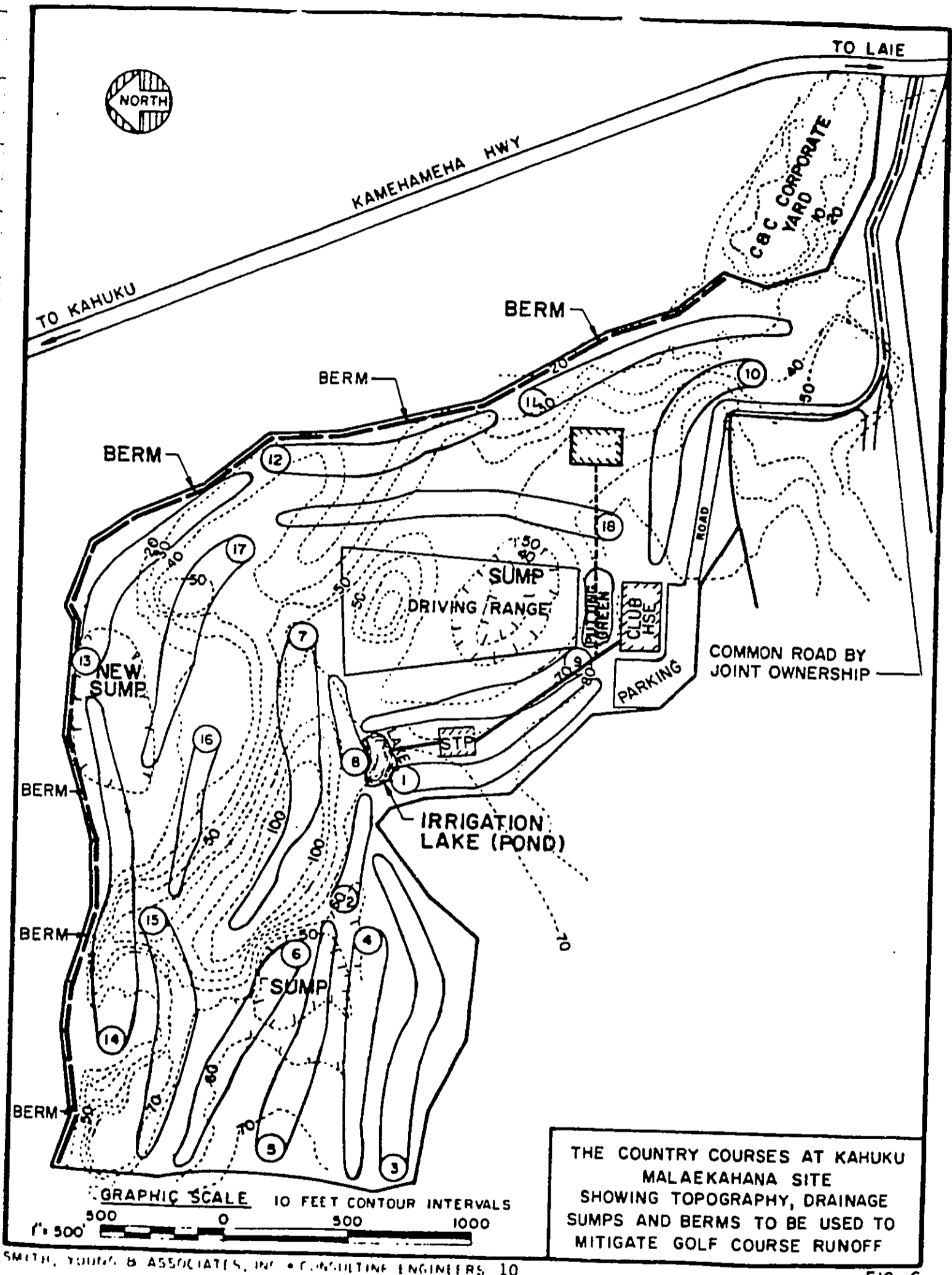


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FIG. 8

Percolation from these two basins will be moderate. The new sump shown in Figure 6 will be located in a deposit of Jaucas Sand, a type of soil that provides rapid percolation and high permeability. The percolation will be to the shallow groundwater table overlying the caprock. There will be no resulting impact to the usable groundwater table underlying the caprock.

Referring to the Malaekahana Watershed shown in Figure 4 it can be seen that an unmitigated runoff increase of 20.0% from the small golf course site provides a rather insignificant increase of 2.5% to the overall basin runoff. With the improved control of the ground cover over the entire golf course site coupled with the mitigating berms and depressions it is possible to say that there will be much less to no runoff from the site when all mitigating measures are undertaken. It should also be noted from the contours provided on the site layout and in reference to the Malaekahana Watershed itself, that runoff from the golf course site, should any occur, would be to the northeast and not towards the aquaculture ponds which are located in and along Malaekahana Stream to the northwest of the site.



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FIG 6

Sub-Appendix F

Malaekahana

GROUNDWATER QUALITY AND SUPPLY

FOR

THE COUNTRY COURSES AT KAHUKU

MALAEKAHANA SITE

PREPARED FOR

THE ESTATE OF JAMES CAMPBELL

PREPARED BY

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HONOLULU, HAWAII 96816

DAMES & MOORE JOB NO. 07597-020-11

APRIL 1990

APPENDIX DM-3

MALAEKAHANA GOLF

GROUNDWATER QUALITY AND SUPPLY

GROUNDWATER QUALITY

The assessment of groundwater quality within the site is primarily based on earlier data summarized by Takasaki and Valenciano (1969). The values for the quality of groundwater, as measured by its dissolved solids, range from about 100 milligrams/liter (mg/l) for dike water discharge into streams to about 2,500 mg/l for basal well water.

Induced sea-water intrusion due to large concentrated withdrawal of basal water from basaltic aquifers contributes most to the deterioration of groundwater quality. In August 1964, a program was begun to monitor the nitrate content of water from selected wells to determine effects of infiltration of irrigation water in the Kahuku area. According to Mink (1962), uncontaminated ground water contains less than 1 mg/l of nitrate. Mink (1962) considers any nitrate content greater than 1 mg/l as the criterion of possible contamination from agricultural fertilizers. According to the Public Health Regulations Chapter 49, Potable Drinking Water, nitrate levels must reach 10 mg/l to be considered unsafe for consumption. For Well 339 water sample analysis measured in August 1964 indicated that nitrite levels reached 6.2 mg/l and that chloride levels reached 315 mg/l well below the Public Health regulation limits.

As indicated by Takasaki and Valenciano (1969) natural flow through most of the basal aquifer is generally large enough that infiltration of soluble fertilizer salts in irrigation water does not significantly contaminate the groundwater reservoir. Since the cessation of sugarcane cultivation, irrigation pumping has been greatly reduced. Therefore, the water quality would have improved in the last two decades.

WATER SUPPLY

Takasaki and Valenciano (1969) indicate that in the past the draft of the basal ground water in the Kahuku subarea ranged from about 3 mgd during periods of no irrigation to more than 50 mgd when fields were heavily irrigated. Well 362, a battery of six wells, averaged 5.2 mgd and had a maximum withdrawal of 17 mgd. Wells 361, 362-1, and 363 together averaged about 2 mgd. Domestic water as well as irrigation water was supplied by Well 363, at about 0.5 mgd.

The presence of poorly permeable rocks underlying the extensions of valleys and gulches interferes with the flow of water across them. The natural groundwater flow is estimated to range between 2 and 4 mgd per mile. During the summer, the flow was much less than the draft, which was 10 mgd per mile (Takasaki, et al., 1969).

The basal water supply in most of the Kahuku subarea was fully developed. The south side of Malaekahana Stream exhibits the capability for additional development.

According to John Mink, Hydrogeologist, in his 1988 report to Campbell Estate, stated;

- (1) The average draft from the Koolauloa Aquifer during the Kahuku Plantation era was 28 mgd, but an average of 35 mgd was sustained during the 1950's. Monthly peaks rose as high as 43 mgd. Of the 28 mgd, about 24 mgd was pumped from Campbell Estate lands within the Kahuku area.
- (2) The sustainable yield of the Koolauloa Aquifer is 35 mgd at a head of 13 feet at Kahuku and 19 feet in Hauula. Of the 35 mgd, the Kahuku Region has been assigned an allowable draft of 15 mgd. This assignment was agreed to by the State Department of Water and Land Development several years ago.
- (3) Current draft in the Kahuku Region is 8.7 mgd. This leaves 6.3 mgd unused. The Board of Water Supply of Honolulu plans to take another 0.5 mgd eventually, thereby leaving 5.8 mgd unused. Campbell Estate lessees have expressed interest in taking an additional 1.8 mgd, leaving a surplus of 4.0 mgd unused. At this time Campbell Estate has a surplus of 6.3 mgd but if the BWS and lessees take their expected additional requirements, the surplus will be reduced to 4.0 mgd. As the Punamano Sites will need 2.1 to 2.2 mgd and the Malaekahana Site some .5 or .6 mgd, on the average, the supply is sufficient to meet the proposed golf courses needs.
- (4) All 15 mgd of allowable yield in the Kahuku Region can be developed as potable water. To accomplish this, however, some existing wells will have to be refurbished and several new wells may have to be drilled.
- (5) Turtle Bay Hotel complex receives its water from the Waialeale Region which runs from Kawela Bay to Sunset Beach. This aquifer is completely separate from the Koolauloa Aquifer. There is sufficient water available for Turtle Bay in the Waialeale Aquifer.

Realizing that irrigation is fundamentally a practice of supplementing that part of the natural precipitation which is available for crop production; and taking into account that the tradewinds are stronger in the Kahuku area than in any other area of Oahu; that the rainfall tends to be less during the drier summer months when the temperature range is slightly higher, and combining this information with the evaporation data presented in Appendix J, Fertilizer and Pesticide Use On the Proposed Country Courses at Kahuku; the need for irrigation of the proposed golf course is recognized. Based on the fact that evaporation exceeds rainfall by some six inches during the month of June, the demand for irrigation water will reach .75 mgd during that month. During January and February, when rainfall exceeds evaporation, the irrigation requirements will drop to about .25 mgd. The average will be .5 to .6 mgd for the year.

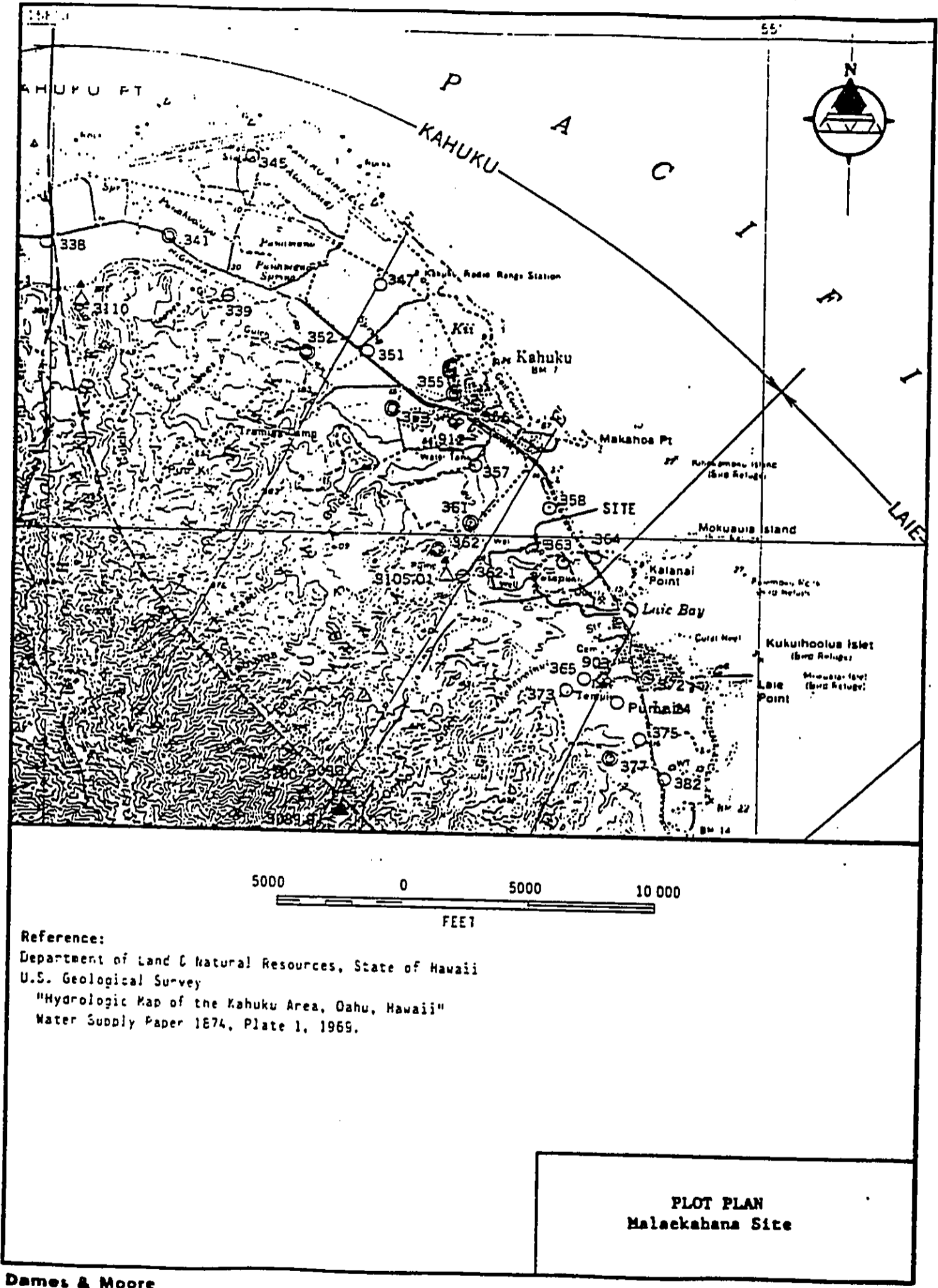
ENVIRONMENTAL IMPACTS RELATED TO WATER QUALITY AND SUPPLY

- o Due to the general reduction of well water pumping since the cessation of sugarcane cultivation, water quality in general should have been improved when compared to earlier water quality data.
- o The BWS Kahuku water system and the private water supply systems of Campbell Estate and Zions Securities are three potential sources of supplying potable water for club house and restaurant usage on the order of 15,000 to 25,00 gallons per day. The recommended source is a refurbished well 363 which is presently delivering domestic water flows.
- o New wells will be required to supply irrigation water for golf the course. The most promising irrigation well development would be on the southside of Malaekahana Stream. The selection of well location would best be determined at the design phase of the project to include the consideration of hydrogeologic influence of all existing wells, the proximity to storage impoundment and irrigation needs.

The regional groundwater resources can sustain the additional withdrawal of 0.5 mgd for golf course irrigation, because the area has previously been capable of supplying much greater water demand for sugarcane irrigation. To ensure minimal impact to groundwater resource in the area, several mitigation measures should be considered.

1. Select new well locations far away from the established wells to minimize hydraulic interference.
 2. Use the lowest pumping rate possible for water retrieval, assuming two new wells pumping continuously at 200 gpm would be sufficient to yield the required irrigation demand. Drawdown of the static water level within the well will determine the rate of discharge the well can provide. The rate, number of wells required and drawdown can only be figured after the well is drilled and pump tested. For present consideration, the drawdown within the new wells should not exceed 2 feet.
 3. To satisfy the on-demand usage of golf course irrigation and fire protection needs, surface impoundment storage on the order of 0.75 MG should be incorporated into the golf course design. These ponds would serve as both irrigation storage and golf course water hazards.
- o Small surface impoundments should be created near buildings and structures to store sufficient quantities of non-potable water for fire-protection usage. Pressurized sprinkler lines with automatic pump starting capability could be installed.
 - o Increased irrigation of golf courses may cause localized deterioration of water quality at the site. To mitigate the impact, storm runoff at the site could be directed to temporary impoundments to be utilized for groundwater recharge.

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Reference:
 Department of Land & Natural Resources, State of Hawaii
 U.S. Geological Survey
 "Hydrologic Map of the Kahuku Area, Oahu, Hawaii"
 Water Supply Paper 1874, Plate 1, 1969.

PLOT PLAN
 Malaekahana Site

Dames & Moore

PLATE N-1

Sub-Appendix G

Malaekahana

Wastewater Management Plan

For

The Country Courses at Kahuku

Malaekahana Golf Course

prepared for

The Estate of James Campbell

prepared by

Smith, Young & Associates, Inc.

3049 Ualena Street

Honolulu, Hawaii

April 1990

Introduction

The Estate of James Campbell is proposing to develop an 18 hole golf course in the vicinity of Laie on the northeast shore of Oahu. The area lies immediately north of Laie at Malaekahana. (Figure 1) The site contains approximately 200 acres and is situated mauka of Kamehameha Highway across from the Malaekahana State Recreation Area. (Figure 2)

The purpose of this report is to provide information on the site and to indicate the preliminary planning and engineering conducted towards the collection, treatment and disposal of wastewater that might be generated on the site. This report addresses the following:

- a. Existing site conditions
- b. Information on the proposed development
- c. Proposed process of wastewater treatment and disposal.
- d. Possible impacts of effluent disposal.

Site and Site Conditions

The proposed site for the 18-hole golf course at Malaekahana is located within the Koolauloa District of Oahu and lies in the the Tax Map Key designations of 5-6-06:Por 7. The project site at Malaekahana has been owned by The Estate of James Campbell since before the turn of the twentieth century.

The site slopes up from the low lying pasture land which exists immediately mauka of Kamehameha Highway and opposite of the Malaekahana State Recreational Area. The 200 acre parcel slopes upwards at some two to two and a half percent grade with several small hills and depressions which approach 10 to 12 percent slopes at specific locations (Figure 2). The highest elevation of the site is a long single hill near the center of the site which is slightly over 100 foot elevation mean sea level (M.S.L.). The site meets Kamehameha Highway on the Laie side of the City and County Corporation yard by way of a narrow strip of land. The site itself was formerly planted in sugar cane when the Kahuku Plantation was active. Today the land lies fallow except for the possibility of some grazing by a few head of cattle and several horses. Although the site is located just south and east of the Malaekahana Stream, no stream gulches cross the site. Several concrete lined ditches cross the lower parts of the site having carried irrigation waters when the lands were actively cultivated. Several barbed wire fences traverse the area and are maintained by lessees who graze their horses on the property.

Land uses adjoining the site are generally agricultural. Cackle Fresh Egg Farm uses the entrance roadway by the City and County Corporation yard as will Asahi Juken Developers who also propose a golf course south of this site. Makai of the site lie agricultural lands currently used for grazing purposes. Lands to the north are also agricultural.

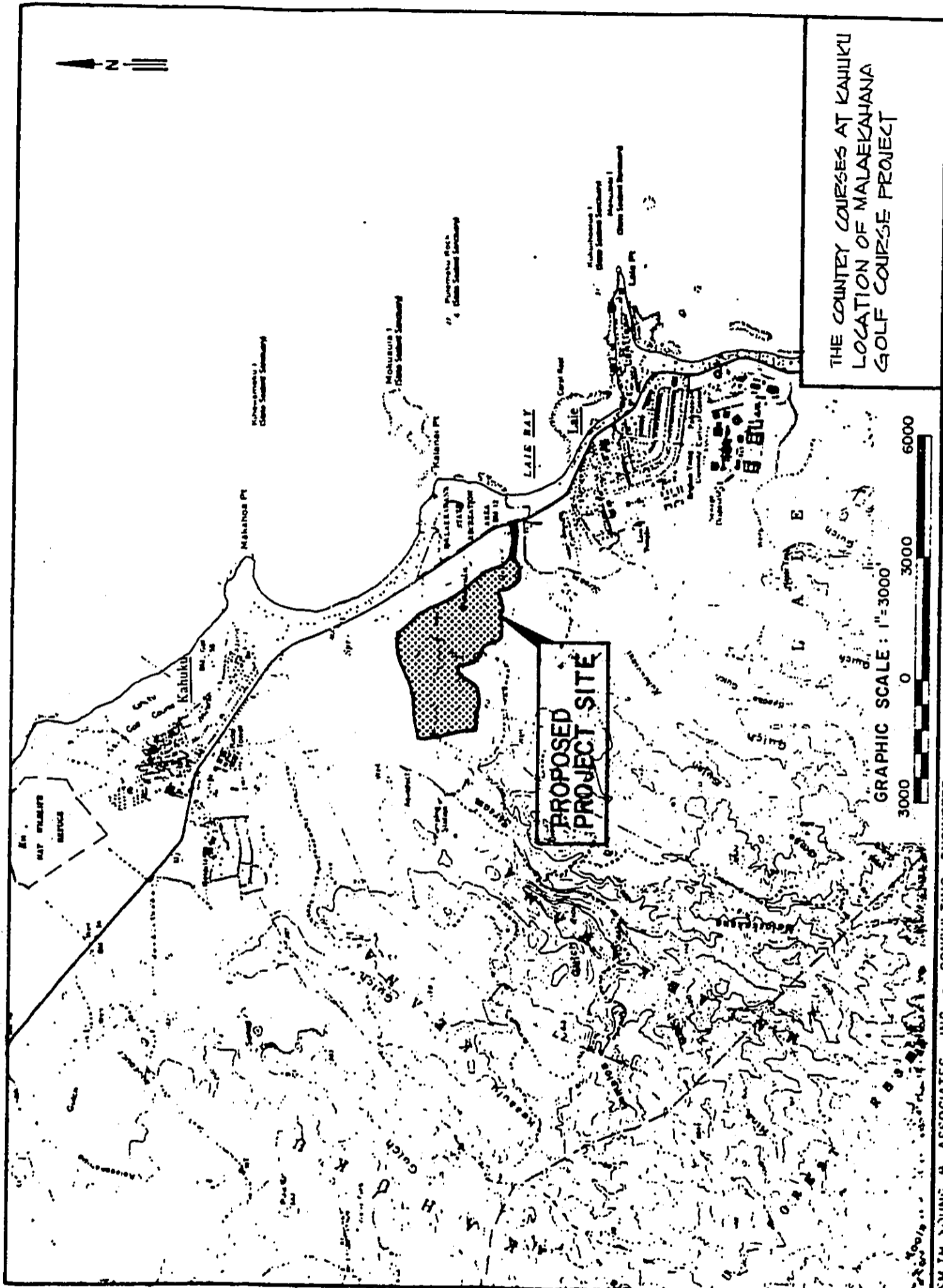


FIG. 1

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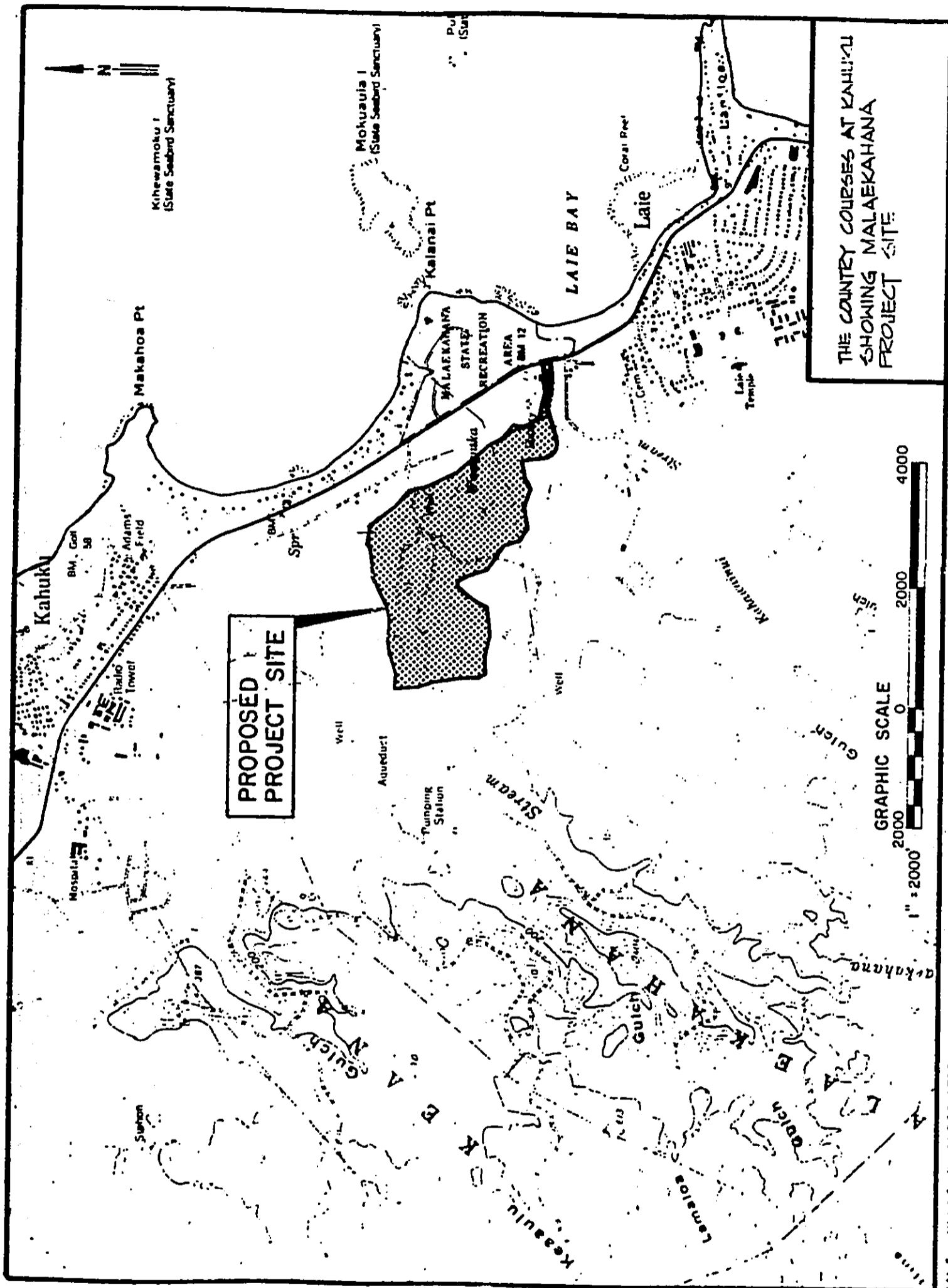


FIG. 2

C.M. THOMPSON & ASSOCIATES, INC. - CONSULTING ENGINEERS

The site is presently designated as an agricultural district by the State Land Use Commission. The Koolauloa Development Plan Land Use Map designates the site Agriculture, and the City and County of Honolulu's Zoning District indicates the site as Agricultural (AG-1/AG-2).

The site has a temperature reading range from the low 60 degrees F to the mid 80 degrees F depending on the day and the season of the year. Daily temperatures vary as much as fifteen to twenty degrees between daylight hours and early morning hours. The median rainfall in the low areas of the site are around 45 inches per year and near the mauka site boundary some 55 inches. The rainfall varies from month to month with some months having zero rainfall. U. S. Department of Interior streamflow measurements of Malaekahana Stream, which flows near the north boundary of the site, has a recorded average discharge of 2.11 cfs per day. Extremes show that in July 1971 the total flow for the month was only .50 cfs whereas on April 24, of the same year the daily flow was 66 cfs. Based on the stream flow data, it is safe to say that the area and the site itself are subject to occasional intense showers.

The Kahuku area is subject to trade winds, which blow from the northeast. As moisture laden clouds are shoved against the northern most extremities of the Koolaus, the updraft of winds cool the clouds sufficiently so that rainfall is intensified at the higher elevations. Rainfall two miles southwest of the site exceeds 118 inches per year.

Although extremes in rainfall are noted at the site, some 30 percent of the days are clear, another 30-35 percent are partly cloudy and another 30-35 percent are cloudy. The climate is good for golfing activities.

Proposed Development

An 18 hole golf course is planned for the site. Approximately one half of the 200 acre site will be developed into tees, greens, fairways, along with a driving range and putting green. The remaining 100 + acres would remain as roughs, or improved into a clubhouse, parking area, and maintenance facilities. The existing large swale lying within the proposed driving range (Figure 3) will remain as a detention pond for storm runoff. Additional ponds or lakes will be created to act as water hazards and for irrigation water storage. The clubhouse, some 16,000 to 18,000 square feet, will have men's and women's locker rooms and showers, pro shop and starter's station, small meeting rooms, lounge, snack bar, kitchen and a storage area for golf carts. A parking lot that will accommodate some 175 to 200 cars will be constructed adjacent to the clubhouse. The club house is proposed to be located on the high level ground near the mid area of the course. This location will permit a panoramic view over the course with ocean and rural views beyond.

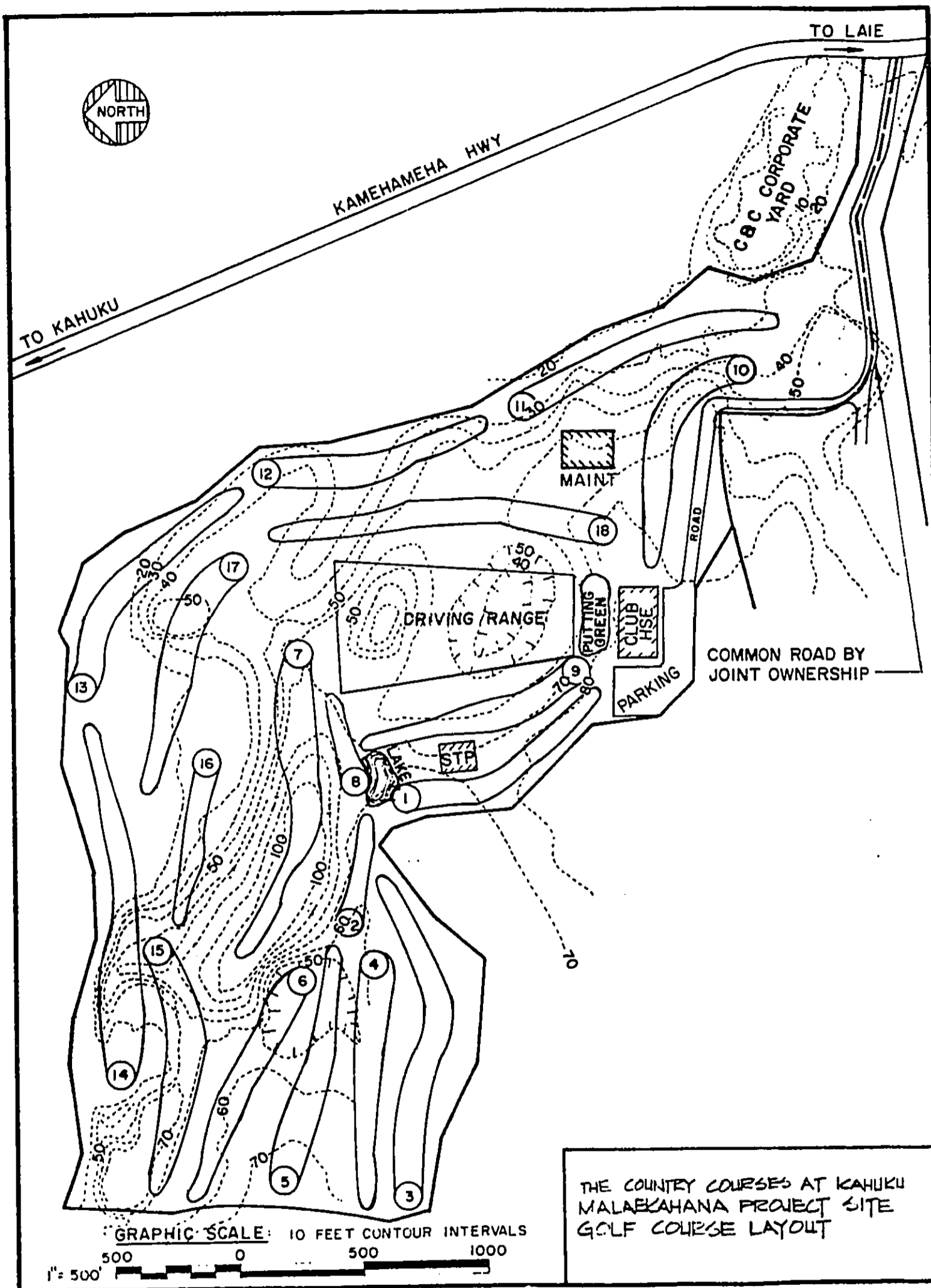


FIG. 3

A golf driving range will be developed along with a large putting green in front of and below the clubhouse. The driving range will be sized for 20 to 25 tee positions. Parking will be above and in back of the clubhouse.

It is planned that this course would be for local residents and tourists alike. The course would be of moderate complexity and offer tournament play to local organizations. The project would provide opportunities to players who presently cannot get starting times at municipal courses.

Proposed Wastewater Treatment and Disposal

The proposed 18 hole golf course lies some 11,000 feet from the Kahuku Wastewater Treatment Plant (WWTP). This WWTP is the only municipal wastewater handling facility near the project area. The plant is presently sized to treat 0.2 million gallons per day with provisions to expand to a 0.4 million gallon per day plant. The sewer areas are all within the Kahuku Village and no plans to extend sewers towards the project site are contemplated. South from the proposed golf course is Laie. This village is only partially sewered and is served by a privately operated WWTP at the Brigham Young University-Hawaii. Zions Securities owns and operates the 0.5 MGD plant and collection system. This private system is rapidly nearing its design capacity of 0.5 MGD. The present flows from the University, Polynesian Cultural Center and some 25 percent of the homes are about .4 MGD. Extension of the collection system to all homes within Laie would load the plant to capacity. The northern extremity of the Laie collection system lies approximately one mile from the proposed golf course development.

Homes in Kahuku and Laie, not served by the WWTP are connected to cesspools.

With the Laie private WWTP inadequate to provide service to all Laie residences and Kahuku WWTP proposed expansion already allocated as to wastewater contributors, it appears unlikely that the golf course would be permitted to connect to the existing systems.

A limited bacteriological survey was conducted in certain locations on the waters along the shoreline and in the Malaekahana and Kahawainui Streams which lie east, north, and south of the proposed golf course site. The results of the sampling are shown in Table 1.

The data indicate that the shoreline water meets the Hawaii State Department of Health water quality standards of 200 coliform per 100 milliliters (ml) for recreational activity, except for two sites at Laie. Two storm water discharge pipes are located at these sites (15 and 17). It is believed that these contribute to the higher coliform counts there. Coliform levels in the streams, including Malaekahana, were also in excess of state water quality standards. The R. M. Towill Corporation Report (1985) on the North Oahu Facility Plan from where this information is derived, attributes the high count to farm animal and agricultural land storm runoff and cesspool seepage from homes.

TABLE 1

BACTERIOLOGICAL SURVEY DATA ANALYSIS

Sub Area	Site No.	Site Location	Sample No.	5/13/82-5/19/82 (Wet Season)			8/24/82-9/14/82 (Dry Season)		
				TC 100 ml	FC 100 ml	FS 100ml	TC 100 ml	FC 100 ml	FS 100 ml
Kahuku	7	Reef Area	1	1	1	410	1	1	50
		By Golf Course	2	1	1	10	1	1	90
	8	Malaekahana Stream	1	800	210	2,200	4,400	2,600	7,200
			2	1,500	200	1,500	4,000	3,400	2,100
10		Shoreline	1	1	1	70	1	1	190
		Makahoa Bay	2	1	1	10	1	1	43
Lai	11	Kahawainui Stream	1	16,000	7,200	2,700	2,700	500	3,700
			2	39,000	1,800	1,500	7,300	2,000	4,100
12		Upstream of Site 11	1	800	300	800	6,000	400	500
				3,900	400	1,000	3,600	1,000	2,700
14		Shoreline	1	30	20	200	50	40	240
		Lai Bay	2	60	20	40	340	180	180
15		Shoreline	1	8,000	5,000	3,200	13,000	2,900	2,500
		BYUH Outfall	2	30,000	1,200	1,000	50,000	30,000	4,100
17		Shoreline	1	1,400	600	1,350	6,300	800	900
		Poly.Cult.Cent.	2	3,600	630	560	6,900	3,400	6,400

Notes: 1. TC = Total Coliform; FC = Fecal Coliform; FS = Fecal Streptococcus

2. For recreational use, FC ≤ 200/100 ml.

As neither the Kahuku municipal sewerage system nor the privately-owned Laie plant is available to handle wastewater flows generated by the proposed Malaekahana Golf Course, it appears that the proposed Golf Course will have its own sewage collection system, treatment plant and disposal system.

The estimated maximum wastewater design flow is based on an estimated maximum water use for the facilities at the clubhouse (restrooms, showers, restaurant, snack bar, offices and maintenance).

300 golfers @ 10 gpd	= 3,000 gpd
150 showers @ 15 gpd	= 2,250 gpd
250 meals @ 5 g/meal	= 1,250 gpd
30 Office & Maintenance Personnel @ 50 gal/shift	= 1,500 gpd
Total gallonage	= 8,000 gpd

From the above it appears that the daily wastewater flow would vary from possibly 7,500 gpd to 10,000 gpd.

Wastewater from the clubhouse will flow in gravity sewers while the maintenance building wastes will be collected in gravity sewers and conveyed to a small sewage ejector station. Intermittently, as sewage collects in the ejector, the wastewater will be lifted to the golf courses WWTP for treatment and disposal. (See Figure 4). The wastewater generated by the project is expected to be typical domestic sewage, possibly slightly high in grease content because of the "short order" cooking of hamburgers and other fried foods. For this reason, the kitchen will require a good grease trap. The biochemical oxygen demand and the suspended solids content of the wastewater will be considered at 200 mg/l.

The proposed treatment process will be complete mix activated sludge. This biological waste treatment method consists of the following major components:

1. Aeration tanks with diffused aeration equipment
2. Settling tanks
3. Return and waste sludge pumps and system
4. Filter
5. Chlorinator & contact tank

A flow diagram of the treatment process is schematically shown in Figure 5.

1. Aeration tank. The aeration tank is a holding chamber where a suspension of microorganisms is maintained in the presence of oxygen. The organic material in wastewater is used by the microorganisms as a food source for growth and reproduction, thereby reducing the organics of the wastewater to inoffensive end products. Aeration is necessary to maintain oxygen levels required by the microorganisms. Mixing by air or mechanical mixers is required to maintain suspension of solids and to ensure direct contact between the activated sludge microorganisms and the incoming raw wastewater.

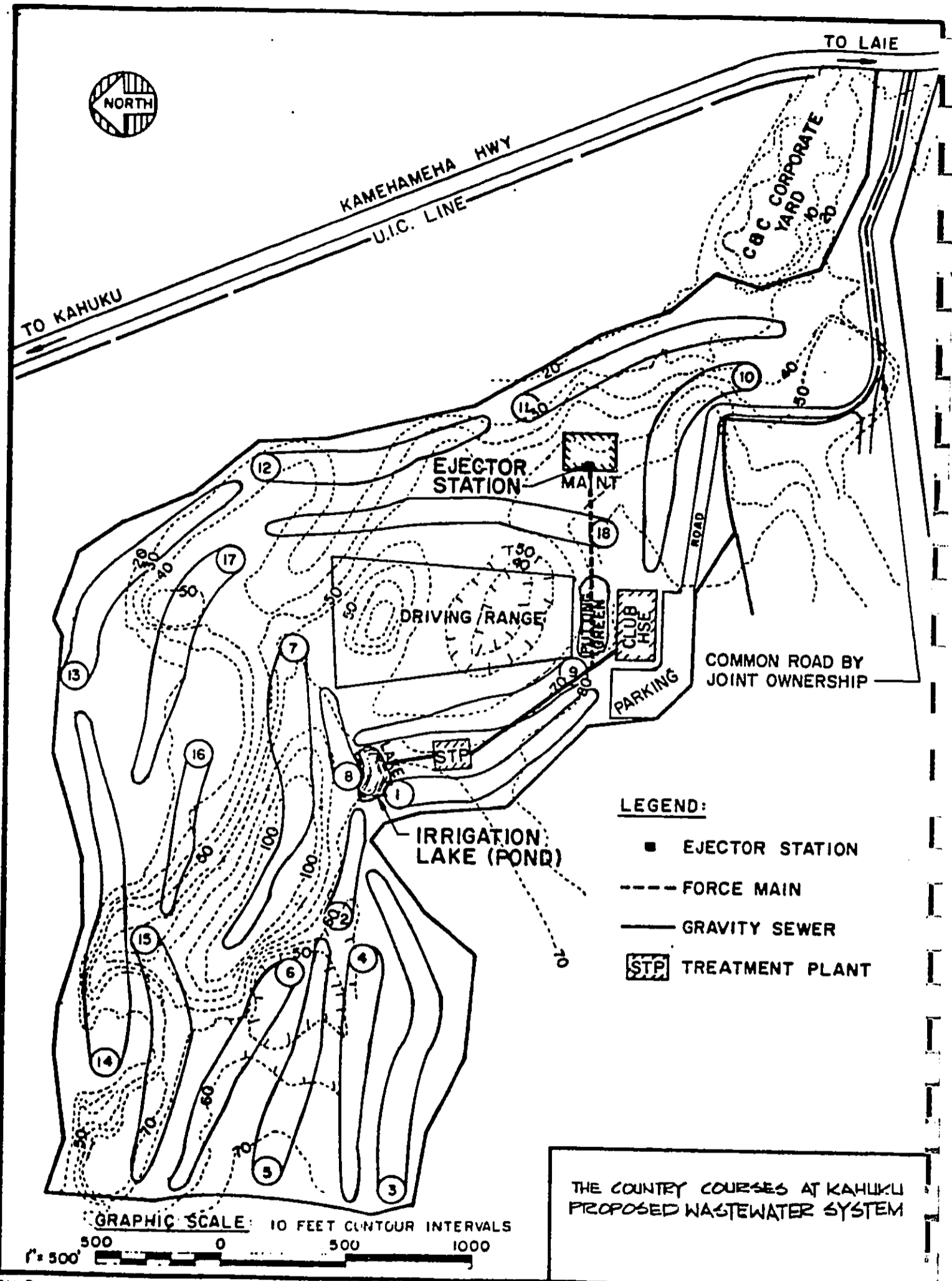
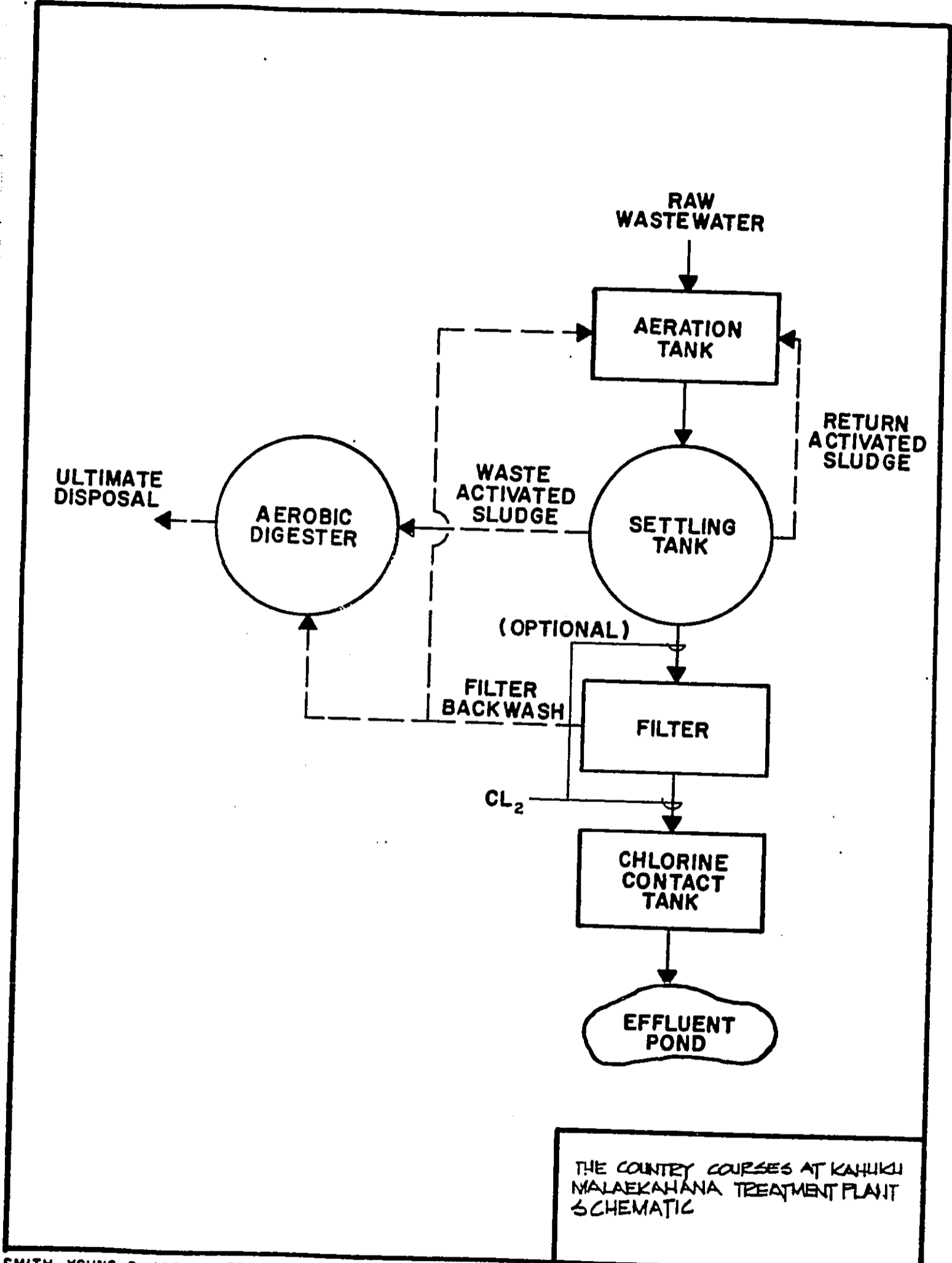


FIG. 4



THE COUNTRY COURSES AT KAHUKU MALAEKAHANA TREATMENT PLANT SCHEMATIC

2. Settling tank. Settling tanks rely on gravity to separate the mixture into a clear, treated effluent (overflow) and a heavier, concentrated activated sludge (underflow). An active culture of microorganisms in the settled sludge can then be continuously returned to the aeration tank to maintain the proper amount of bacteria for efficient treatment. When a surplus amount of settled sludge is present, a certain percentage is transferred into the aerobic digester for further treatment and final disposal.
3. Filter. Filtration of the settling tank overflow removes additional solids by deposition on the filter media. Thus, effluent quality can be improved by further reduction of BOD and SS concentrations as well as bacterial numbers. Periodic backwashing of the filter media is required to loosen and remove the accumulated solids from the media. Filter backwash can be returned to the liquid treatment process by recirculation to the aeration tank or directed to the aerobic digester for solids treatment.
4. Chlorination. Chlorination of effluent provides disinfection, prevents the spread of waterborne diseases, and controls algal growth and odors. Chlorination can be accomplished by in-line chemical injection to ensure good mixing of chlorine in the effluent. Mixing followed by adequate contact time in a chamber prior to disposal ensures effective disinfection. An optional point of chlorine application is before the filter. This will control algal growth on the filter media.

In the treatment process for solids treatment and disposal, waste activated sludge will be pumped to an aerobic digester-holding tank for sludge stabilization. Additional sludge treatment may be accomplished by transporting the aerobically digested sludge to a City and County treatment facility via tanker trucks. Disposal of sludge at the approved locations requires a permit from the City and County of Honolulu, Division of Wastewater Management.

For treatment reliability, each unit process at the WWTP will be designed for redundancy to provide backup capability during times of equipment failure or repair. Two tanks of equal volume will be constructed for each of the following unit processes.

Aeration
Settling
Aerobic digestion

The filtration units will be sized so that the average design flow can be accommodated if one unit is off line. One backup ejector will be provided at the maintenance area.

Effluent Characteristics

The WWTP will be designed to remove 90% of BOD and SS. With the use of the filter, the effluent characteristics should be:

BOD	10 to 15 mg/l
SS	10 to 15 mg/l
Nitrogen	20 mg/l
Phosphorus	6 mg/l
Total coliform bacteria	23/100 ml

The effluent quality will meet criteria stated in the current Hawaii Administrative Rules, Title 11, Department of Health, Chapter 62, Wastewater Systems (effective as of December 10, 1988). The total coliform organisms in five grab samples of reclaimed water used for golf course irrigation taken during a 30-day period shall not exceed a median figure of 23 per 100 ml.

As the collection system will be well above groundwater level, no infiltration of high chloride or brackish water is to be expected. The effluent will possibly contain chlorides ranging from 20 to 25 mg/l above the domestic water content.

Proposed Method of Effluent Disposal

The proposed method of effluent disposal is irrigation of the golf course. Chlorinated effluent will flow to an irrigation storage pond. The pond capacity estimated at one to two million gallons, will contain a blend of wastewater effluent and nonpotable irrigation water from onsite wells. One to two feet of freeboard will be provided as additional storage during periods of prolonged inclement weather. The pond will be lined to prevent seepage of irrigation water.

Reclaimed effluent will comprise less than 5 percent of the total daily irrigation water requirements.

Impacts of Effluent Disposal

Under the new State Department of Health Regulations, the old Board of Water Supply "pass-no-pass" line has been superceded and the Hawaii State Department of Health's Underground Injection Control (UIC) line controls. The UIC line is situated along Kamehameha Highway. Thus, the project site is located mauka of and within this injection control zone. Injection is not recommended and is not contemplated.

There is only the remotest possibility that effluent will impact the groundwater and coastal waters if irrigation water should percolate and reach near mean sea level conditions. An evaluation of three elements (nitrogen, phosphorus, and biological organisms) will be discussed further to emphasize this situation.

Nitrogen

Based on typical secondary effluent data, a nitrogen concentration of 20 mg/l may be expected. At a flow rate of 10,000 gpd, approximately 1.5 pounds per day of nitrogen will be contributed by effluent. The irrigation requirements for an 18-hole golf course are between 0.4 and 0.8 mgd, depending on weather conditions and rainfall. Thus, it is assumed that all 1.5 pounds per day of nitrogen will be applied to the golf course turf. A typical 18-hole golf course

could use, on the average, 60 to 70 pounds of nitrogen per day. Therefore the daily effluent will supply only 2 percent of the nitrogen requirements. Because the nitrogen from the effluent will be applied a bit at a time every day, all effluent nitrogen can be utilized by the grass roots. The impact of nitrogen from the treated effluent will not be detrimental to the groundwater or coastal water quality due to the following factors:

1. The quantity of percolate and its corresponding quantity of nitrogen is extremely small in comparison to the groundwater lens.
2. The immense "mixing" and "net transport" characteristics of the coastal waters fronting the project significantly dilute and disperse any percolate entering the coastal waters.
3. The amount of nitrogen introduced unto the ground by the effluent is small. After grass root uptake, the available nitrogen for percolation is nearly non existent.

Phosphorus

A typical phosphorus concentration for secondary effluent averages 6 mg/l. At a flow rate of 10,000 gpd, approximately .5 pound per day of phosphorus will be applied to golf course turf. Unlike nitrogen, phosphorus remains fixed to soil particles; thus, groundwater infiltration of phosphorus is not to be expected.

Bacteria and Viruses

Disinfection of effluent by chlorination will reduce total coliform counts to no more than 23 per 100 ml, as specified by the State Department of Health. Thus, the maximum bacteria and virus levels in the effluent will be within allowable limits for landscape irrigation and better than the measured levels in Malaekahana and Kahawainui streams and Laie Bay (Table 1). Studies conducted by the Water Resources Research Center of the University of Hawaii reported that bacteria and viruses were not present in percolate from secondary effluent irrigation. Researchers attributed the removal of these organisms to soil adsorption, dessication, elevated temperatures, and exposure to sunlight. Infiltration of these organisms to deep aquifers is not probable.

Conclusion

Significant adverse impacts due to effluent disposal by irrigation of the golf course are not foreseen. Mitigation measures include:

1. Storage of excess effluent in irrigation ponds during periods of inclement weather; and
2. Incorporation of a filter in the process treatment scheme to provide reliable treatment efficiency at all times.

The process recommended can meet the eleven conditions applicable to new golf courses as promulgated by the State Department of Health on January 31, 1989.

Other Impacts

There will be short term impacts which are related to the construction process of developing the golf course. This would include dust, noise and to a small extent traffic disruption at the intersection of the course access road at Kamehameha Highway.

Dust will be controlled by a watering program. Noise problems will be mitigated by controlling working hours although the rural location of the site virtually removes the possibility of noise nuisance to neighboring residences. As much of the site work will be concentrated mauka of Kamehameha Highway, the probability of traffic disruption will also be limited. Dust would only be a disrupting factor to traffic during Kona conditions. As this situation occurs some 10 to 15 percent of the time and when it does occur, the "Kona winds" in the Laie area are relatively mild, therefore the dust problem will be minimum to highway traffic. This impact is discussed further in the Construction Activities report. Because of the site location, inconveniences to motorists and visitors to the State Recreational Park will be at a minimum.

Long Term Impacts

Possible negative impacts to the golf course site because of the wastewater treatment process and disposal plan are:

- a. Odors generated from the wastewater treatment plant;
- b. Visual impact of the plant site within the golf course proper;
- c. Noise from equipment operation at the treatment plant.

With proper operation of the treatment plant, in accordance with Chapter 62 of the State Department of Health Regulations, objectionable odors should not be generated by the wastewater plant. Placing the treatment plant upwind and some one thousand feet from the clubhouse will mitigate any odor nuisance that might be generated. However; aerobic conditions at the plant at all times will minimize the possibility of odor generation. Septic conditions of the wastewater will be minimal as the major portions of the flow will be by gravity. Use of an ejector at the maintenance facility automatically forces air into the pumped sewage. This air aids in keeping the waste from "going septic".

The blowers at the treatment plant are the primary source of noise. These blowers will be enclosed and the structure walls treated for sound suppression. The muffling effect will virtually eliminate the noise generation beyond the treatment site.

Landscaping around the perimeter fence of the plant will reduce the visual impact of the plant to the golfers. The distance from the clubhouse combined with the landscaping will mitigate the visual impact to the clubhouse users.

Sub-Appendix H

Malaekahana

Report
on
Grading and Construction Activities
For
The Country Courses at Kahuku
Malaekahana Site

prepared for
The Estate of James Campbell

prepared by
Smith, Young & Associates, Inc.
3049 Ualena Street
Honolulu, Hawaii

April 1990

Introduction

The Estate of James Campbell is proposing the development of an 18 hole golf course in the vicinity of Laie on the northeast shoreline of Oahu. The site, Malaekahana, lies mauka of Kamehameha Highway opposite the Malaekahana State Recreational Area and contains some 200 acres (Figure 1).

The objective of this report is to present the necessary planning and preliminary engineering for the site grading and construction of the proposed golfing site.

Specifically this report covers the following points of the proposed development:

- a. Existing site and site conditions;
- b. Background information on the proposed development site;
- c. Proposed development and necessary grading and construction work;
- d. Impacts and mitigative measures to be undertaken at the site.

Site and Site Conditions

The property considered for development is located in the Koolauloa District, with the Tax Map Key designations TMK 5-6-05: Portion 7. The 200 acre site has been owned by The Estate of James Campbell since before the turn of the twentieth century.

The site is connected to Kamehameha Highway by a narrow strip of land extending mauka to the main body of the property. The site is currently vacant, with the exception of some grazing areas. The site was previously planted in sugar cane, but since the closing of Kahuku Plantation, the land has been returned to pasture. Some of the areas have become overgrown indicating the underusage of the site.

No stream or intermittent stream gulches cross the property. The site slopes upward from approximately 10 feet above sea level near Kamehameha Highway to some 80 feet near the mauka boundary. Several small hills and several depressions are found on the site. Concrete lined ditches cross parts of the site. These were used for irrigation purposes during the sugar cane years. They are now in disrepair and overgrown. Several barbed wire fences, placed by tenants to control the grazing animals, extend through the site.

Land uses of adjoining properties are industrial, agricultural, recreational, and vacant. The Malaekahana Recreational State Park lies across Kamehameha Highway. The City and County Corporation Yard is immediately east of the site. To the south, Asahi Juken is proposing an additional golfing area. West and north from the site lie agricultural lands partially in use; some areas lie fallow.

The site is presently designated an agricultural district by the State Land Use Commission. The Koolauloa Development Plan Land Use Map shows the site Agriculture, while the City and County of Honolulu's Zoning District classifies the site as Agriculture (AG-1/AG-2).

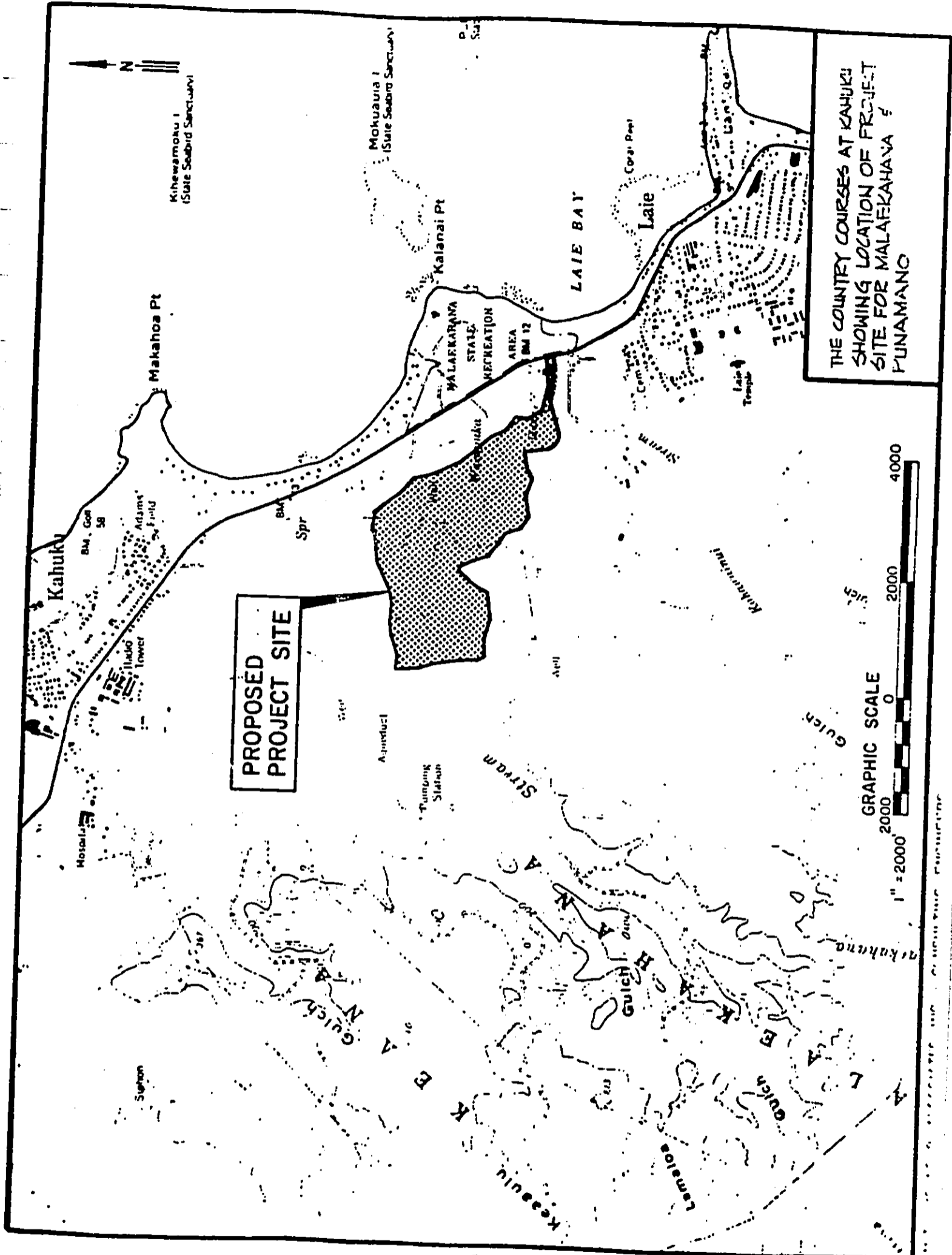


FIG. 1

Figure 2 shows that the Malaekahana site lies between the 39" and 59" isohyetal lines of the Median Annual Rainfall Map, as published by the Department of Land and Natural Resources, State of Hawaii. The annual rainfall near the entrance at Kamehameha Highway may be around 40 inches while the upper reaches of the site might receive a possible 57" rainfall.

Proposed Development

An 18 hole golf course is planned for the site. Approximately one half of the 200 acre site will be developed into tees, greens, fairways, along with a driving range and putting green. The remaining 100 + acres would remain as roughs, or improved into a clubhouse, parking area, and maintenance facilities. The existing large swale lying within the proposed driving range (Figure 3) will remain as a detention pond for storm runoff. Additional ponds or lakes will be created to act as water hazards and for irrigation water storage. The clubhouse, some 16,000 to 18,000 square feet, will have men's and women's locker rooms and showers, pro shop and starter's station, small meeting rooms, lounge snack bar and kitchen. Storage for golf carts will also be provided. A parking lot that will accommodate some 175 to 200 cars will be constructed adjacent to the clubhouse. The clubhouse is proposed to be located on the high level ground near the mid area of the course. This location will permit a panoramic view over the course with ocean and rural views beyond.

A golf driving range will be developed along with a large putting green in front of and below the clubhouse. The driving range will be sized for 20 to 25 tee positions. Parking will be above and in back of the clubhouse.

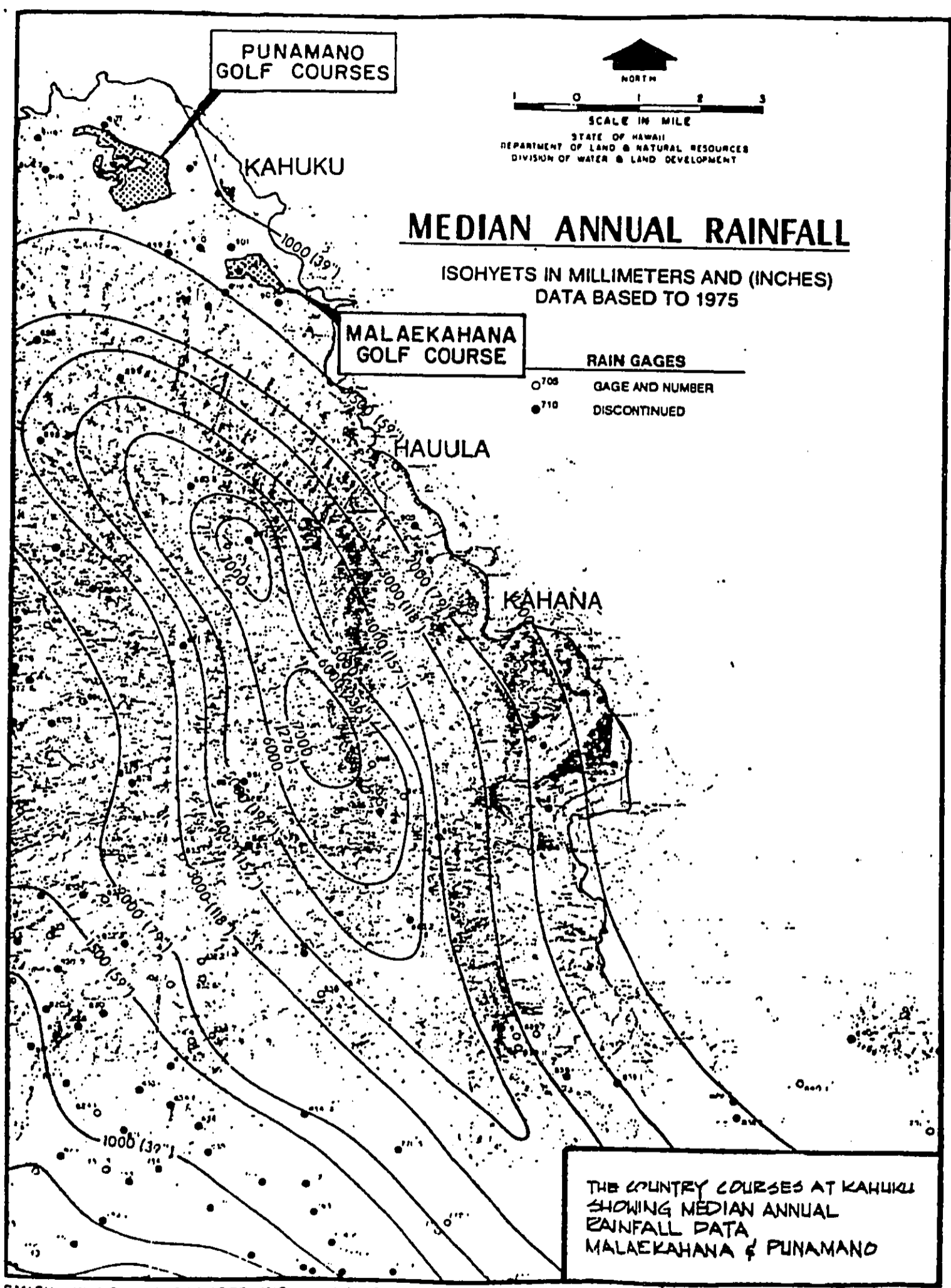
It is planned that this course would be for local residents and tourists alike. The course would be of moderate complexity and offer tournament play to local organizations. The project would provide open opportunities to players who presently cannot get starting times at existing municipal courses.

Construction Work and Grading

In the construction of the facilities discussed in the previous paragraph, it will be necessary to bring about certain short-term negative impacts associated with construction. Within the 200 acre parcel that constitutes the project site, some 110 acres will be reshaped to some extent. This will require grading of the golf course site itself, reshaping tees and greens, developing sand traps and swaling areas to guide surface runoff to retention areas or ponds.

The total cubic yardage of excavation is not expected to be extensive. The volume and location of deposition of excavated soil will be indicated on the grading plan when the detailed grading requirements are known. It is expected that all excavated soil will be spread and leveled to shape the several fairways, tees and greens of the course. Shaping of drainage swales, retention basins, sand traps and the like will be a combination of excavated areas and embankments. The grading permit review will require both the volume of grading and the site location for deposition. When the permit is sought, an erosion control plan will be provided.

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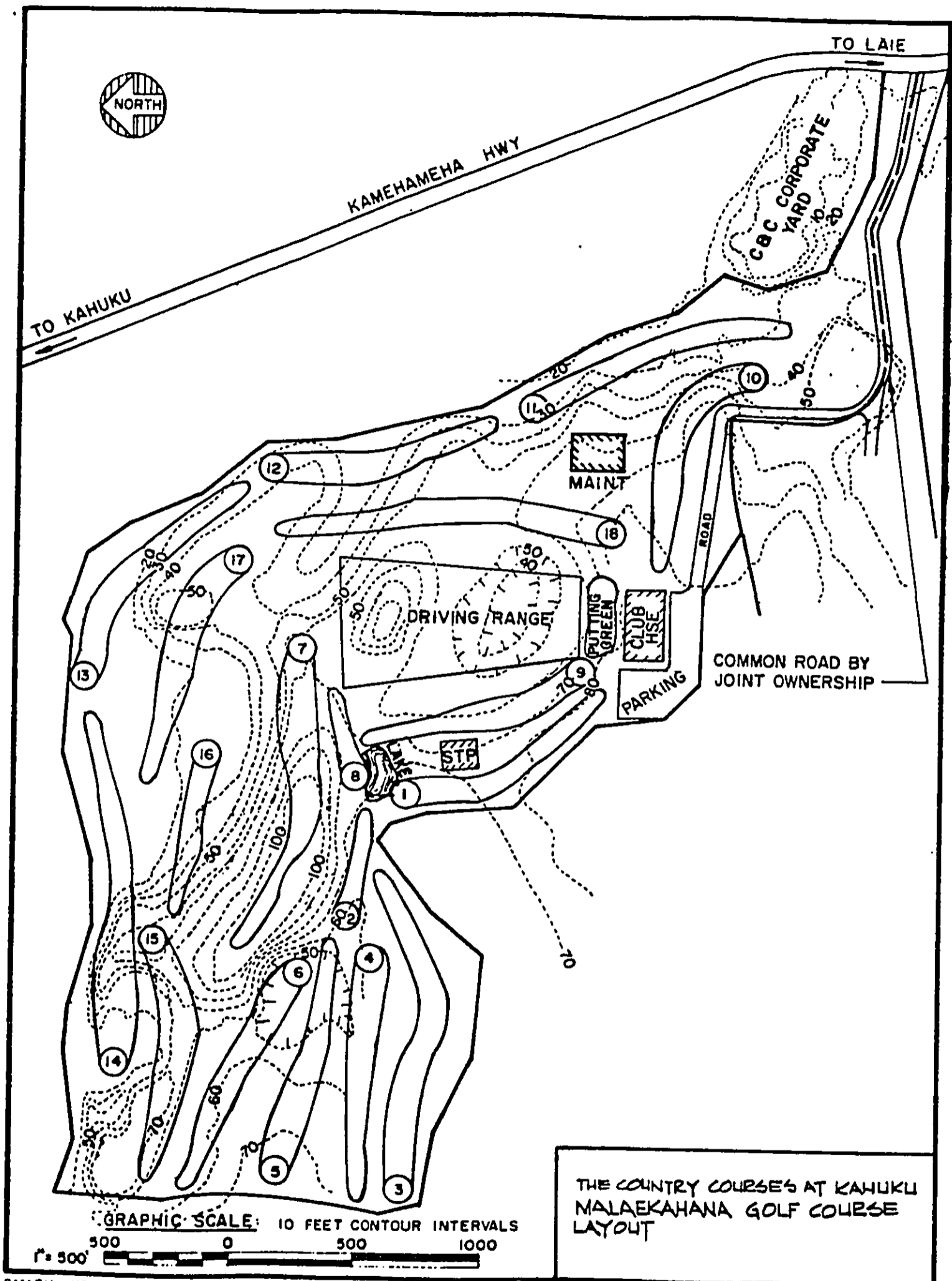


FIG. 3

The location of swales, drainage ditches, irrigation water retention ponds and sedimentation basins will fall under the control of the golf course designer who lays out the course in its final form. Our general layout, and this EIS points out that swales ditches, ponds, traps, and retention basins will be required. The final design, after general concept approval has been received, will match these requirements with the design details of the course by the golf course professional selected. Control of these features will be by Public Works review at the time of grading permit requests and erosion control maps are presented.

As the golf course itself develops, the access road will be constructed, the parking lot graded and leveled and the clubhouse will be erected. Associated with these activities will be the necessary trenching for waterline, sewerline, electrical and telephone ducts and all utility work associated with such a development. At least one new well will be drilled and one well refurbished.

Trenching, foundation excavation, parking lot grading and stabilization as well as access road construction will be accomplished in the normal manner as required by Public Works Construction.

Clearing, grubbing and grading of the golf course proper will be accomplished in phases so that a limited acreage will be barren of ground cover at any given period of time. Every step possible to suppress dust will be undertaken by the golf course developer.

Prior to any work being undertaken at the site, an erosion control plan shall be completed and adhered to. Basically the following construction methods will be followed throughout the project:

1. All clearing and grubbing work shall be done in accordance with Chapter 23, Grading, Soil Erosion and Sediment Control, of the Revised Ordinances of Honolulu, 1978, as amended (Ordinance No. 81-13).
2. The contractor shall remove all silt and debris resulting from his work and it shall not be deposited in drainage facilities, roadways, and other areas.
3. The contractor shall keep the project area and surrounding area free from dust nuisance. The work shall be done in conformance with the air pollution control standards and regulations of the State Department of Health.
4. All slopes and exposed areas shall be sodded or planted as soon as final grades have been established. Planting shall not be delayed until all grubbing has been completed. Redistribution of surplus excavation shall be continuous, and any area within which work has been interrupted or delayed, shall be planted.
5. Fills on slopes steeper than 5 horizontal to 1 vertical shall be keyed.
6. Temporary erosion controls shall not be removed before permanent erosion controls are in-place and established.
7. All grubbing operations shall be performed in conformance with the applicable provisions of Chapter 54, Water Quality

- Standards, and Chapter 55, Water Pollution Control, of Title II, Administrative Rules of the State Department of Health.
8. Maximum cut and fill slopes shall be 2 horizontal to 1 vertical.
 9. The limits of the area to be grubbed shall be flagged before the commencement of the grubbing work.
 10. Grubbed material shall not be placed next to drainage ways, streams, waterways, etc.
 11. The contractor shall maintain a water truck and shall dampen the grubbed graded area with water.
 12. The contractor shall conduct his operations so that the exposed area shall be kept damp with water during his clearing and grubbing operation. At the end of each day, the site shall be sufficiently dampened so that the site remains moist during the night.

As the project site lies within agricultural lands mauka of Kamehameha Highway the site is an easy workable site as far as nuisance value is concerned. The land lies downwind from the main highway and traffic so that dust, should it be generated, will not bother the motorists during the time of tradewind conditions. Because the site lies on the leeward slope under "kona wind" conditions, the winds will be light and variable during that wind condition. Disturbance by dusty conditions would therefore be at a minimum.

Few homes exist near the site except the vacation beach houses adjacent to the State Recreational Park along Malaekahana Beach (Makahoa Bay). As the proposed site also lies downwind from these residences, any noise generated by the equipment will be suppressed by the wind direction during normal trade-wind conditions. Equipment expected to be used by a contractor for the development of the site would be normal heavy equipment; bulldozers, graders, backhoes, drilling equipment, trenchers, and trucks. There appears to be no need for blasting or jack-hammer work.

Mitigating Measures

Dust suppression by watering is probably the major mitigating step to be taken during the development of the course. Planting the graded areas as soon as possible after the grading and shaping is completed is probably a close second.

All equipment used on site shall be provided with mufflers and shall be operated during normal working hours between 7 a.m. and 5 p.m. There does not appear to be a need for night work. Building construction will be during normal working hours. Traffic, that might be generated at the access road and Kamehameha Highway, shall be limited to normal automobile traffic between 6:00 a.m. and 8:00 a.m. and 4:00 p.m. and 6:00 p.m. Hauling of materials or use of heavy equipment along Kamehameha Highway shall be restricted to the hours after 8:00 a.m. and prior to 4:00 p.m. Because the site proper will only have some 60 percent of the land developed, or re-shaped, it is believed that hauling of material to and from the site will be minimal and that traffic nuisance will also be at a minimal level.

Sub-Appendix I

Malaekahana

Tsunami

and

Flood Hazards

Report

for

The Country Courses at Kahuku

Malaekahana Site

prepared

for

The Estate of James Campbell

prepared by

Smith, Young & Associates, Inc.

3049 Ualena Street

Honolulu, Hawaii

April 1990

Introduction

The Estate of James Campbell is proposing the development of an 18 hole golf course in the vicinity of Laie on the northeast shoreline of Oahu. The site, Malaekahana, lies mauka of Kamehameha Highway opposite the Malaekahana State Recreational Area and contains some 200 acres (Figure 1).

The objective of this report is to present the necessary planning and preliminary engineering for the Tsunami/Flood Hazards of the site.

Site and Site Conditions

The property considered for development is located in the Koolauloa District, with the Tax Map Key designations TMK 5-6-05: Portion 7. The 200 acre site has been owned by The Estate of James Campbell since before the turn of the twentieth century.

The site is connected to Kamehameha Highway by a narrow strip of land extending mauka to the main body of the property. The site is currently vacant, with the exception of some grazing areas. The site was previously planted in sugar cane, but since the closing of Kahuku Plantation, the land has been returned to pasture. Some of the areas have become overgrown indicating the underusage of the site.

No stream or intermittent stream gulches cross the property. The site slopes upward from approximately 10 feet above sea level near Kamehameha Highway to some 80 feet near the mauka boundary. Several small hills and several depressions are found on the site. Concrete lined ditches cross parts of the site. These were used for irrigation purposes during the sugar cane years. They are now in disrepair and overgrown. Several barbed wire fences, placed by tenants to control the grazing animals, extend through the site.

As far as site topography is concerned, the elevations range from 10 feet above sea level near Kamehameha Highway to some 80 feet along the mauka boundary (Figure 2). The highest elevation within the site is slightly over 100 feet. Slopes of 3 to 10 percent are found throughout the site with some steeper slopes of 25 percent around isolated hillocks. Two depressions lie within the site which would tend to hold some normal runoff at times of moderate to heavy rainfall. Aside from the two depressions, the drainage of the site is towards the north and northeast to the main course of Malaekahana Stream.

The project site is situated along the southern or southeastern portion of the Malaekahana watershed (Figure 3). The proposed golf course site represents slightly over 5 percent of the entire basin. Runoff from the Malaekahana drainage basin flows to the ocean by way of the Malaekahana Bridge at Kamehameha Highway.

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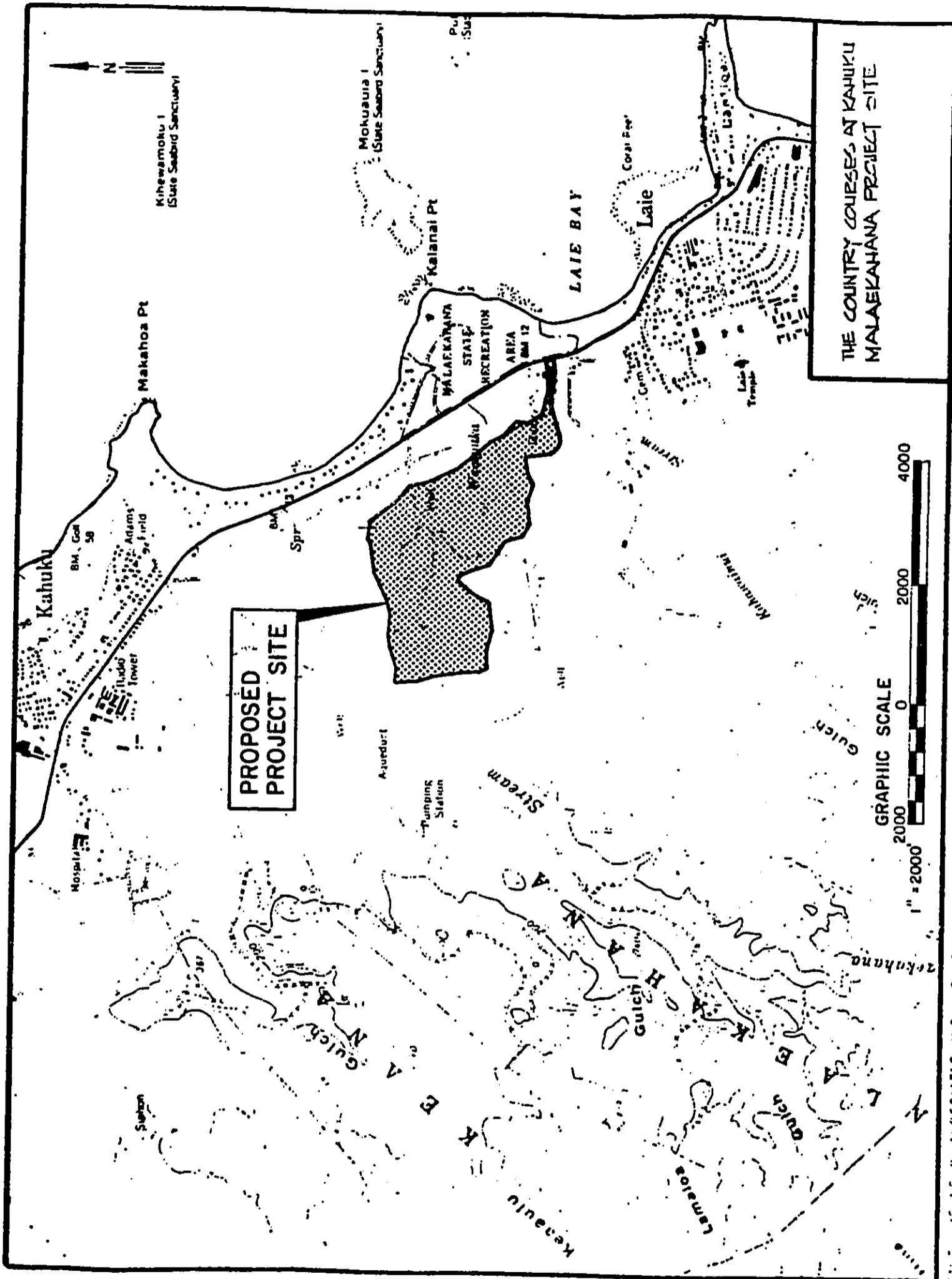
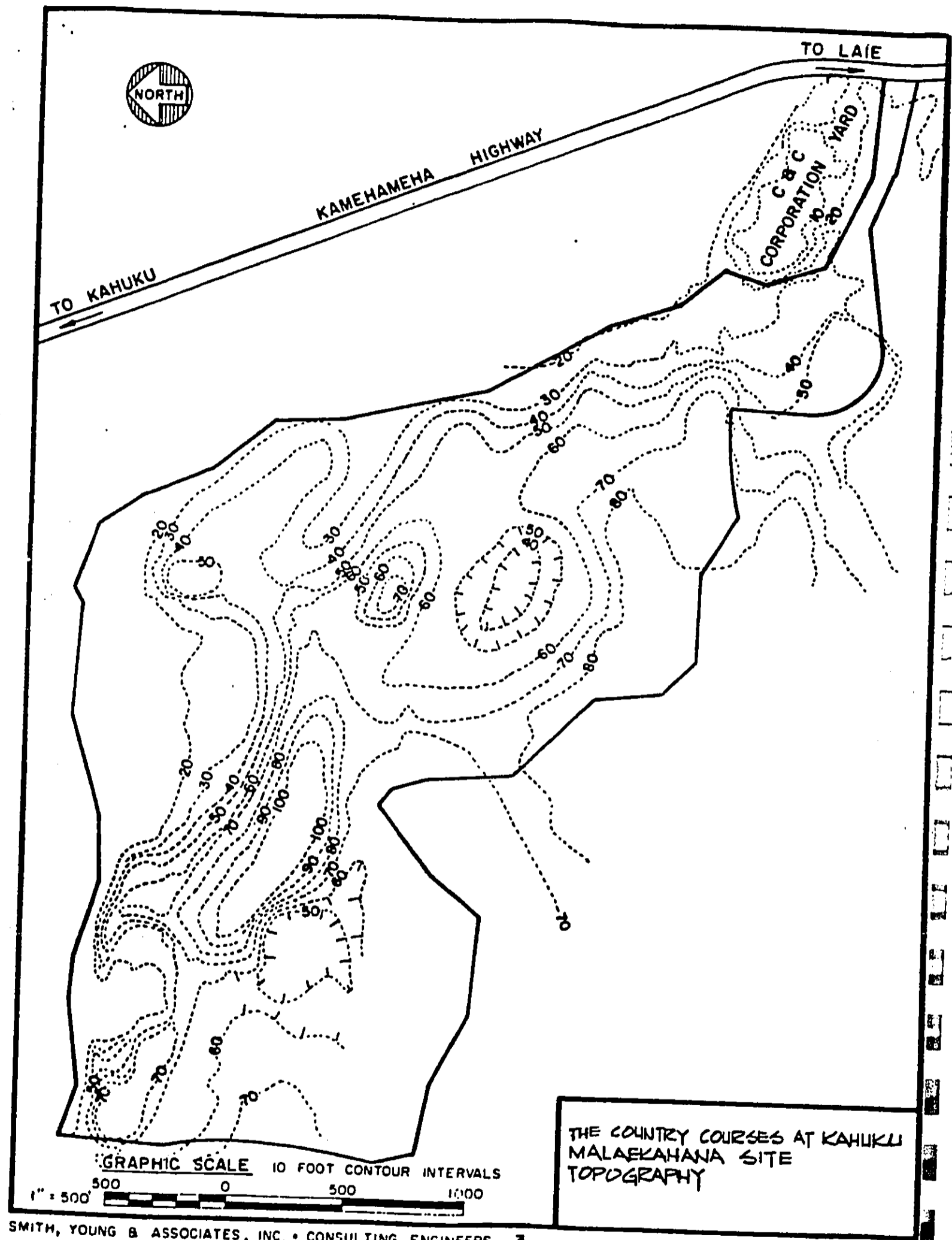


FIG. 1

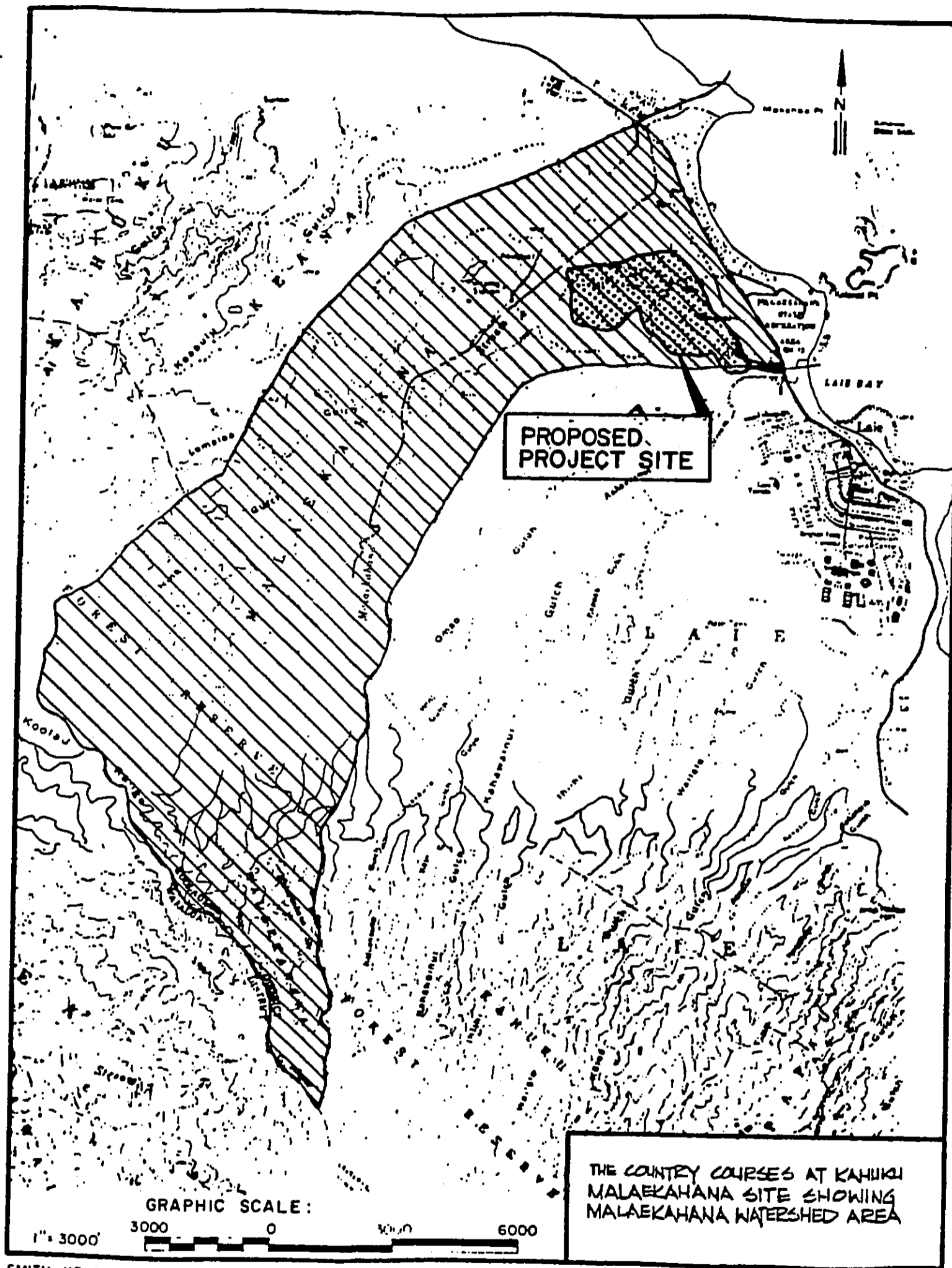
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SMITH, YOUNG & ASSOCIATES, INC. • CONSULTING ENGINEERS 3

FIG. 2

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SMITH, YOUNG & ASSOCIATES, INC • CONSULTING ENGINEERS 4

FIG. 3

Flood Hazards

The proposed Malaekahana site for the 18 hole golf course lies outside of the flood hazard area. Circular C 93, Volume II, General Flood Control Plan for Hawaii as produced by the State of Hawaii, Department of Land and Natural Resources, September 1983 provides recommended measures for combating floods. The Malaekahana Stream had only two recommended improvements:

1. Flood plain zoning to establish encroachment zones along the lower reach of Malaekahana Stream in the potential tsunami inundation area (See Figure 4).
2. Open and stabilize the outlets and improve the carrying capacity of the lower reach.

Malaekahana Stream has an approximate drainage basin area of some 5.3 square miles. Stream flow records from July 1963 through September 1971 indicate that a flow from the total watershed could be as high as 4000 cfs as an instantaneous peak discharge. The average daily flow of the stream is more likely to be some 7 or 8 cfs with zero flow possible during the dry months. The Flood Insurance Rate Map shows that a small section of the proposed golf course lies in the AE zone where the base flood elevation has been determined. This area coincides with the proposed new sump to be established to hold storm runoff waters from the site. Should a storm of this magnitude occur the lower extremity of the golf course would be flooded as would be the aquaculture ponds lying northwest of the golf course site. Figure 5 shows that the 20 foot elevation lies within that AE zone. All of the remaining portion of the golf course lies in D zone or areas where the flood hazards are undetermined. In as much as a U. S. Geological Survey Map shows a bench mark of 13 feet msl on Kamehameha Highway is not within the broad flood plain of Malaekahana, it is questionable that the 20 foot msl contour would be flooded. If any portion of the proposed Malaekahana golf course lies within a designated flood plain, it would be the low lying impoundment area proposed to hold stormwater runoff at fairways 13, 14, and 17. Please refer to the Impacts and Mitigation measures of Drainage and Stormwater Runoff Report.

Figure 4 shows the tsunami inundation area as provided by the Department of Civil Defense, City and County of Honolulu. The proposed project site lies beyond the tsunami inundation area.

No mitigation features are necessary.

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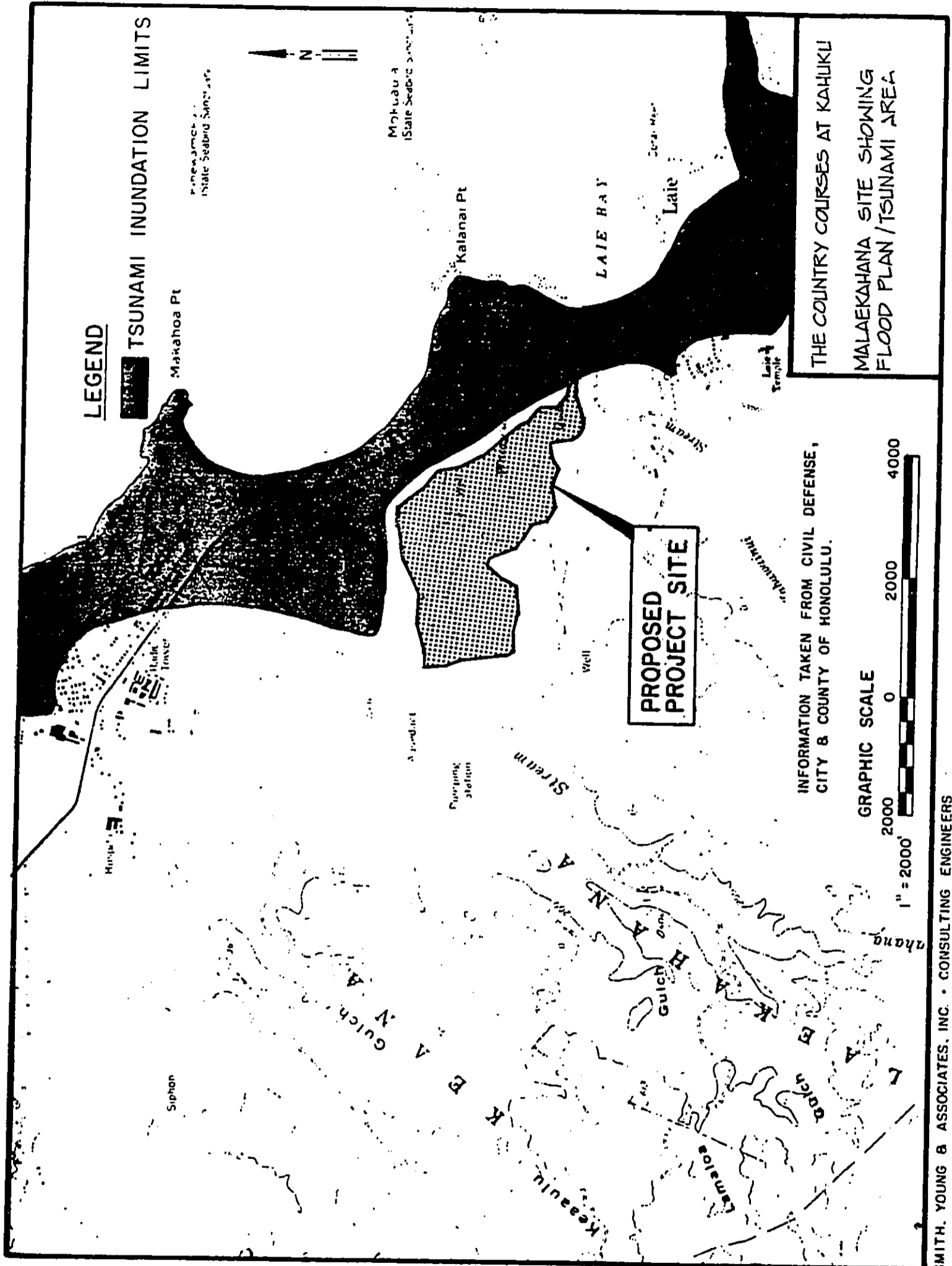
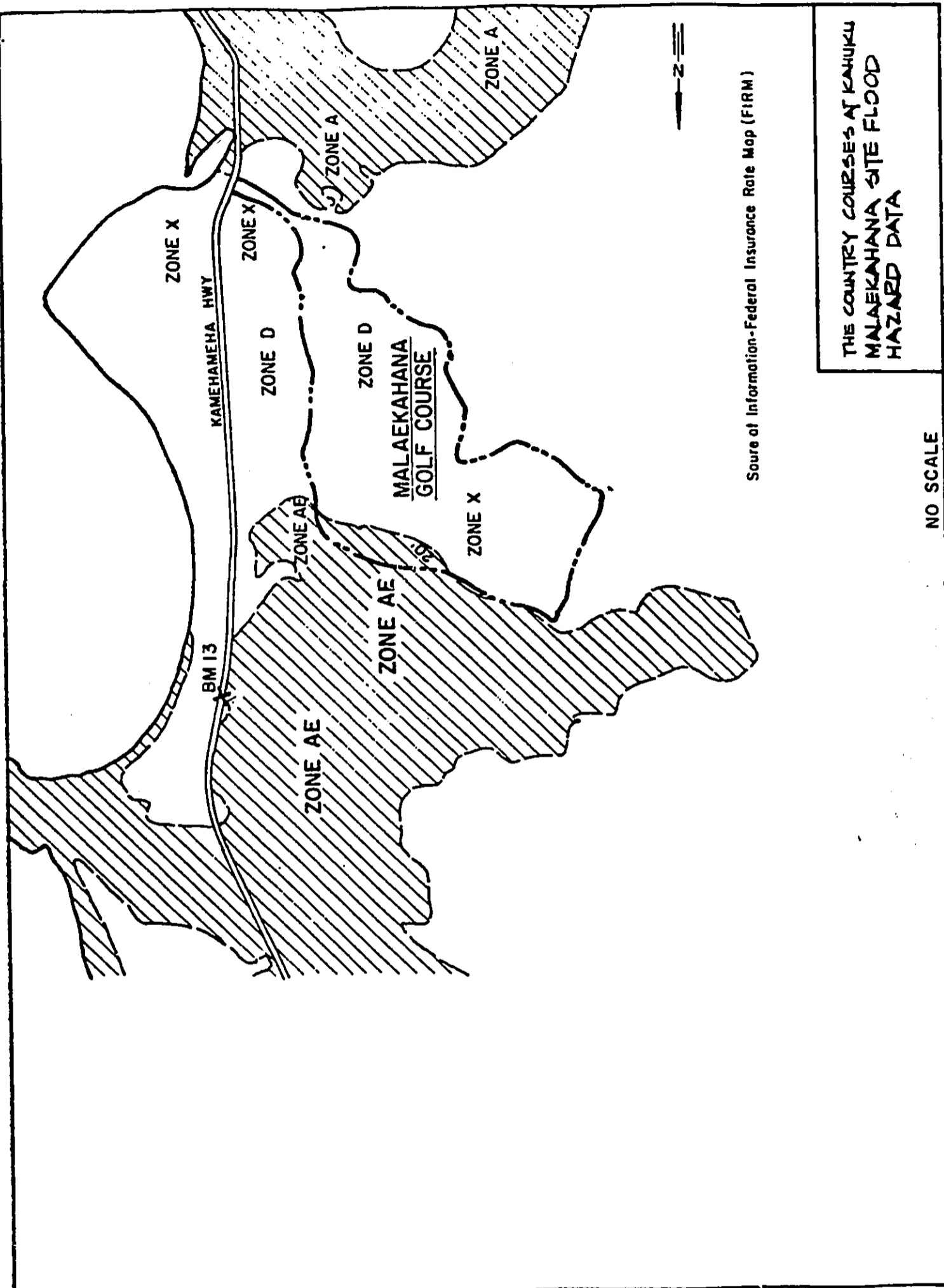


FIG. 4

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Sub-Appendix J

Malaekahana

Report
on
Solid Waste Disposal
and
Landfill Requirements
For
The Country Courses at Kahuku

Malaekahana Site

prepared for
The Estate of James Campbell

prepared by
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April 1990

Introduction

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The objective of this report is to present information on solid waste disposal and the resulting requirements of a sanitary landfill during the construction and operation of the proposed golfing site.

Specifically this report covers the following points of the proposed development:

- a. Existing site and site conditions;
- b. Possible generation of solid wastes at the site and its disposal.

Site and Site Conditions

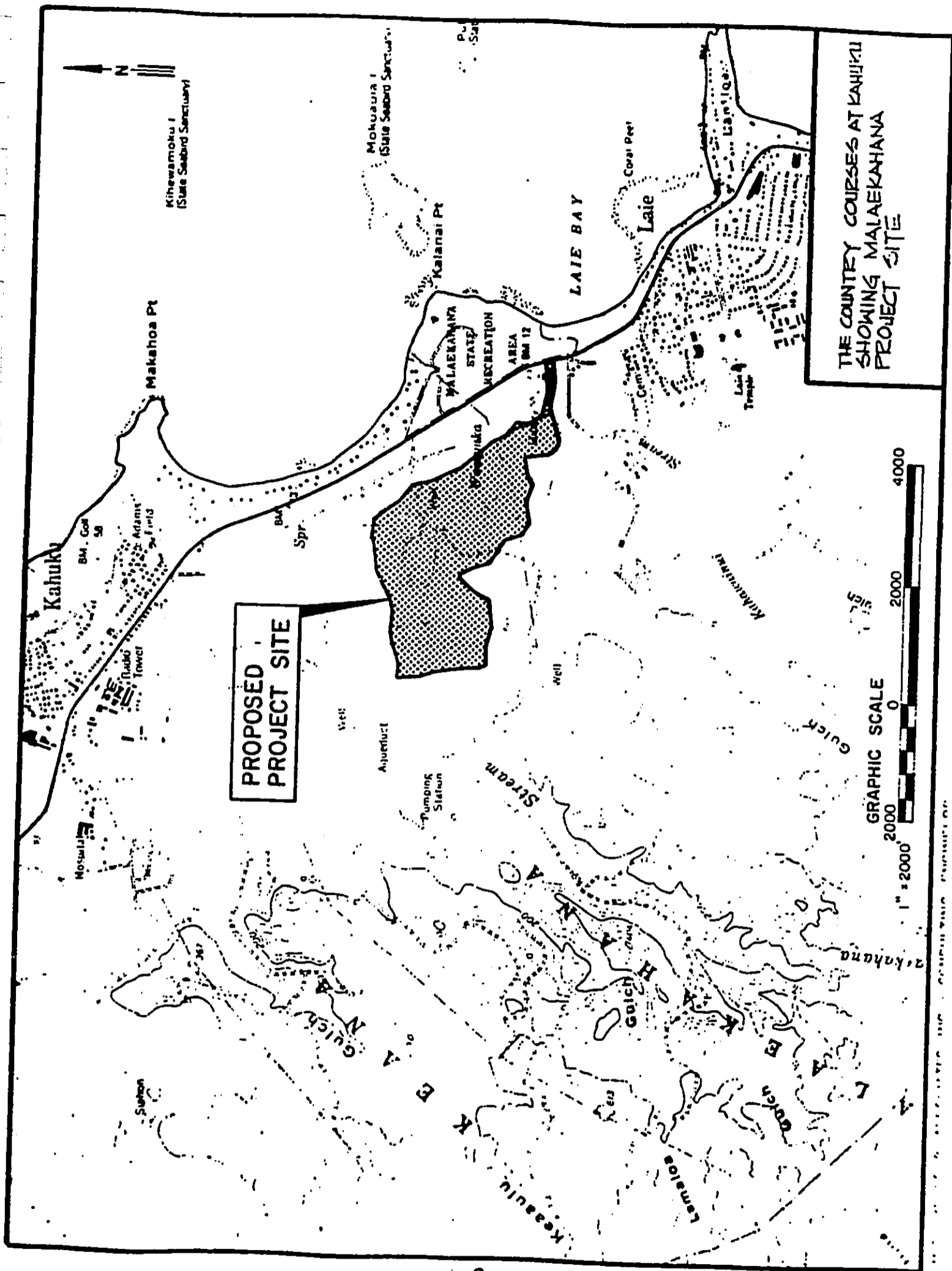
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The site is connected to Kamehameha Highway by a narrow strip of land extending mauka to the main body of the property. The site is currently vacant, with the exception of some grazing areas. The site was previously planted in sugar cane, but since the closing of Kahuku Plantation, the land has been returned to pasture. Some of the areas have become overgrown indicating the underusage of the site.

No stream or intermittent stream gulches cross the property. The site slopes upward from approximately 10 feet above sea level near Kamehameha Highway to some 120 feet near the mauka boundary. Several small hills and several depressions are found on the site. Concrete lined ditches cross parts of the site. These were used for irrigation purposes during the sugar cane years. They are now in disrepair and overgrown. Several barbed wire fences, placed by tenants to control the grazing animals, extend through the site.

Land uses of adjoining properties are agricultural, recreational, and vacant. The Malaekahana Recreational State Park lies across Kamehameha Highway. To the south, Asahi is proposing an additional golfing area. West and north from the site lie agricultural lands partially in use.

The site is presently designated an agricultural district by the State Land Use Commission. The Koolauloa Development Plan Land Use Map shows the site Agriculture, while the City and County of Honolulu's Zoning District classifies the site as Agriculture (AG-1/AG-2).



THE COUNTRY COURSES AT KAHIKI
 SHOWING MALAEKAHANA
 PROJECT SITE

PROPOSED
 PROJECT SITE

GRAPHIC SCALE
 1" = 2000'
 0 2000 4000
 FEET

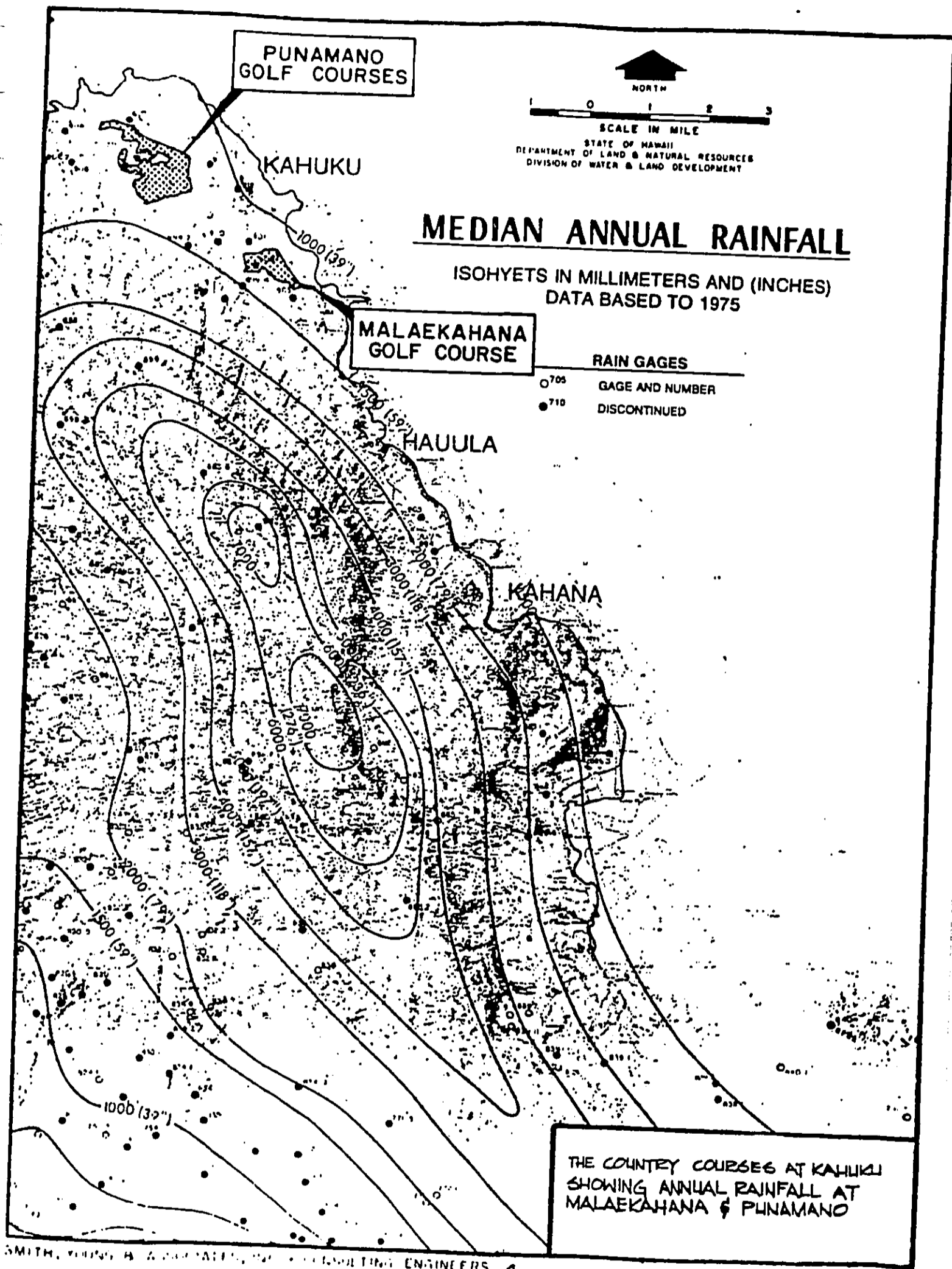
FIG. 1



Figure 2 shows that the Malaekahana site lies between the 39" and 59" isohyetal lines of the Median Annual Rainfall Map, as published by the Department of Land and Natural Resources, State of Hawaii. The annual rainfall near the entrance at Kamehameha Highway may be around 40 inches while the upper reaches of the site will receive a possible 57" rainfall.

Solid Waste Generation

Solid waste generation during construction will be trucked off site for disposal in a City and County sanitary landfill. This material would consist of vegetation that would be grubbed from the site, the concrete ditch material no longer useable, old barbed wire fences and of course some of the excess construction material developed in the process of building the clubhouse and maintenance facilities. This material would be collected by the contractor or a private collection and disposal company to be hauled to the nearest available City and County sanitary landfill. It is not possible to estimate the volume of solid waste that will be generated during the construction phase.

After completion of the construction, when the Malaekahana course has come under full operation, the lounge, bar, restaurant and kitchen may generate some six or seven hundred pounds of solid waste. Much of this will be in the form of cans, bottles, paper plates, and napkins. Additional solids waste from the maintenance facility such as broken or worn out machinery may add another three hundred pounds of solid waste per day. This 1000 pounds of solid waste from the Malaekahana golf course will be handled by a private refuse collector and disposed of in an appropriate active sanitary landfill or carried to "H-Power" at Campbell Industrial Park.




 NORTH

 SCALE IN MILE
 STATE OF HAWAII
 DEPARTMENT OF LAND & NATURAL RESOURCES
 DIVISION OF WATER & LAND DEVELOPMENT

MEDIAN ANNUAL RAINFALL

ISOHYETS IN MILLIMETERS AND (INCHES)
DATA BASED TO 1975

FIG 2

Sub-Appendix K

Malaekahana

Preliminary Design of Course

and

Support Facilities

For

The Country Courses at Kahuku

Malaekahana Site

prepared for

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April 1990

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The objective of this report is to present the proposed development of the site.

Specifically this report covers the following points of the proposed development:

- a. Existing site and site conditions;
- b. Preliminary design of the course including necessary support facilities.

Site and Site Conditions

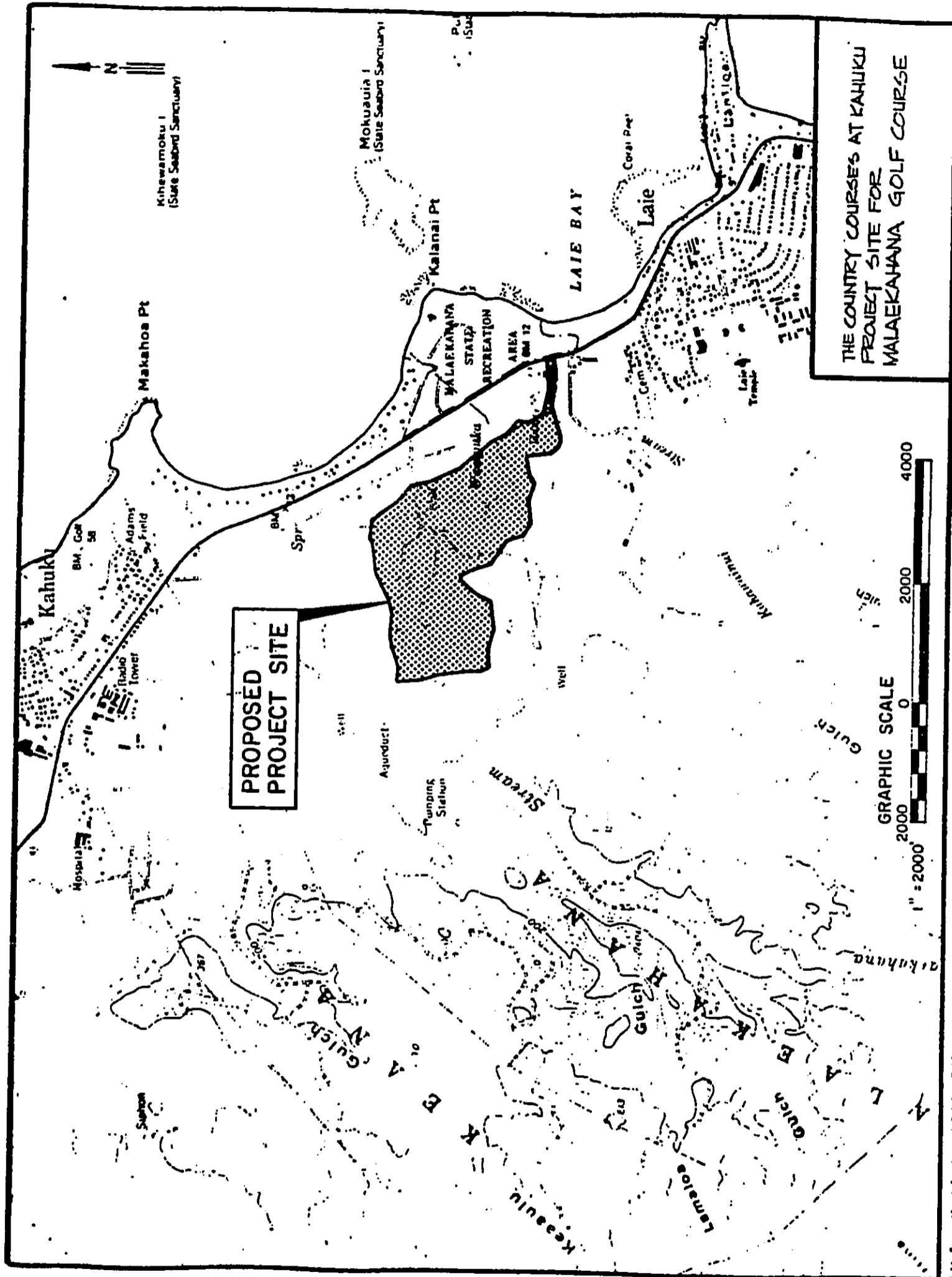
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THE COUNTRY COURSES AT KAHUKU
 PROJECT SITE FOR
 MALAEKAHANA GOLF COURSE

PROPOSED
 PROJECT SITE



FIG. 1

Figure 2 shows that the Malaekahana site lies between the 39" and 59" isohyetal lines of the Median Annual Rainfall Map, as published by the Department of Land and Natural Resources, State of Hawaii. The annual rainfall near the entrance at Kamehameha Highway may be around 40 inches while the upper reaches of the site will receive a possible 57 inch rainfall.

The site has a temperature reading range from the low 60 degrees F to the mid 80 degrees F depending on the day and the season of the year. Daily temperatures vary as much as fifteen to twenty degrees between daylight hours and early morning hours. The median rainfall in the low areas of the site are around 40 inches per year and near the mauka site boundary some 57 inches. The rainfall varies from month to month with some months having zero rainfall. U. S. Department of Interior streamflow measurements of Malaekahana Stream, which flows near the north boundary of the site, has a recorded average discharge of 2.11 cfs per day. Extremes show that in July 1971 the total flow for the month was only .50 cfs whereas on April 24, of the same year the daily flow was 66 cfs. Based on the stream flow data, it is safe to say that the area and the site itself is subject to occasional intense showers.

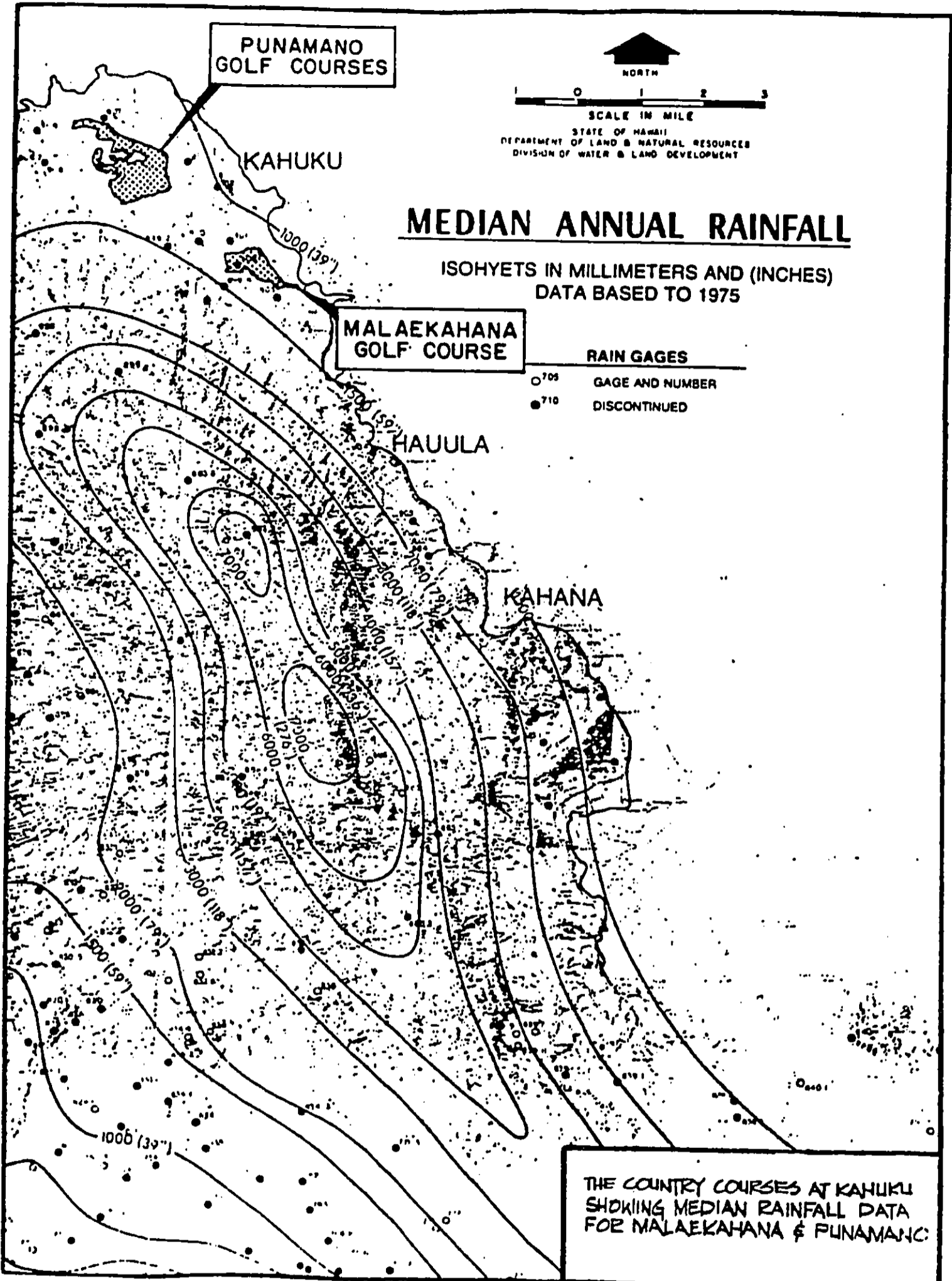
The Kahuku area is subject to trade winds, which blow from the northeast. As moisture laden clouds are shoved against the northern most extremities of the Koolaus, the updraft of winds cool the clouds sufficiently so that rainfall is intensified at the higher elevations. Rainfall two miles southwest of the site exceeds 118 inches per year.

Although extremes in rainfall are noted at the site, some 30 percent of the days are clear, another 30-35 percent are partly cloudy and another 30-35 percent are cloudy. The climate is good for golfing activities.

Preliminary Design of the Course, Including Support Facilities

The preliminary design of the 18 hole course at Malaekahana is shown on Figure 3. The clubhouse planned will be some 16,000 to 18,000 square feet with provisions for men's and women's locker rooms, showers, pro shop, starter's station, small meeting rooms, lounge, snack bar, kitchen and storage area for golf carts. A parking lot for some 175 to 200 cars will be provided at the rear and mauka of the clubhouse. In front of the clubhouse will be a good sized putting green and a driving range with some 25 to 30 tee sites.

The course shown on Figure 3 represents a 6,057 yard, par 72 course. The preliminary layout shows one irrigation lake, or pond, which would also serve as a blending facility for the wastewater effluent and the stored irrigation water pumped during the day for nighttime spraying on the tees, greens and fairways. Additional irrigation ponds may be added elsewhere as water hazards to the course play. These additional ponds would also act as drainage retention ponds to improve percolation and/or irrigation supply sources which would be impervious. Sand traps and swales are not shown at this preliminary phase but their design would include swales that would serve as drainage retention areas.



PUNAMANO
GOLF COURSES



SCALE IN MILE
0 1 2 3

STATE OF HAWAII
DEPARTMENT OF LAND & NATURAL RESOURCES
DIVISION OF WATER & LAND DEVELOPMENT

KAHUKU

MEDIAN ANNUAL RAINFALL

ISOHYETS IN MILLIMETERS AND (INCHES)
DATA BASED TO 1975

MALAEKAHANA
GOLF COURSE

RAIN GAGES

- 705 GAGE AND NUMBER
- 710 DISCONTINUED

HAUULA

KAHANA

THE COUNTRY COURSES AT KAHUKU
SHOWING MEDIAN RAINFALL DATA
FOR MALAEKAHANA & PUNAMANO



TO KAHUKU

KAMEHAMEHA HWY

TO LAIE

CBC CORPORATE YARD

MAINT

DRIVING RANGE

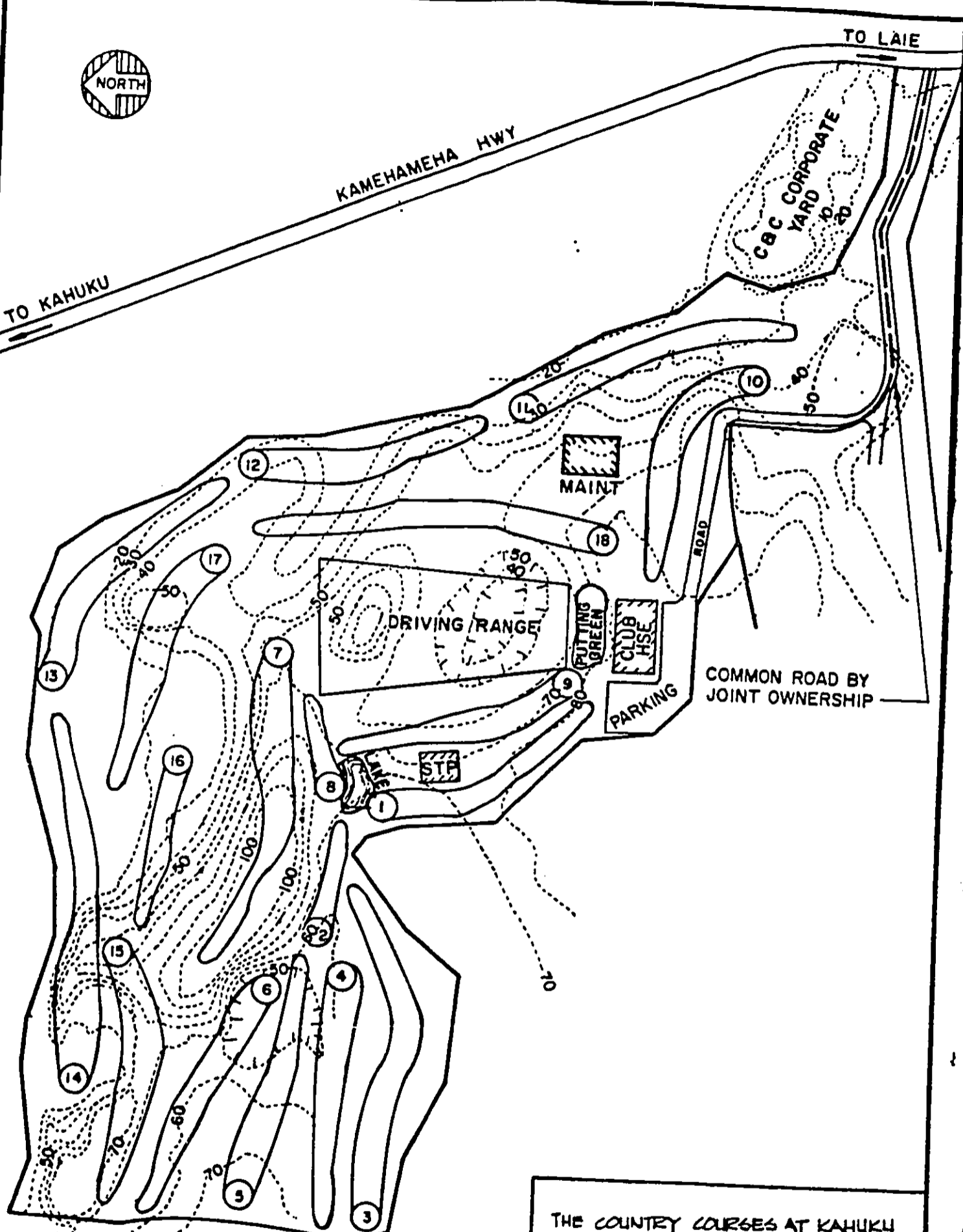
FUTTING GREEN

CLUB HSE

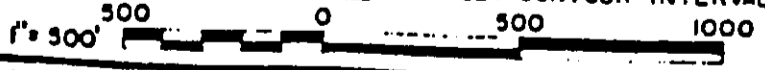
PARKING

COMMON ROAD BY JOINT OWNERSHIP

STR



GRAPHIC SCALE: 10 FEET CONTOUR INTERVALS



THE COUNTRY COURSES AT KAHUKU
NALAEKAHANA SITE SHOWING
PROPOSED GOLF COURSE LAYOUT

FIG. 3

A maintenance facility is indicated between the 10-11-18 fairways, an alternative site may well be between the 7 and 17 greens. It is not the intent to insist on a rigid design of the course in this presentation.

Domestic or potable water for the clubhouse usage will be from the existing well (Pump 7 or Well 363) near the site, or from a new well. At least one additional well will be developed on site to supply irrigation water, as noted in the Water Quality and Supply report. The system should be designed to supply the necessary irrigation supply over a longer period of the day (to assure better quality irrigation water) than the time required to irrigate the course. The extra water to accomplish this irrigation would be taken from the lined irrigation lake (or lakes) which then can be re-charged with well water during the day, after irrigation has been completed. This process is presently followed at Waialae Golf Course in Honolulu to a very successful degree. Water for fire protection will be supplied from the irrigation holding or storage ponds.

The use of sand traps, swales, and depressions within the golf course or along the fairways to control storm runoff from the site has been covered in the Drainage and Stormwater Runoff report.

The site and course at Malaekahana might be considered a course of median complexity with relatively wide fairways and "forgiving" roughs.

Impacts and Mitigative Measures

There appear to be no long term adverse impacts involved with the golf course development. There are short term adverse impacts resulting from the construction activities. These impacts and the mitigating steps necessary have been covered in the report on Construction Activities.

Sub-Appendix L

Malaekahana

Report
on
Infrastructure Improvements
For
The Country Courses at Kahuku
Malaekahana Site

prepared for
The Estate of James Campbell

prepared by
Smith, Young & Associates, Inc.
3049 Ualena Street
Honolulu, Hawaii

April 1990

Introduction

The Estate of James Campbell is proposing to develop an 18-hole golf course at Malaekahana, in the vicinity of Laie (see Figure 1). The site contains some 200 acres of open agricultural lands. Reports have been made on a number of features covering the proposed development. These reports are on:

- A. Soils
- B. Topography
- C. Climate
- D. Ground Water Resources
- E. Drainage and Storm Runoff
- F. Water Quality and Supply
- G. Wastewater Treatment and Disposal
- H. Grading and Construction Activities
- I. Tsunami/Flood Hazards
- J. Solid Waste Disposal and Landfill Requirements
- K. Electrical Power/Telephone
- L. Preliminary Design of Courses Including Support Facilities
- M. Electrical Power and Telephone

The summation of certain of these reports and the developments associated with them comprise the proposed infrastructure of the golf course.

Site and Site Conditions

The property considered for development is located in the Koolauloa District, with the Tax Map Key designation TMK 5-6-05: Portion 7. The 200 acre site has been owned by The Estate of James Campbell since before the turn of the twentieth century.

The site is connected to Kamehameha Highway by a narrow strip of land extending mauka to the main body of the property. The site is currently vacant, with the exception of some grazing areas. The site was previously planted in sugar cane, but since the closing of Kahuku Plantation, the land has been returned to pasture. Some of the areas have become overgrown indicating the underusage of the site.

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Land uses of adjoining properties are agricultural, aquacultural, recreational, and vacant. The Malaekahana Recreational State Park lies across Kamehameha Highway. To the south, Asahi is proposing an additional golfing area. West and north from the site lie agricultural and aquacultural lands partially in use; some areas lie fallow.

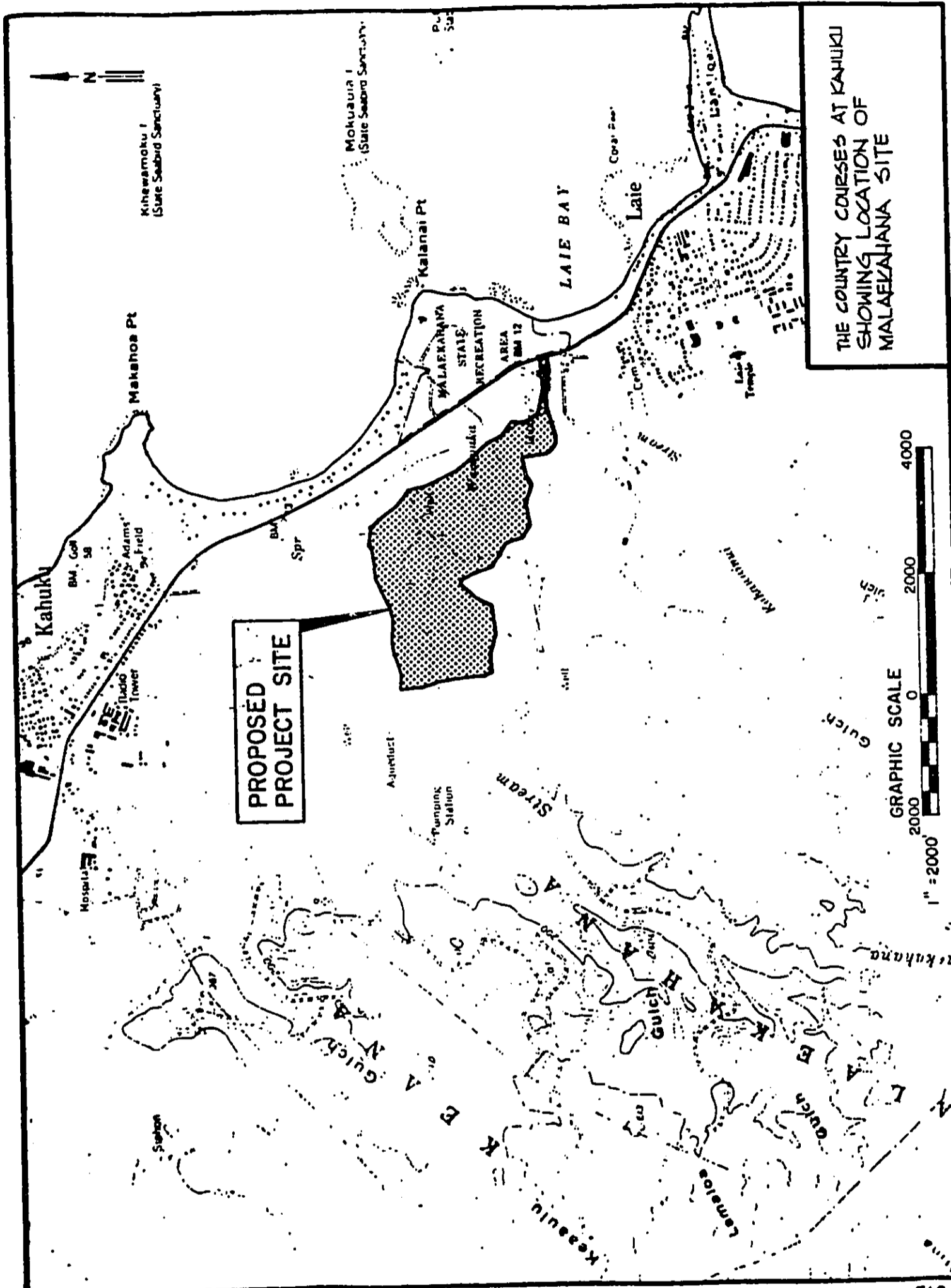


FIG. 1

The site is presently designated an agricultural district by the State Land Use Commission. The Koolauloa Development Plan Land Use Map shows the site Agriculture, while the City and County of Honolulu's Zoning District classifies the site as Agriculture (AG-1/AG-2).

Figure 2 shows that the Malaekahana site lies between the 39" and 59" isohyetal lines of the Median Annual Rainfall Map, as published by the Department of Land and Natural Resources, State of Hawaii. The annual rainfall near the entrance at Kamehameha Highway may be around 40 inches while the upper reaches of the site might receive a possible 57" rainfall.

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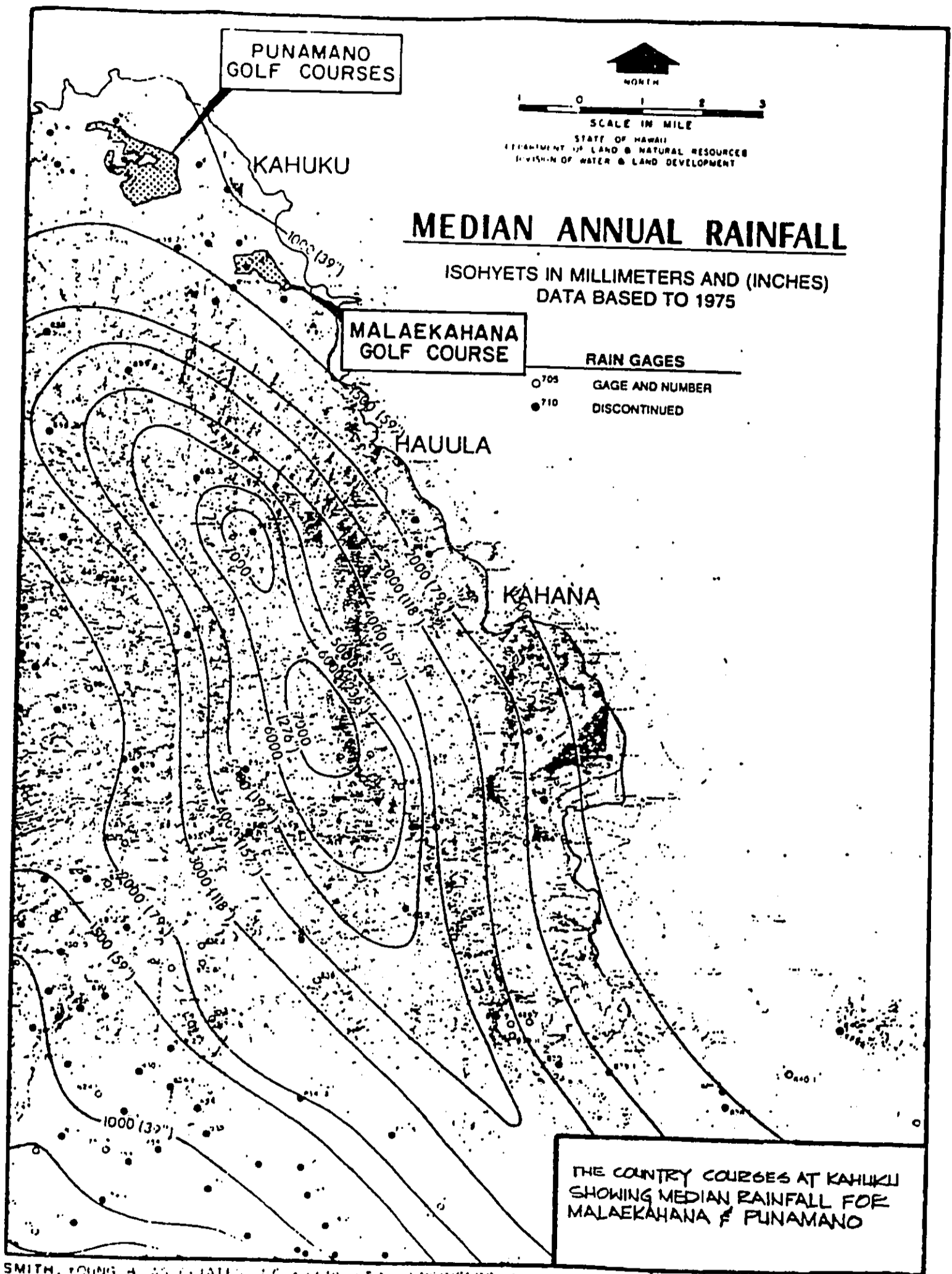
1. Ground Water Resources

The Malaekahana site overlies the basal water lens that can be found along the coastal plain of northeastern Oahu. It is expected that the top of the water lens near Kamehameha Highway is some 8 to 10 feet above sea level with the fresh water lens extending downward for some 300 + feet. The water resource appears more than sufficient for the proposed development. Farther inland the water lens rises to approximately 18 feet with the corresponding depth reaching some 600-700 feet below sea level. This inland source will not be touched by the golf course development.

2. Drainage and Stormwater Runoff

Two large depressions exist on the Malaekahana site. These will continue to be used to pond surface storm flows. Additional smaller storage areas and sand traps will be created throughout the golf course to further lower surface runoff during heavy rains. A new sump will be created, along with a berm on the north and east boundaries of the site to catch surface flows as stormwater runoff. The stormwater retention will be greater within the developed golf course than presently exists on the site today.

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Although the surface runoff from closely cropped fairways will be greater than that presently anticipated from the present site conditions, the increased retention areas will off-set the increase so that less water will leave the site during any given storm situation. For normal rainfall, there should be no runoff from the site.

3. Water Quality and Supply

The water resource study indicates that there is a sufficient resource to provide both domestic and irrigation water to the development. History has indicated that over pumpage degraded the quality of the supply during the "sugar cane" years of Kahuku Plantation. It is now believed the lens has re-established itself as a good water source. An existing well near Malaekahana Stream (363) provides domestic water today. Site development will determine whether this well should be refurbished or a new well drilled to provide domestic water service. Irrigation water will probably require one or two new wells on site.

An important mitigating feature must be incorporated into the proposed water supply and distribution systems. A slow steady withdrawal of water from the wells that penetrate the basal lens is essential. This slow withdrawal is necessary to reduce well drawdown and thereby reduce possible salt water encroachment from the bottom of the lens. Well withdrawal should be over a 20 to 24 hour period per day, at a reasonable drawdown rate. If the drawdown is unreasonable (over 3 or 4 feet) a second well will be required. The water withdrawn from the wells shall then be stored in irrigation ponds (water hazards) for use over a 6 to 10 hour irrigation period during the night hours.

Depending on the distribution pipe system, the number of holding ponds and pump stations may vary. At least one large storage reservoir and one pump station will provide a continuous pressurized system around the clubhouse. The system will be pressurized by a small jockey pump for hand watering of putting greens etc. At a demand great enough to cause a sizeable pressure drop, large pumps will become activated for irrigation of the course or provide fire flows to the fire hydrants to be located at the clubhouse or maintenance facility.

The system for irrigation would be identical to that at the Waialae Country Club in Honolulu as far as supply and distribution operations are concerned.

4. Wastewater Treatment and Disposal

An activated sludge "package plant" complete with redundant tankage and effluent filter is considered for the site. The concept meets Chapter 62 of the State Department of Health Regulations. The filter combined with chlorination assures an acceptable effluent. The effluent, as discussed in Appendix G will be blended with the irrigation water and applied to the golf course at each irrigation period.

5. Grading and Construction Activities

Site grading will be phased and controlled and watered so as to reduce dust. Trenching, grading and all construction work will be conducted in compliance with Department of Public Works construction specifications and noise and nuisance that might be generated will be controlled by the State Department of Health Requirements both as to times of operation and decibals of sound.

6. Solid Waste Disposal and Landfill Requirements

The amount of waste and need for landfill during construction is impossible to estimate. There will be construction material and existing concrete ditch material that will be required to be hauled to landfill sites by the contractor. After development, the daily quantity of solid waste that private collectors will haul to a landfill or to "H-Power" is estimated to be 1000 pounds per day.

7. Electrical Power/Telephone

Underground service to the clubhouse, maintenance facilities and treatment plant will be provided by a duct and handhole system. Hawaiian Electric power service and Hawaiian Telephone service are available from overhead lines which follow the Kamehameha Highway right-of-way alignment. Trenching and backfilling of the underground, on site service, are covered in the construction activities report.

8. Preliminary Design of Course Including Support Facilities

The clubhouse, parking, and maintenance facilities have been covered in Appendix G. The course will have a paved access road, which ends in a sizeable parking lot at the clubhouse. The clubhouse will contain a pro-shop, starter station, lounge, snack bar, kitchen, and men's and women's locker facilities. A putting green and driving range will be provided below the clubhouse. An 18 hole, 6050 yard, par 72 course is planned that will provide a median level complexity to playing skills.

Sub-Appendix M

Malaekahana

Report
on
Electrical Power and Telephone
For
The Country Courses at Kahuku
Malaekahana Site

prepared for
The Estate of James Campbell

prepared by
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3049 Ualena Street

Honolulu, Hawaii

April 1990

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The Estate of James Campbell is proposing to develop an 18 hole golf course in the vicinity of Laie on the the north shore of Oahu. The area lies immediately north of Laie at Malaekahana (Figure 1). The site contains approximately 200 acres and is situated mauka of Kamehameha Highway across from the Malaekahana State Recreation Area

The purpose of this report is to provide information on the site and to indicate the availability of electrical and telephone services at the site. This report addresses the following:

- a. Existing site and site conditions;
- b. Availability of electrical power and telephone service.

Site and Site Conditions

The proposed site for the 18-hole golf course at Malaekahana is located within the Koolauloa District of Oahu and lies in the Tax Map Key designations of TMK 5-6-06:Portion 7. The project site at Malaekahana has been owned by The Estate of James Campbell since before the turn of the twentieth century.

The site slopes up from the low lying pasture land which exists immediately mauka of Kamehameha Highway and opposite of the Malaekahana State Recreational Area. The 200 acre parcel slopes upwards at some two to two and a half percent grade with several small hills and depressions which approach 10 to 12 percent slopes at specific locations (Figure 2). The highest elevation of the site is a long single hill near the center of the site which is slightly over 100 foot elevation mean sea level (M.S.L.). The site meets Kamehameha Highway on the Laie side of the City and County Corporation yard by way of a narrow strip of land. The site itself was formerly planted in sugar cane when the Kahuku Plantation was active. Today the land lies fallow except for the possibility of some grazing by a few head of cattle and several horses. Although the site is located just south and east of the Malaekahana Stream, no stream gulches cross the site. Several concrete lined ditches cross the lower parts of the site having carried irrigation waters when the lands were actively cultivated. Several barbed wire fences traverse the area and are maintained by lessees who graze their horses on the property.

Land uses adjoining the site are generally agricultural. Cackle Fresh Egg Farm uses the entrance roadway by the City and County Corporation yard as will Asahi Developers who also propose a golf course south of this site. Makai of the site lie agricultural lands currently used for grazing purposes. Lands to the north are also agricultural.

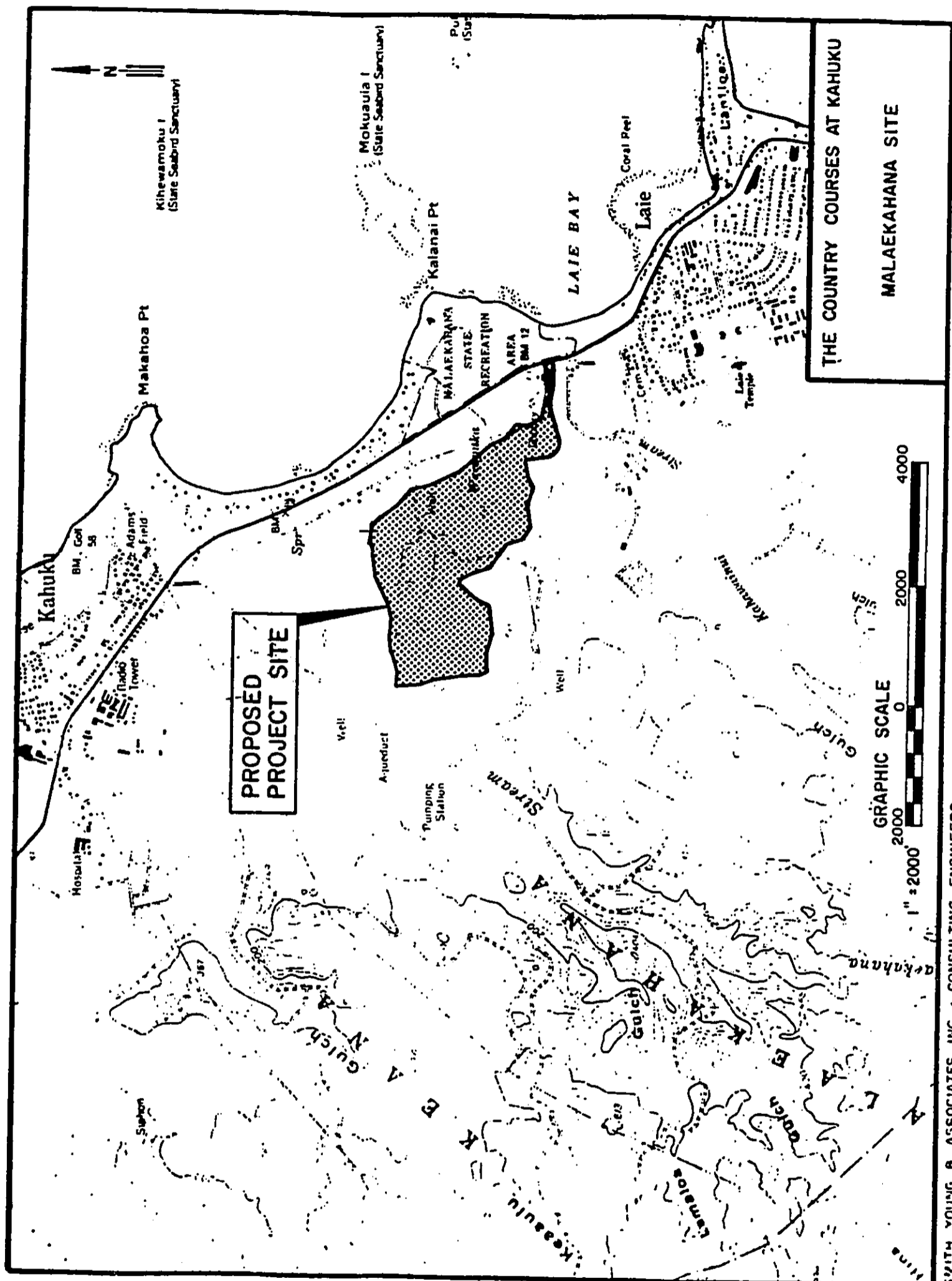
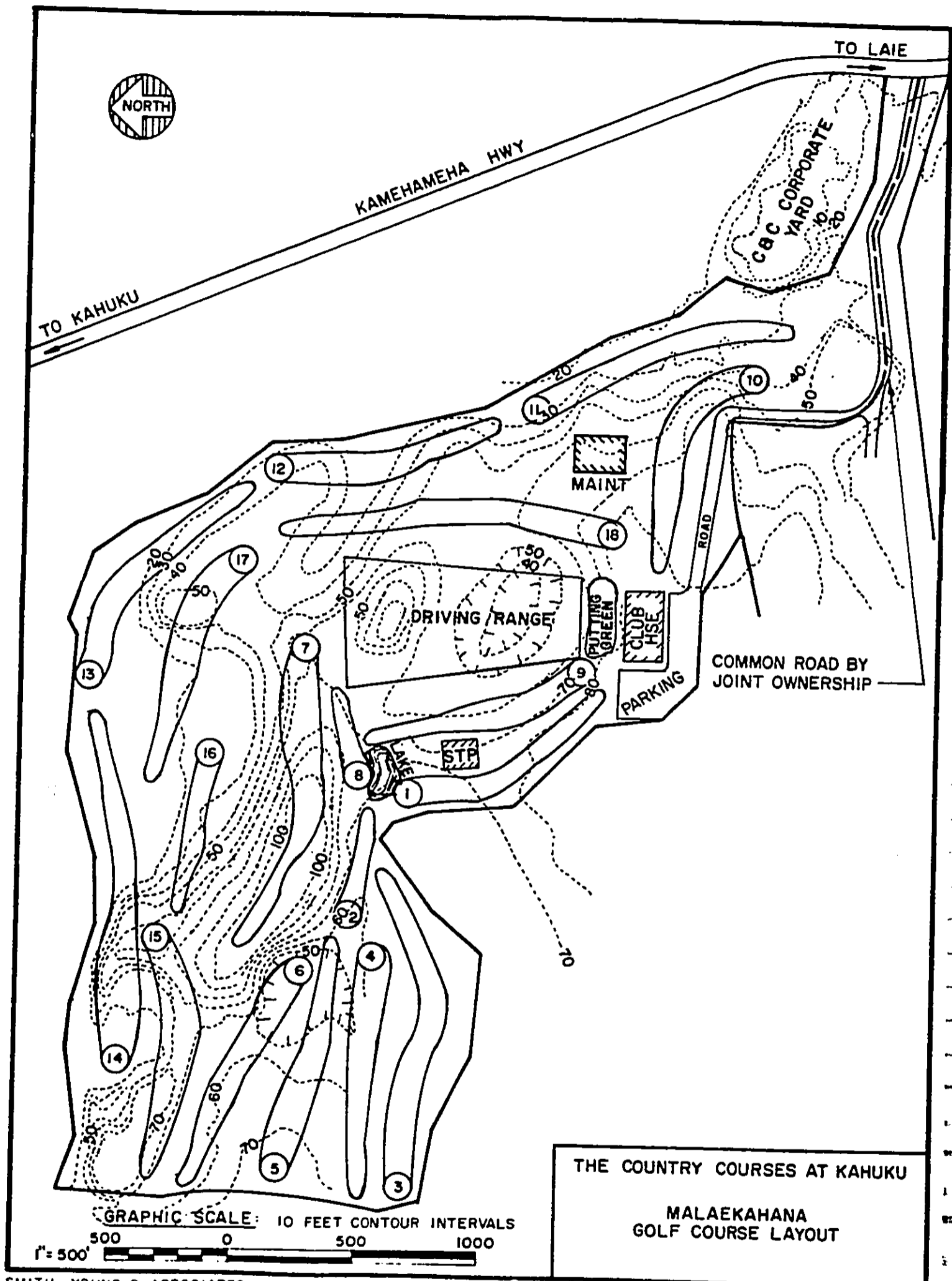


FIG. 1

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SMITH, YOUNG & ASSOCIATES, INC • CONSULTING ENGINEERS 3

FIG. 2

Electrical Power and Telephone

At the present time commercial electrical power service is available from an overhead electric line that runs along Kamehameha Highway. Hawaiian Electric's distribution voltage in this service is 12.47 kv. The service has sufficient capability to service the proposed 18 hole course development and its infrastructure.

Hawaiian Telephone service also runs along Kamehameha Highway in an overhead service. It also has the capacity to serve the proposed golf course development at the Malaekahana Site.

The electrical and telephone service will be provided by an underground ducting and handhole system from the Kamehameha Highway overhead service to the clubhouse, maintenance facility treatment plant and any other infrastructure facility that may be constructed.

Impact and Mitigative Measures

The installation of the underground electrical and telephone lines and handholes will require excavation and trenching. The anticipated short term impact of this construction activity is covered in the report on Construction Activities. The mitigating measures to reduce the short term impacts of construction are also covered therein. There are no long term impacts for electrical and telephone services.

TECHNICAL RESUME OF

RUSSELL L. SMITH, JR., President
Smith, Young & Associates, Inc.
(Consulting Engineers)
3049 Ualena Street Suite 1104
Honolulu, Hawaii 96819
Phone: (808) 836-0015

EDUCATION (FORMAL)

University of Hawaii - 1946-1949 - B. A. in Math and Physics in 1948
Stanford University - 1938-1941 - Undergraduate Prelegal Major

EDUCATION (SUPPLEMENTAL)

US Navy Sponsored - Redicheck Program - Honolulu 1987
ACEC/AIA Sponsored - Value Engineering Workshop - San Francisco - 1975
University of California - Extension Seminar Program VII - 1970
National War College - Summer - Washington D.C. - 1962
Yale University - Short Air Force Engineering Course - 1943

ENGINEERING REGISTRATION

Professional Civil and Sanitary Engineer, Territory of Guam,
Certificate No. 23-E (1962)
Professional Civil and Sanitary Engineer, State of Hawaii,
Certificate No. 711-E (1953)

PROFESSIONAL HISTORY

March 15, 1987 to Present
President - Smith, Young & Associates, Inc.

January 2, 1985 to December 31, 1986
Director and Chief Engineer, Department of Public Works,
City and County of Honolulu

June 1, 1975 to December 31, 1984
President - The Russ Smith Corporation

June 12, 1959 to May 31, 1975
Vice President and Treasurer - Austin, Smith & Associates, Inc.

1966 - 1974
Consultant on Water Supplies to Public Utility Agency Guam,
Territory of Guam

Technical Resume of
Russell L. Smith, Jr., President
Smith, Young & Associates, Inc.
Page 2

1960 - June 1967

Director of Materiel and Command Pilot with the rank of Lt. Colonel
in the Hawaii Air National Guard - Served as Logistics
Director of three radar sites and one fighter squadron area -
Retired June 1967.

February 1, 1956 to March 31, 1964

Vice President and Secretary - H. A. R. Austin & Associates, Ltd.

May 1, 1957 to June 12, 1959

Secretary - Austin & Towill, Ltd.

1955 - 1960

Staff Installations Officer, Hawaii Air National Guard - Provided
direct supervision of Construction of all Air National Guard
facilities in the Territory of Hawaii - Command Pilot.

1953 - 1956

Associate Engineer - H. A. R. Austin

1949 - 1952

Junior Engineer - Austin & Towill

1947 - 1949

Pilot, Photogrammetric Engineer and Surveyor - Part-time for
R. M. Towill.

1946

One of the founders of the Hawaii Air National Guard.

OTHER ENGINEERING ACHIEVEMENTS OF NOTE SINCE 1959

Hawaii Engineer of the Year for 1976 (Selected by the Hawaii Society of
Professional Engineers).

Designed the first High Rate Trickling Filter Wastewater Treatment Plant
in Hawaii (On island of Oahu).

Designed the first Wastewater Treatment Plant on the islands of Kauai,
Maui and Hawaii.

Masterplanned the Sewerage and Water Systems of the Six Districts of the Trust Territory of the Pacific Islands.

Designed the Sewerage and Water Systems for the islands of Saipan, Koror and Ponape in the Trust Territory of the Pacific Islands.

Formulated the Storm Drainage Standards for the Island of Guam.

Masterplanned the Water System for the Island of Guam.

Designed first Advance Wastewater Treatment Plant (Tertiary) in the State of Hawaii - 1969.

Masterplanned the Water System for American Samoa and designed Phase I of the system in 1963 and Phase II in 1972.

Designed the Northern District Sewerage System, Territory of Guam.

Fresh Water System Analysis for Naval Station, Midway Island - 1978.

TECHNICAL SOCIETIES MEMBERSHIPS

American Society of Civil Engineers, Fellow (ASEC)
Hawaii Section President - 1961
Hawaii Section Vice President - 1960
Hawaii Section Secretary-Treasurer - 1959
Chairman of Qualifications Committee - 1969 - 1973; Member 1963-1968
Conference Chairman - 1963

American Water Works Association (AWWA)
American Consulting Engineers Council (ACEC)
National President - 1982-1983
National President-Elect - 1981-1982
National Vice President - 1976-1978
Representative to International Federation of Consulting Engineers
- Liaison with Asian Development Bank - 1971
Member, International Committee (601) - 1971-1976

Consulting Engineers Council of Hawaii (Local Organization) (CEC/H)
President - 1970-1971
Vice President - 1969-1970
National Director - 1972
Alternate National Director - 1967, 1970
Chairman Professional Practices Committee - 1969-1970
By-Laws Committee - 1974-1977
Past National Directors Committee - 1973-1977, Chairman - 1973
Conference Chairman - 1968

Technical Resume of
Russell L. Smith, Jr., President
Smith, Young & Associates, Inc.
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Engineering Association of Hawaii (EAH)
Director - 1956-1957
Hawaii Society of Professional Engineers (HSPE)
Hawaii Water Pollution Control Association (HWPCA) & (WPCF)
President - 1967
Vice President - 1966
Secretary-Treasurer - 1965
Acting National Director - 1965
Conference Chairman - 1963
Interprofessional Council Environmental Design (ICED)
National Chairman - 1981-1982
Society of American Military Engineers, Oahu Post (SAME)
Director - 1963

BIOGRAPHICAL LISTINGS

Men and Women of Hawaii

Who's Who in the West

Who's Who in America

Who's Who in Engineering

Who's Who in the United States

Men of Achievement

International Biography

Library of Human Resources

Notable Americans of the Bicentennial Era

Community Leaders and Noteworthy Americans

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX B

**TRAFFIC IMPACT ASSESSMENT,
REPORT FOR THE COUNTRY
COURSES AT KAHUKU —
MALAEKAHANA SITE**

Pacific Planning and Engineering, Inc.

APPENDIX B

TRAFFIC IMPACT ASSESSMENT REPORT

for

THE COUNTRY COURSES AT KAHUKU MALAEKAHANA SITE

Kahuku, Oahu, Hawaii

December 1989

Prepared by:

Pacific Planning & Engineering, Inc.
1144 Tenth Avenue, Suite 202
Honolulu, Hawaii 96816

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EXECUTIVE SUMMARY

Introduction

Pacific Planning & Engineering, Inc. (PPE) was engaged to undertake a study to identify and assess future traffic impacts resulting from the Estate of James Campbell's proposed The Country Courses at Kahuku. The project includes the development of three golf courses at Punamano near the Turtle Bay Resort, and one golf course at Malaekahana. This report represents the findings and recommendations of the traffic study for a golf course at the Malaekahana Site. The Punamano Site will be covered in a separate report.

The focus of the study is to determine the impact of the project generated traffic at the intersection of Kamehameha Highway and the proposed golf course access road when the course is completed and in operation in 1994. Impacts from the proposed project were measured by the change in level-of-service (LOS) for specific turning movements for the present case, 1994 *without* the project, and 1994 *with* the project.

Project Description

The proposed project is an eighteen-hole golf course in Kahuku, Oahu, Hawaii. The course will be located mauka of Kamehameha Highway, between Kahuku and Laie. The project site is located on 200 acres of land that is presently used primarily for cattle and horse grazing land. The project consists of an 18 hole golf course, a driving range, and a clubhouse with dining facilities and a proshop. The main access to the project will be an

existing road that connects to Kamehameha Highway. The project is expected to be completed by 1994.

Conclusions and Recommendations

The Malaekahana Golf Course of the proposed The Country Courses at Kahuku is not expected to have an adverse impact on traffic flow along Kamehameha Highway in 1994, when the project is expected to be completed.

The results of the analysis show that the project will cause *little or no delay* (LOS A) to traffic along Kamehameha Highway during the Saturday afternoon peak hour. The left turn traffic into the project access road from Kamehameha Highway will remain at LOS A in 1994 *without or with* the project traffic.

By 1994 even without the project, the LOS for vehicles attempting to exit the project access road onto Kamehameha Highway will operate with long delays (LOS E) during the Saturday afternoon peak hour. This increased delay is due in part to an increase in traffic along Kamehameha Highway as well traffic generated from other developments along the project access road.

With the project in 1994, the LOS for the vehicles attempting to exit the project access road onto Kamehameha Highway will worsen. The LOS for vehicles exiting the access road will drop from LOS E to LOS F. This condition occurs during the peak traffic periods on Kamehameha Highway and is expected to improve as the volume on the Highway subsides.

To minimize the impact of the project, we recommend that exclusive right and left-turn lanes be provided along the project access road for traffic exiting onto Kamehameha Highway. This will permit drivers attempting right turns to bypass the left turning vehicles and decrease delays for vehicles attempting right turns.

PROJECT DESCRIPTION

The Estate of James Campbell is proposing a golf course at Malaekahana. The Malaekahana course is a part of the planned Country Courses at Kahuku which include additional golf courses at Punamano, near the Turtle Bay Resort. The traffic study for the Punamano site is under a separate report.

The golf course at the Malaekahana site is located mauka of Kamehameha Highway, between Kahuku and Laie. Figure 1 shows the project location and the roadway network in the vicinity. The project site consists of 200 acres of land that is presently used primarily for cattle and horse grazing land.

The project consists of an 18 hole golf course, a driving range, and a clubhouse with dining facilities and a proshop. Figure 2 shows the golf course layout plan. The main access to the project will be from an existing road that connects to Kamehameha Highway. The project is expected to be completed by 1994.

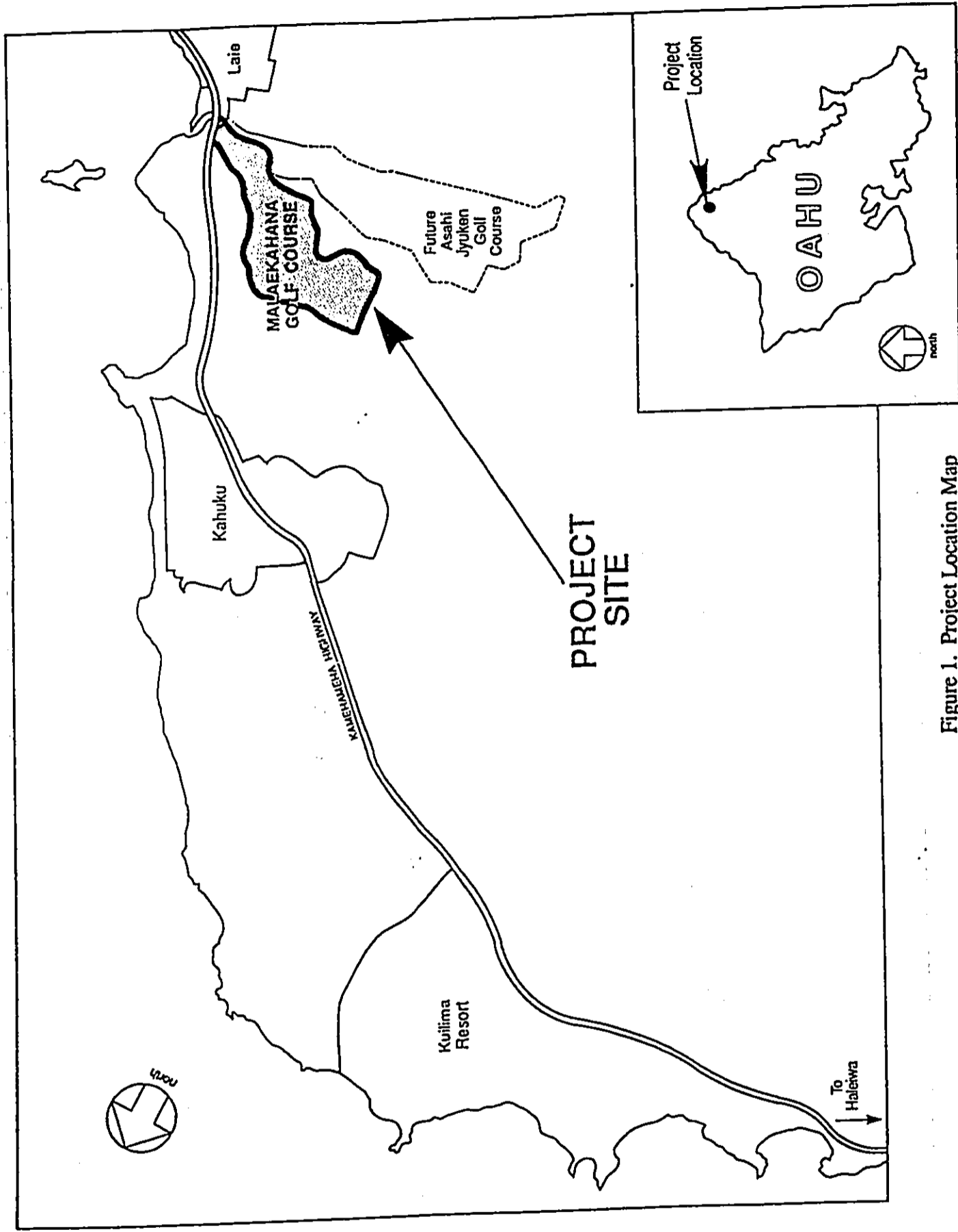


Figure 1. Project Location Map

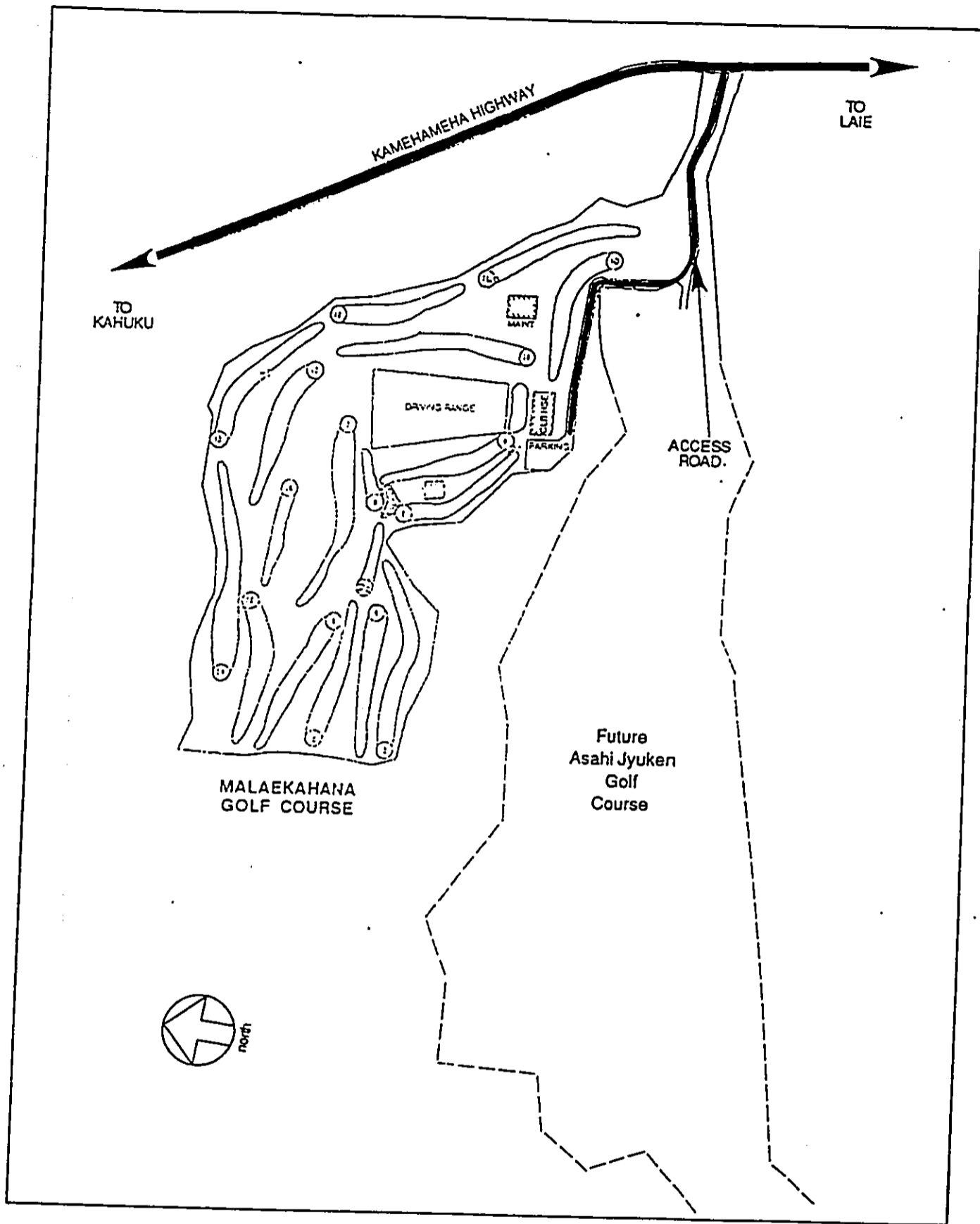


Figure 2. Project Site Plan

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AREA CONDITIONS

A survey of existing conditions was conducted to better understand the traffic impact of the proposed project. The survey included the land use of the area, roadway facilities in the area and existing traffic conditions.

Existing Land Uses

The land uses surrounding the project site is generally a mixture of recreational, tourist, residential, and commercial uses in a rural setting. Areas immediately surrounding the site are primarily ranching and farming activities.

To the north of the project site is Kamehameha Highway and across it the Malaekahana State Park with picnic and camping facilities. Further north is the town of Kahuku. To the west is the town of Laie, which has a major tourist attraction in the Polynesian Cultural Center. Kahuku and Laie Towns are primarily low density, rural communities with residential homes, small commercial shopping center, churches, and schools. To the south is the Koolau Mountain Range and to the west is the Turtle Bay Resort. The Turtle Bay Resort presently consists of a 400 unit hotel, an 18 hole golf course, tennis courts, small commercial shops, and about 400 residential condominium units.

Roadway Facilities

Vehicular access to the proposed golf course will be from Kamehameha Highway which is the only highway in the area providing for through traffic along the North Shore of Oahu.

Kamehameha Highway is a rural arterial highway connecting major population centers along the North Shore such as Haleiwa, Kahuku, and Laie. It is a State maintained highway with a 50 foot right-of-way and a 20 foot wide pavement in the vicinity of the project. There is on 10 foot wide lane in each direction. The shoulders are grassed or dirt and vehicles park along both sides of the road. The posted speed of Kamehameha Highway in the project vicinity is 35 miles per hour.

Traffic Conditions

Traffic volume data from the State Department of Transportation (DOT) was used to determine traffic trends on Kamehameha Highway. Figure 3 summarizes the trend in Average Daily Traffic (ADT) along Kamehameha Highway at Laie (Station 26-A). The plotted data show a steady increase in traffic growth on the order of 3.0% per year. The trend lines were estimated using linear regression analysis.

Traffic counts along Kamehameha Highway near the Kualoa Sugar Mill taken over a one week period were obtained from the DOT. The State counts indicate that the peak traffic during the week generally occurs on Saturday afternoon between 2:00 to 3:00 pm. The DOT counts are shown in Appendix C.

Manual traffic counts were conducted on January 21, 1989, during the Saturday afternoon peak hour at the intersection of Kamehameha Highway with the project access road. Manual counts were taken of passenger cars, trucks, buses, and motorcycles by turning movements and approaches to the study intersection during these periods. During the manual counts, the weather was clear and the pavement was dry. The survey was conducted to establish a baseline condition to compare against future traffic. A summary of the traffic counts for the observed afternoon peak hour is shown in Figures 4. Manual traffic count data is shown in Appendix B.

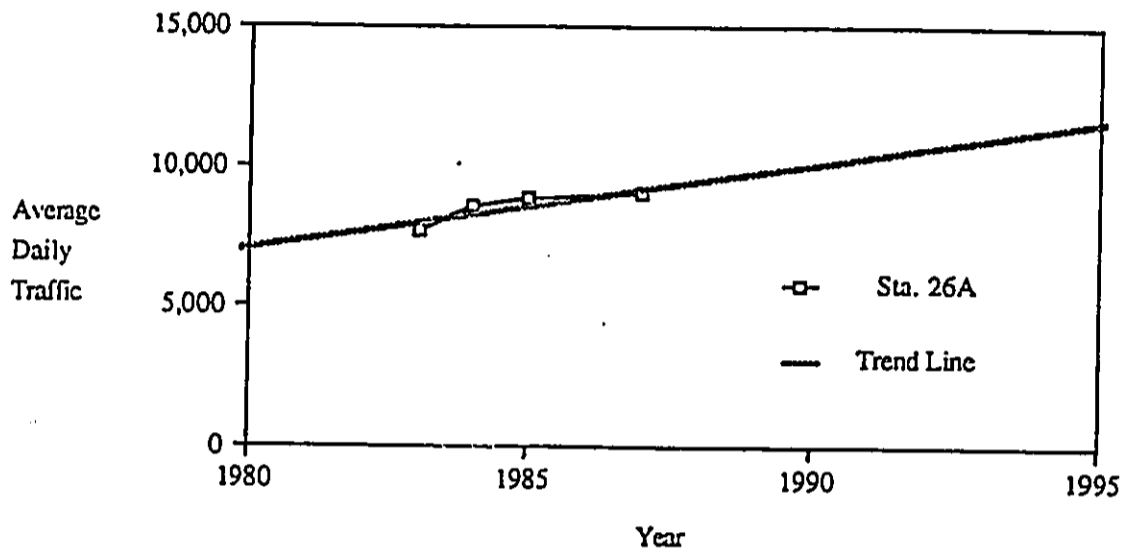


Figure 3. Trend in Traffic on Kamehameha Highway

Observed Traffic Conditions

During the field survey, it was observed that a line of vehicles would form behind slower moving vehicles such as buses, which created gaps for vehicles to exit onto Kamehameha Highway.

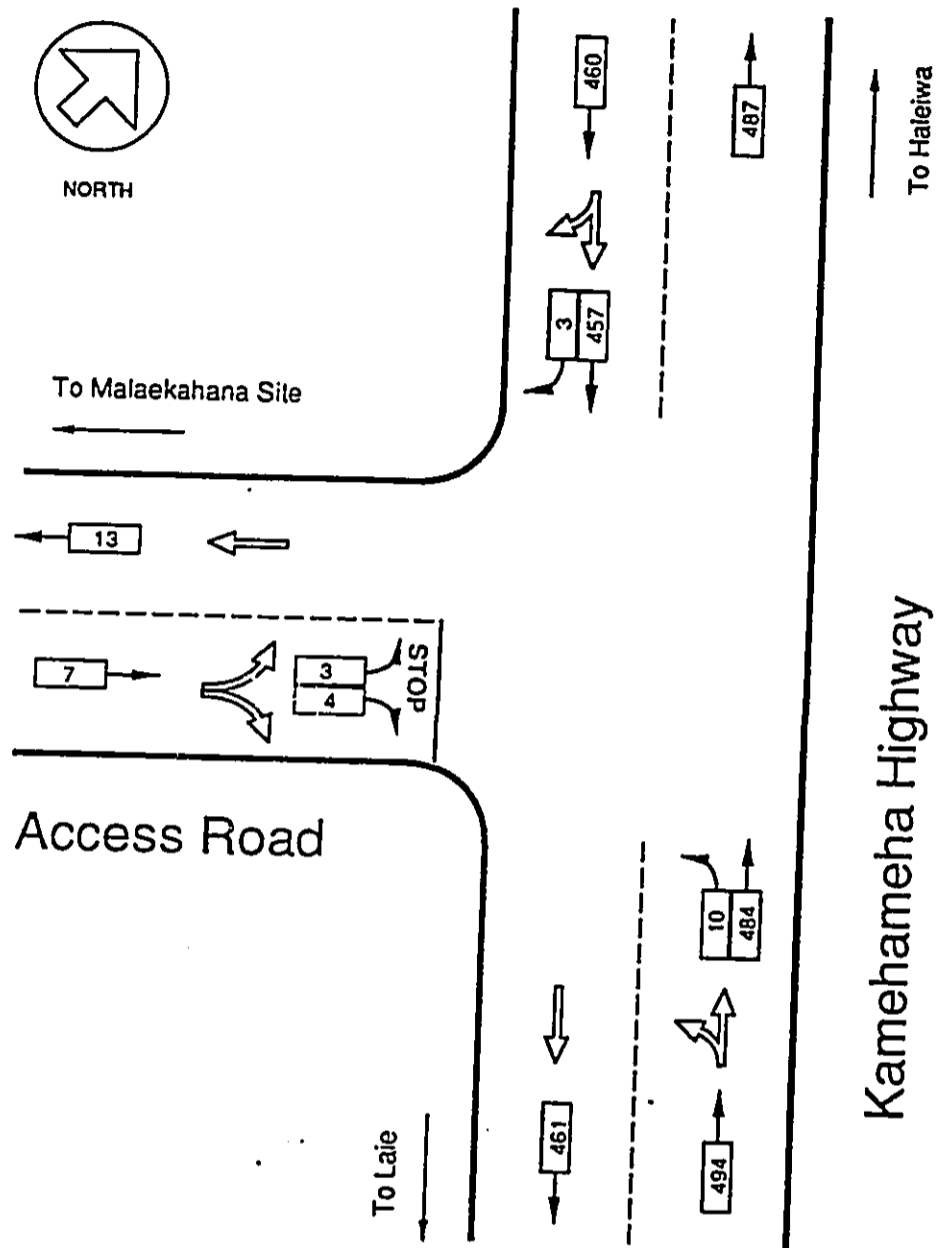


Figure 4. 1989 Saturday Afternoon Peak Hour Traffic
Kamehameha Highway and Access Road

FUTURE CONDITIONS

Future Land Uses

Future land uses in the immediate area that would affect future traffic conditions were identified. Among the major planned developments are the expansion of the Turtle Bay Resort, the Kahuku Village Makai Subdivision, and the Asahi Jyuken Golf Course.

The expansion of the Turtle Bay Resort is expected to contribute to an increase in ambient traffic along Kamehameha Highway. By the year 1994, it is estimated that the resort will expand by 1030 additional hotel units, 20,000 square feet of gross leasable commercial area and an 18 hole golf course. Additional development at Turtle Bay is planned beyond 1994.

The proposed Kahuku Village Makai Subdivision consists of 177 units of single family dwellings. The subdivision is anticipated to be completed and fully occupied by 1993.

Asahi Jyuken is planning an 18 hole golf course immediately adjacent to the project site. It will directly impact the project since it will use the same access road to get to Kamehameha Highway. The golf course will be built on 228 acres of land and is expected to be completed in 1994.

Future Roadway Facilities

Presently, there are no major roadway improvements planned by the Department of Transportation for Kamehameha Highway in the Malaekahana area.

PROJECTED TRAFFIC CONDITIONS

Future traffic forecasts without and with the project were estimated for the year 1994, when the project is expected to be completed.

Future Ambient Traffic

Ambient traffic is the traffic which would occur even if the proposed project was not built. The ambient traffic was forecasted by increasing the existing through traffic volumes along Kamehameha Highway by the traffic growth rate and adding traffic generated by developments within the immediate area.

Traffic Growth along Kamehameha Highway

Traffic counts by the State Department of Transportation shows that average daily traffic has been increasing by about 3% annually, as discussed in the section on "Existing Conditions." The growth rate on Kamehameha Highway generally reflects traffic increase from developments outside the study area. The existing peak hour through traffic volumes, shown in Figure 4, were increased by 15% (3% for five years) to obtain the ambient traffic forecast volumes in 1994.

Traffic from Other Developments

A three-step procedure of trip generation, distribution, and assignment was used to forecast future traffic generated by three nearby developments: the Kahuku Village Makai Subdivision, the Asahi Jyuken Golf Course, and the Turtle Bay Resort expansion.

The trip generation step calculates the number of trips that would be generated during the peak hour by a particular development. The number of trips were estimated based on trip generation data from the ITE Trip Generation Report for the 177 unit Kahuku Village Makai Subdivision and the 228 acre Asahi Jyuken Golf Course. The trip rates for the Turtle Bay Resort expansion were based on a traffic report completed in 1985 by Austin Tsutsumi & Associates, Inc. (ATA) entitled, Traffic Impact Report For The Proposed Turtle Bay Resort.

Table 1 shows the trip rates derived from ITE data and ATA trip rates and the number of trips generated by the proposed land uses during the Saturday afternoon peak hour.

Table 1. Trip Generation

<u>Land Use</u>	<u>Size</u>	<u>Unit</u>	<u>Trip Rates</u>		<u>Number of Trips</u>	
			<u>Enter</u>	<u>Exit</u>	<u>Enter</u>	<u>Exit</u>
Turtle Bay Resort						
Hotel ¹	1032	Rooms	0.14	0.13	144	135
Shopping Center ¹	20,000	Sq. Ft.	1.28	3.90	28	78
Golf Course ²	200	Acres	0.18	0.33	35	67
Asahi Jyuken Golf Course ²	228	Acres	0.16	0.30	37	69
Kahuku Villages ²	177	Dwellings	0.52	0.46	<u>92</u>	<u>82</u>
Total Trips					336	431

¹ATA trip generation rates

²Based on ITE trip generation data

The trip distribution and traffic assignment steps allocate the generated trips to the different directions of travel and specific turning movements on the roadway. The trip distribution and traffic assignment for Turtle Bay was based on the ATA report. Traffic generated from the Kahuku Villages Makai Subdivision was distributed based on existing travel patterns derived from additional counts by PPE. About 45% of the traffic was distributed to the Haleiwa direction and 55% in the Laie direction.

When determining the traffic contribution on Kamehameha Highway due to the Kahuku Village Makai Subdivision and the Turtle Bay Resort expansion, it was assumed that 10% of traffic generated by these developments would remain in the Kahuku area.

The volumes derived from increasing through traffic by the historical growth rate were added to the traffic generated by future developments in the area. The resultant ambient traffic volumes are shown in Figure 5.

Project Generated Traffic

The three-step procedure of trip generation, trip distribution and traffic assignment was used to forecast future peak hour traffic from the proposed project.

The trip generation step calculates the number of trips which would be generated during the Saturday afternoon peak hours by the proposed project. The number of trips were estimated from data in the ITE Trip Generation Report (Fourth Edition, 1987) for a 200 acre golf course. Table 2 shows the number of trips generated by the proposed golf course during the Saturday afternoon peak hour using the ITE trip generation data. The trip generation data for golf courses for the Saturday peak hour of generator were used to generate the project traffic.

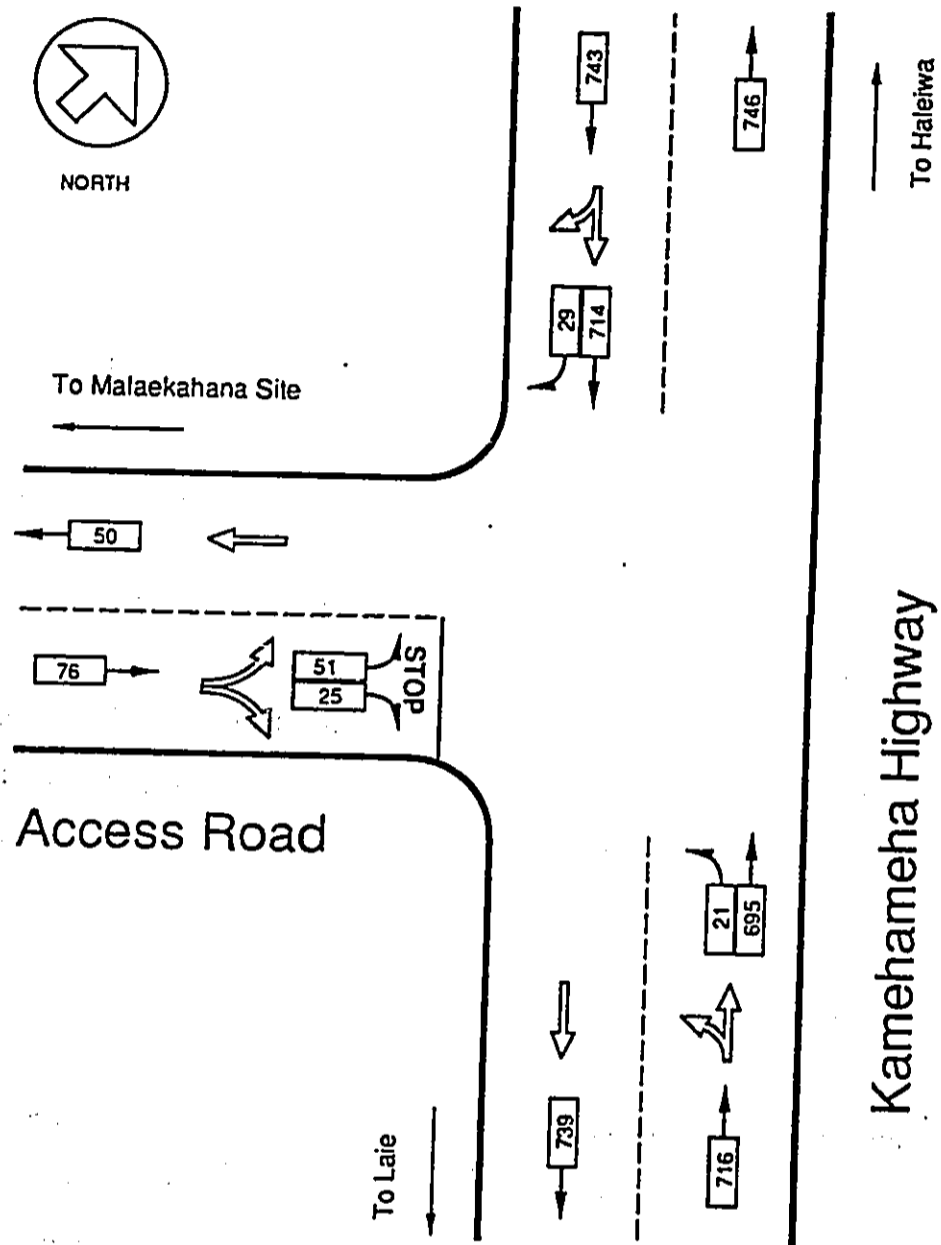


Figure 5. Forecasted Afternoon Peak Hour Traffic
 Kamehameha Highway and Access Road
 1994 Without Project

Table 2. Trip Generation

<u>Land Use</u>	<u>Acreage</u>	<u>Trip Rates</u>		<u>Number of Trips</u>	
		<u>Enter</u>	<u>Exit</u>	<u>Enter</u>	<u>Exit</u>
Golf Course	200 acres	0.175	0.325	35	65

Trip distribution and traffic assignment allocate the generated trips to different directions of travel and specific turning movements on the roadway. Trips were distributed to the surrounding areas based on the distribution of population of Oahu and the estimated shortest travel times to the project. It was estimated that 30% of the project traffic would be from the Kaneohe direction and 70% from the Haleiwa direction. The project generated traffic entering and exiting the project site were assigned to Kamehameha Highway.

Total Traffic

The ambient traffic volumes were added to the project generated traffic volumes to forecast 1993 traffic with the project. Figure 5 show the resulting turning movement volumes with the proposed project. Table 3 summarizes the turning movement volumes for the existing, 1993 without project and 1993 with project traffic conditions.

Table 3. Saturday Afternoon Peak Hour Forecast Traffic

	Kamehameha Highway				Access Road	
	Laie Bound		Haleiwa Bound		Makai Bound	
	TH*	RT	LT	TH	LT	RT
Present	457	3	10	484	3	4
Ambient Growth	70			72		
Kahuku Village Makai	41			46		
Asahi Jyukun Golf Course		26	11		48	21
Turtle Bay Resort Expan. **	146			93		
Project		25	11		46	23
1994 Without PROJECT	714	29	21	695	51	25
1994 With PROJECT	714	54	32	695	97	48

* TH=Through Lane, RT=Right Turn, LT=Left Turn

**Austin Tsusumi & Associates' Turtle Bay Resort Traffic Impact Report, 1985

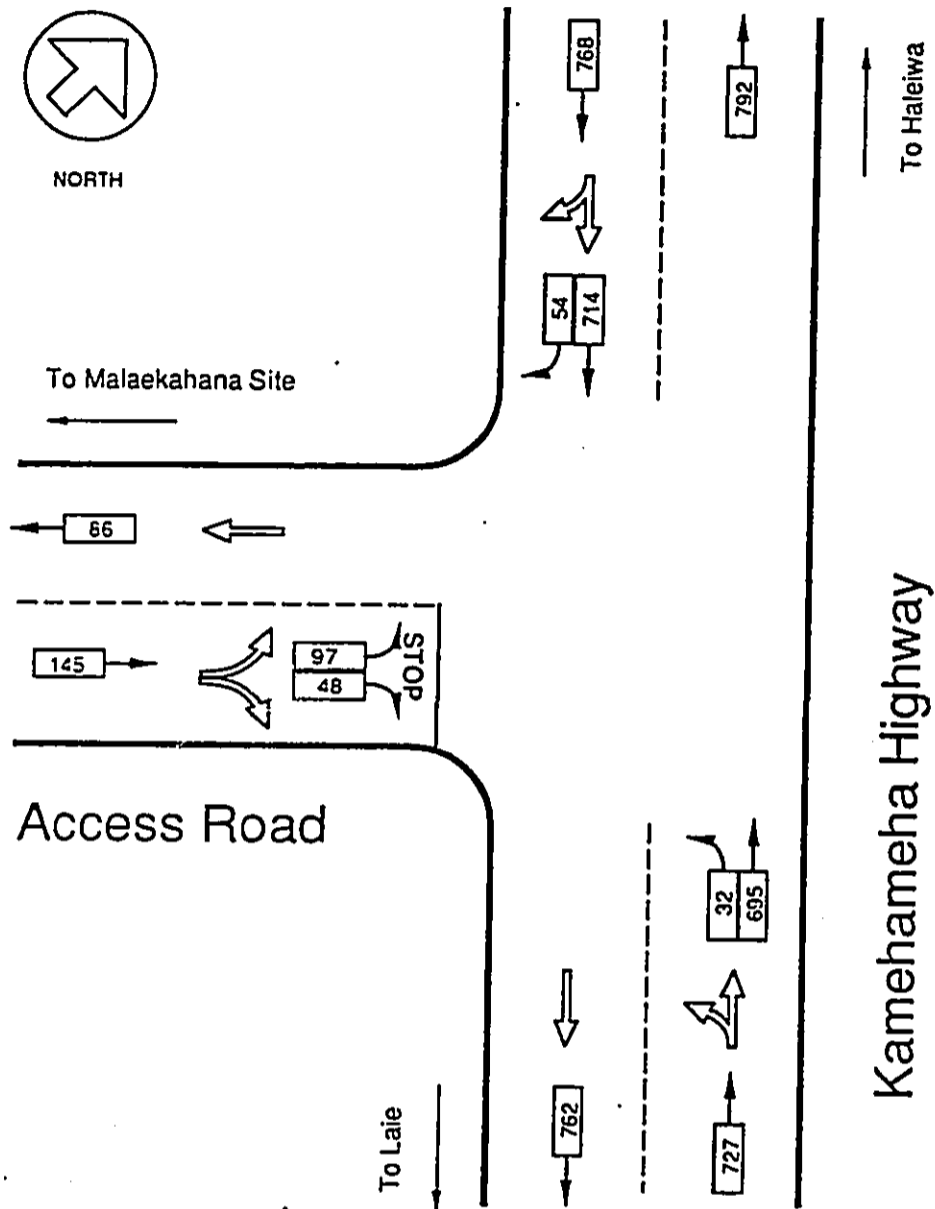


Figure 6. Forecasted Afternoon Peak Hour Traffic
 Kamehameha Highway and Access Road
 1994 With Project

TRAFFIC IMPACT ANALYSIS

Impacts from the proposed project were measured by the change in level of service (LOS) for specific turning movements with and without the project. The methodology for analyzing unsignalized intersections in the Transportation Research Board Highway Capacity Manual, Special Report 209 (1986) was used. The analysis method is based on the estimated number of turning movements that could occur through a conflicting traffic stream for stop and yield controlled turning movements. The LOS is determined by the amount of reserve capacity for a turning movement.

The methodology yields levels of service ranging from A to F (summarized in Appendix C). The LOS for the traffic movements at an intersection is classified into six categories ranging from little or no delay (LOS A) to extreme delays (LOS F). The results of the analysis are summarized in Table 4.

Table 4. Level of Service @ Intersection of Kamehameha Highway and Project Access Road

	Kamehameha Highway		Access Road ¹	
	Haleiwa-bound		Makai-bound	
	LT		LT	RT
1989 - Present	A		B	B
1994 - w/out Project	A		E	E
1994 - With Project	A		F	F

¹Left and right turns share one lane

• LT=Left Turn, RT=Right Turn

Presently, the study intersection is operating with average delays or better for all turning movements during the Saturday afternoon peak hour. The left turn movement from Kamehameha Highway into the project access road will operate with little or no delays (LOS A).

By 1994 without the project, the left turn movement from Kamehameha Highway into the project access road will continue to operate at LOS A. Kamehameha Highway through traffic will experience little or no delays. The LOS for vehicles attempting to exit project access road onto Kamehameha Highway will worsen. Traffic exiting the access road will operate with very long delays (LOS E) during the Saturday afternoon peak hour. This increased delay is due in part to an increase in traffic along Kamehameha Highway as well traffic generated from other developments along the access road.

By 1994 with the project, the left turn movement from Kamehameha Highway into the project access road will continue to operate at LOS A. Kamehameha Highway through traffic will experience little or no delays. The LOS for vehicles attempting to exit the project access road onto Kamehameha Highway will worsen. Traffic exiting the access road will drop from LOS E and LOS F during the Saturday afternoon peak hour.

Presently, vehicles exiting the project access road share one lane. If there were an exclusive right turn lane, the delays for vehicles turning right would decrease. Vehicles exiting the access road turning right would experience little delays (LOS B). The LOS for left turning vehicles would remain at LOS F.

CONCLUSIONS AND RECOMMENDATIONS

The Malaekahana Golf Course of the proposed The Country Courses at Kahuku is not expected to have an adverse impact on traffic flow along Kamehameha Highway in 1994, when the project is expected to be completed.

The results of the analysis show that the project will cause *little or no delay (LOS A)* to traffic along Kamehameha Highway during the Saturday afternoon peak hour. The left turn traffic into the project access road from Kamehameha Highway will remain at LOS A in 1994 *without or with* the project traffic.

By 1994 even without the project, the LOS for vehicles attempting to exit the project access road onto Kamehameha Highway will operate with long delays (LOS E) during the Saturday afternoon peak hour. This increased delay is due in part to an increase in traffic along Kamehameha Highway as well traffic generated from other developments along the project access road.

With the project in 1994, the LOS for the vehicles attempting to exit the project access road onto Kamehameha Highway will worsen. The LOS for vehicles exiting the access road will drop from LOS E to LOS F. This condition occurs during the peak traffic periods on Kamehameha Highway and is expected to improve as the volume on the Highway subsides.

To minimize the impact of the project, we recommend that exclusive right and left-turn lanes be provided along the project access road for traffic exiting onto Kamehameha Highway. This will permit drivers attempting right turns to bypass the left turning vehicles and decrease delays for vehicles attempting right turns.

APPENDIX A

Definition of Level-of-Service For

Unsignalized Intersections

APPENDIX A
DEFINITION OF LEVEL-OF-SERVICE

For unsignalized intersections, the traffic most impacted will be the minor or cross-street with the stop or yield control. The major roadway will have the right-of-way. The level-of-service is the amount of delay expected for the average vehicle desiring to cross or enter the major road. The following gives a general description of the measure.

The concept of levels of service is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst.

Level-of-Service definitions--In general, the various levels of service are defined as follows for uninterrupted flow facilities:

Level-of-service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

Level-of-service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

Level-of-service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by

interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

Level-of-service D represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level-of-service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuver. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go wave, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of the vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and level-of-service F is an appropriate designation for such points.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

APPENDIX B

Manual Traffic Count Data

APPENDIX B

MANUAL TRAFFIC COUNT DATA
MALAEKAHANA GOLF COURSE

TIME	KAMEHAMEHA HIGHWAY				ACCESS ROAD	
	Laie Bound		Haleiwa Bound		Makai Bound	
	TH	RT	LT	TH	LT	RT
1:45	107	1	1	135	0	2
2:00	126	1	3	119	0	2
2:15	107	1	4	132	2	1
2:30	101	1	1	110	0	0
2:45	123	0	2	123	1	1
3:00	110	0	1	119	1	2
PEAK HR	457	3	10	484	3	4

TH=THROUGH, LT=LEFT TURN, RT=RIGHT TURN

APPENDIX C

**State Department of Transportation
One Week Peak Hour Traffic Counts**

Kamehameha Highway DOT Station C-29-B

<u>Date (1989)</u>	<u>24-Hour Volume</u>	<u>Morning Peak Hour</u>		<u>Afternoon Peak Hour</u>	
		<u>Time (am)</u>	<u>Vol.</u>	<u>Time (pm)</u>	<u>Vol.</u>
Sun, Jan. 31	7864	11:00-12:00	649	12:00-1:00	767
Mon, Feb. 1	9778	10:45-11:45	644	3:15-4:15	851
Tue, Feb. 2	9379	11:00-12:00	622	3:45-4:45	792
Wed, Feb. 3	9646	11:00-12:00	581	3:30-4:30	880
Thur, Feb. 4	9696	10:00-11:00	570	3:30-4:30	799
Fri, Feb. 5	10801	10:00-11:00	606	3:45-4:45	878
Sat, Feb. 6	11828	10:30-11:30	789	2:00-3:00	1092

PACIFIC PLANNING & ENGINEERING, INC.

COMPANY QUALIFICATIONS

JULY 1989

PACIFIC PLANNING & ENGINEERING, INC.

We provide planning and consultancy services to:

- Public Works Agencies
- Housing Agencies
- Transportation Departments
- Private Development Groups
- Major Facility Owners (Golf Courses, Major Resorts)
- Airports
- Airline Interests

We work closely with our clients to gain an understanding and appreciation of their needs beyond the bound report or design sheet. Our sensitivity to client needs arises from our experience in managing large public works departments. Our awareness of the pressures and nuances of management decision-making enables us to provide perspectives beyond the norm. Our understanding and working knowledge of agencies in planning and governance enable us to serve beyond the technical area.

Management Services

- Management Information Assistance
 - Rapid, Highly Focused Evaluations
 - Financial Analysis
 - Feasibility Studies
 - Organizational Assessments
- Planning and Design Team Management
- Construction Management
- Lease Negotiations
- Property Management Evaluations

Planning and Engineering Consultancy

- Assistance with Government Requirements
- Alternatives Analysis
- Traffic Impact Studies
- Traffic Engineering and Roadway Design
- Ground Transportation System Evaluations
- Facilities Planning

PACIFIC PLANNING & ENGINEERING, INC.

PPE, Inc.--CLIENTS

Department of Housing and Community Development, City and County of Honolulu
Castle & Cooke
Queens' Development Corporation
Airport Operators Council International
The Estate of James Campbell
Hawaii Finance and Development Corporation, State of Hawaii
Princeville Development Corporation
Aloha Airlines
Japan Travel Bureau International
Department of Business and Economic Development, State of Hawaii
Department of Accounting and General Services, State of Hawaii
Signal Puako Corporation
R. M. Towill, Inc.
DHM, Inc.
Engineering Concepts, Inc.
Transcontinental Development Company
Department of Transportation
Aloha Tower Development Corporation

SAMPLING OF PROJECTS BY PPE, INC.

West Loch Estates
Kapolei Town Center
Signal Puako
Maui Palisades
Honoapiilani Apartments
UH Hilo Expansion
Queens' Medical Center
Waikiki Landmark
Lanai Airport Planning
Lanai Highway Planning
Princeville Airport
Waikiki Convention Center
Honolulu Waterfront Development Project
Lanai City Traffic Circulation
Waikoloa Expansion Project
State Filming Facility
Lihue/Puhi District Project
Ewa Regional Long-Range Transportation Plan
Aloha Stadium Master Plan Update
Honolulu International Airport Intra-Airport Transportation System

PACIFIC PLANNING & ENGINEERING, INC.

Personnel

The Principals of PPE, Inc. are Dr. Jonathan Shimada and Mr. Howard Abe. They have decades of experience and training in management and technical fields.

In managing the Hawaii Airports System for seven years, Dr. Jonathan Shimada has experience in:

- airport system management
- transportation planning consultancy
- traffic engineering and safety
- airport finance and budgeting
- lease and property management
- airline and retail concession operations
- ground transportation
- program planning and evaluation
- engineering administration
- media and public relations
- management and technical Workshops
- contract negotiations

He has a wide range of experience by having managed a large public works agency with a \$120 million annual operating budget and over 800 employees. He has dealt with print and television reporters, small and large airport operators, State Legislature and County Governments, major retail businesses, protocol personnel, airlines, small businesses, ground transportation operators, special interest groups, and attorneys. This provides a strong and effective base for assisting those needing people and solutions who can deal effectively with technical problems, government agencies, and private enterprise. Dr. Shimada is well-known and respected in the world-wide system of airports, and particularly in the Pacific Basin.

Mr. Howard Abe's professional experience has been notable in its ever increasing management responsibilities. His management experiences, technical knowledge and field experience over three decades provide a strong and practical base. He is widely respected by the agencies he has served, and most significantly by government, media, private and community groups with whom he has worked. His awards and recognition are even more noteworthy when one considers they were given in the public service field of highways. He has received awards and recognition from such respected and diverse groups as:

- Maui Chamber of Commerce
- State Government
- Maui County
- Newspaper editors
- State legislators, mayors, and private citizens

His past achievements in his work represent abilities and knowledge which he will bring to bear in the most demanding and difficult planning/engineering situations.

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX C

**ARCHAEOLOGICAL INVENTORY
SURVEY FOR THE PROPOSED
MALAEKAHANA GOLF COURSE, A
PORTION OF THE COUNTRY
COURSES AT KAHUKU**

Archaeological Consultants of Hawaii

APPENDIX C



JOSEPH KENNEDY
Archaeologist

ARCHAEOLOGICAL CONSULTANTS of HAWAII

59-624 Pupukea Rd.
Haleiwa, Hawaii 96712
(808) 638-7442

Mr. William Wanket
William E. Wanket, Inc.
1001 Bishop St. Suite 660
Honolulu, Hawaii 96813

December 11, 1989

RE: Archaeological Inventory Survey for the Proposed
Malaekahana Golf Course, a Portion of The Country Courses
at Kahuku.

Dear Mr. Wanket:

EXECUTIVE SUMMARY

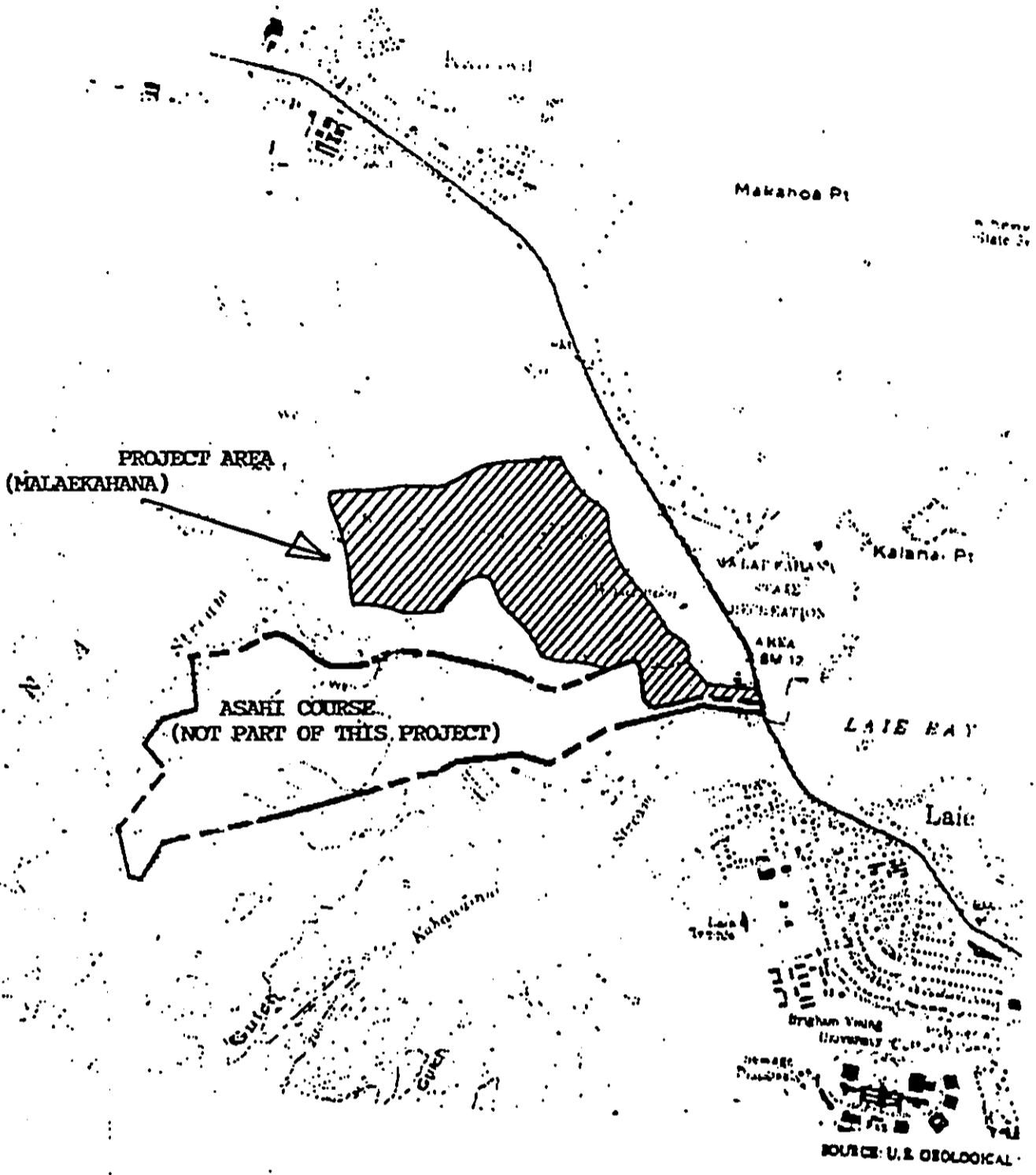
At the request of your office, Archaeological Consultants of Hawaii, Inc. has conducted an archaeological inventory survey of 200 acres at the site of the proposed Malaekahana Golf Course. Our investigations resulted in the identification of 19 surface features including overhang shelters with evidence of previous human occupation, suspected agricultural terraces, low mounds, midden scatter areas, large, sandy dune formations with suspected cultural components, prehistoric surface artifacts, a historic gun emplacement, and a historic railroad bed.

The sites identified in this survey will have to be tested and perhaps subjected to further data recovery depending on test results. Site specific evaluations will be presented in the text.

PHYSICAL SETTING

The proposed Malaekahana Golf Course is situated inland from Kahuku Point on the island of Oahu. Topographically, the property may be divided into three zones, exposed coral reef escarpment, aeolian sandy dunes and flat coastal plain. Artificial ponds constructed in recent times for the production of shrimp, some modern dwellings and access roads are also present on the property. The exposed reef features a thin layer of red soil while the flat plain - once used for

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THE COUNTRY COURSES AT KAHUKU (MALAEKAHANA)

PROPERTY BOUNDARY



W. Wanket
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sugar cane production - consists of deep deposits of silty clays belonging to the Lahaina Series; these areas are now used as pasture lands. The dune areas have sandy deposits at least 10 feet deep according to Mr. Chuck Cagle who has farmed and ranched the land in recent years and it is suspected that they are much more substantial.

Ground cover vegetation on the subject property -except where the land has been cleared for pasture, roads or housing - is dominated by haole koa (Leucaena glauca), christmasberry (Schinus terebinthifolus), tree helitrope (Messerschmidia argentea), ironwood (Casuarina equisetifolia) Java plumb (Eugenia javanica) and a variety of grasses.

Elevation on the subject property ranges from 20 to almost 400 feet above sea level. Rainfall ranges from 40 to 60 inches a year. While there are no permanent streams, periodic water is available through abundant rainfall and nearby springs.

METHODOLOGY

The Malaekahana survey was conducted by a team of six archaeologists covering the ground on foot in a systematic fashion using compass transects, contour and aerial maps. Survey increments were employed according to topography, roads and pastures. Because much of the area is an operating cattle and horse ranch with many fenced pastures, these divisions provided the survey teams with consistent terrain within a unit. Radio contact was maintained between sweepers and temporary site numbers were assigned to individual sites and features.

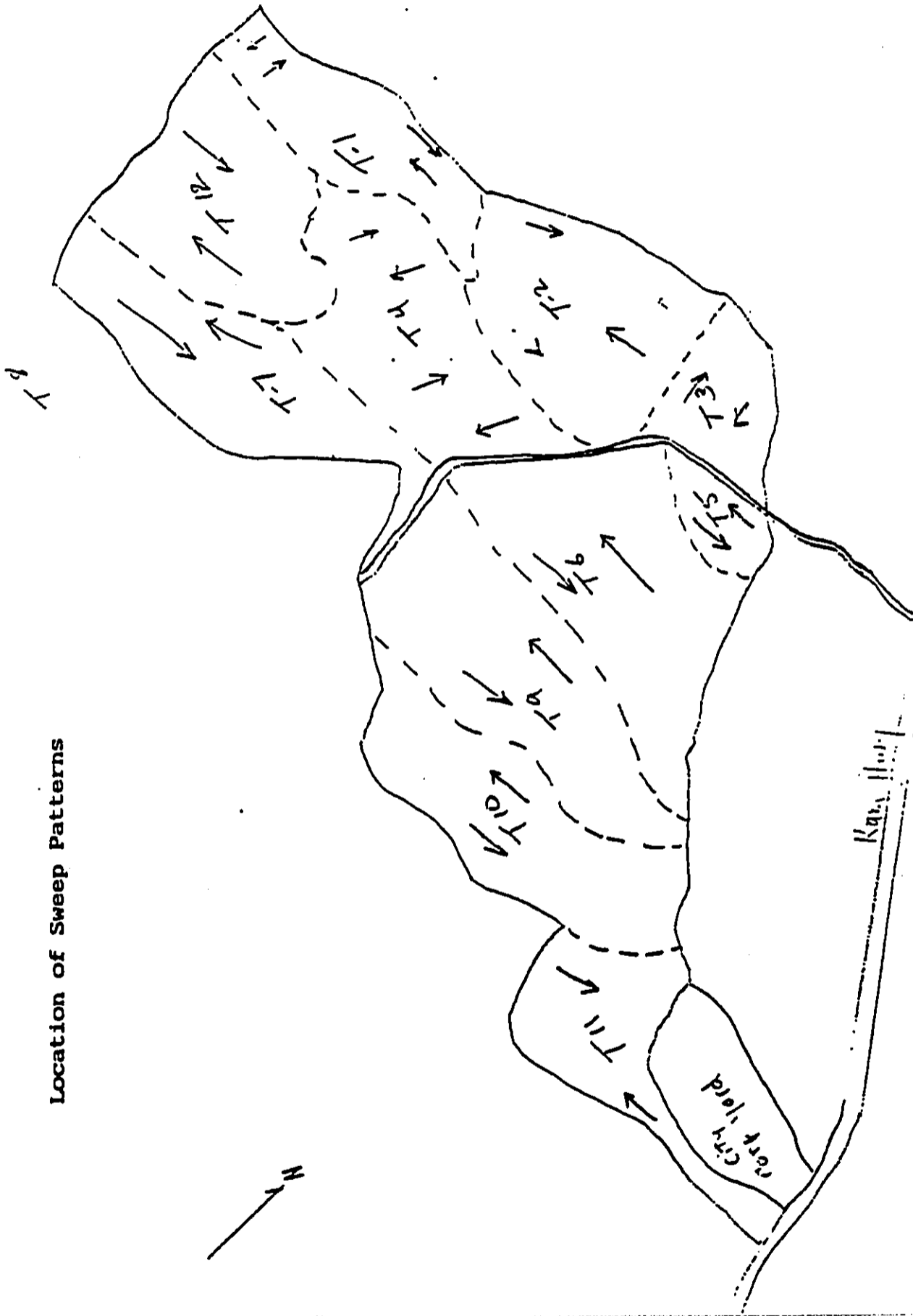
The numbering system consists of a "T" -for Temporary - followed by sweep or unit number, 1-12, a dash, and a site number using three digits; 000 - 045. For example, T1-008 would be Sweep 1 and site 008. 45 potential sites were located on initial sweeps and 19 of these sites survived a second examination, therefore, the reader should be aware that site numbers are not in perfect sequential arrangement.

A total of 12 sweep units were established and sites were located in only 5 (T1, T2, T3, T4 and T6); the remainder of the sweeps produced no surface indications. As a side note, sites were located in sweep 8, but this area was later shown to be off the property.

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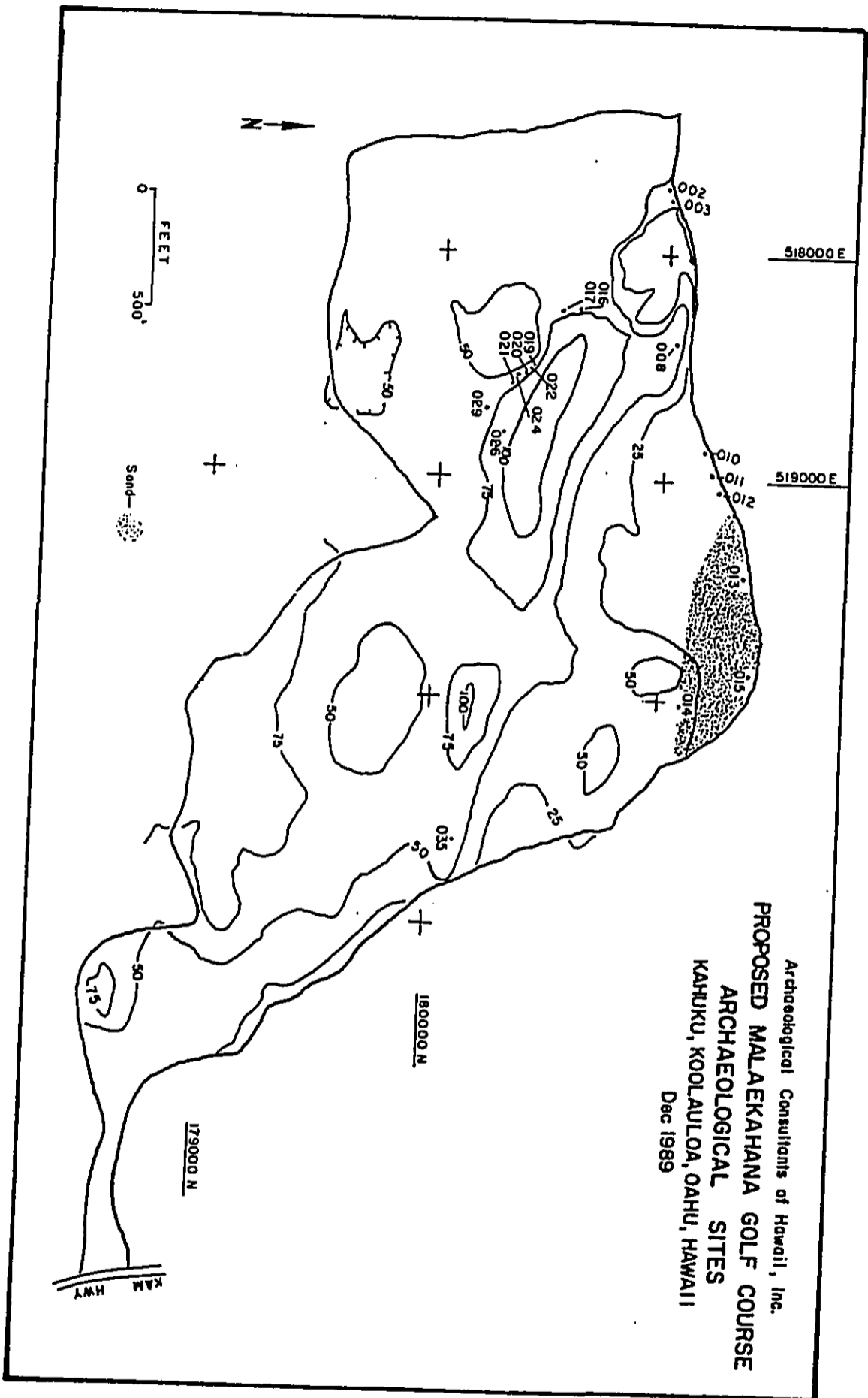
RECEIVED AS FOLLOWS

MALAEKAHANA GOLF COURSE



Location of Sweep Patterns

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000



Archaeological Consultants of Hawaii, Inc.
PROPOSED MALAEKAHANA GOLF COURSE
ARCHAEOLOGICAL SITES
KAHUKU, KOOLAULOA, OAHU, HAWAII
 Dec 1989

RECEIVED AS FOLLOWS

PREVIOUS ARCHAEOLOGICAL WORK IN THE AREA

Work in the area dates back to the McAllister survey in the 1930's. At that time, the Kukio Pond was recorded and since then, the pond has been destroyed. Of additional interest was McAllister's interview with the Kaleo family who reported numerous burials in shallow, sandy graves in this general area.

Between McAllister's work and this writing, a number of archaeological projects have been conducted in this general area. Most notable are the works of Davis (1981) who detailed two habitation sites and a religious structure in the Kahuku Wind Farm project area, Dye (1977) who performed subsurface test excavations revealing two occupation levels (one of which being prehistoric) and Bath (1984) who's work resulted in the establishment of the "Kahuku Point Archaeological Area" which was later determined to be eligible for the National Register of Historic Places. Yent and Estioko-Griffin (1980) conducted a substantial excavation program at Malaekahana State Recreation Area and discovered three major occupation levels dating as early as c. AD 1600

Human remains in this general area have been reported by Neller (1984), Walker and Haun (1986) and Jensen (1989).

While no previous archaeological work has taken place on the subject property, the Jensen survey, mentioned in the preceding paragraph, for PHRI details the results of a survey on the site of the proposed Asahi Golf Course which is just south of the subject property towards Laie. At this location Jensen discovered a total of six sites including a possible platform burial, two caves, two habitation overhangs and a ditch/tunnel with historic research value. All six sites have been recommended for further research.

A brief historical overview of the general area has been prepared by Helen Wong Smith and is presented in the Jensen report.

EXCAVATION RESULTS/ SIGNIFICANCE EVALUATIONS/FUNCTION

Presented in tabular form below is a list of archaeological/historical sites located at the proposed Malaekahana Golf Course together with their significance evaluation and suspected function.

ARCHAEOLOGICAL CONSULTANTS OF HAWAII, INC.

SITES AT MALAEKAHANA GOLF COURSE

SITE #	SITE TYPE	SIGNIFICANCE CRITERIA	POSTULATED FUNCTION
T1-002	Shelf/Midden Scatter	D	Habitation
T1-003	Shelf/Midden Scatter	D	Habitation
T1-008	Cave/Wall	D	Habitation
T2-010	Sand Dune	D/E	Hab./Burial
T2-011	Sand Dune	D/E	Hab./Burial
T2-012	Sand Dune	D/E	Hab./Burial
T3-013	Sand Dune	D/E	Hab./Burial
T3-014	Sand Dune	D/E	Hab./Burial
T3-015	Sand Dune	D/E	Hab./Burial
T4-016	Gun Emplacement	A	WWII
T4-017	Railroad Bed	A	Koolau RR
T4-019	3 Overhangs	D	Habitation
T4-020	Overhang	D	Habitation
T4-021	Terrace/Wall	D	Agricultural
T4-022	Ramp/Overhang	D	Habitation
T4-024	Stacked Rock	D/E	Hab./Burial
T4-026	Terrace	D	Agricultural
T4-029	Low Mound	D/E	Ag./Burial
T6-035	3 Mounds/Bottle Dump	D	Hist. Value

CODE -NS -Not significant, NLS -No longer significant, A - Reflects major trends in history, B -Associated with significant person, C -Excellent site type, D -Important for scientific value, E -Cultural significance.

SITE DISCUSSIONS

- 002- A shelf overhang located in escarpment area above modern A-frame house. Excavation potential will most likely be limited due to poor soil conditions; testing is recommended. Coral polishing stone collected from surface. Site condition: Good
- 003- A shelf on side of escarpment; testing recommended. One basalt core, a hammer stone and several flakes collected from surface. Site condition: Good
- 008- Shallow cave in escarpment area with associated wall; testing recommended. Associated wood with square nails. Site Condition: Excellent
- 010- Sand dune. Extensive testing recommended due to possibility of burials.
- 011- " " "
- 012- " " "
- 013- " " "
- 014- " " "
- 015- " " "
- 016- Gun emplacement, concrete. Most likely associated with WWII military presence in area. Marginal candidate for preservation. May also be considered NLS (no longer significant).
- 017- Portion of Koolau Railroad with few ties and tracks. Associated with historic plantation activities in area. Historic value.
- 019- Three shallow overhangs in escarpment area. Limited testing recommended. Site condition: Marginal.
- 020- Shallow overhang in escarpment area. Some midden observed. Limited testing recommended. Site condition: Marginal.

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SITE DISCUSSIONS (CONT.)

- 021- Small terrace and wall along top of escarpment. Testing recommended. Site Condition: Good
- 022- Ramp with stacked coral rock faces. Testing is recommended. Site condition: Good
- 024- Stacked coral between outcrops. Testing recommended. Site condition: Good
- 026- Stacked coral between outcrops, terrace. Testing recommended. Site condition: Good
- 029- Low coral mounds. Limited testing recommended. Site condition: Poor
- 035- Three, low coral mounds. Limited testing recommended. Site condition: Poor

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CONCLUSIONS AND RECOMMENDATIONS

Based on the information presented above, we believe that further work is necessary at most site locations. Reasons for this include previous work in the area which has demonstrated substantial precontact occupations with research potentials. In addition, human osteological material has been uncovered in both escarpment and sandy areas in the vicinity.

The subject property features escarpment areas, suspect mounds, and substantial sand dunes which are considered prime burial areas. Informant testimony from McAllister also helps support the possibility of sand burials being present here.

The nature of the additional work recommended for the proposed Malaekahana Golf Course (at this point) involves testing and ranges from simple limited testing of suspect mounds to a comprehensive investigative probing of the sand dunes.

Further work, in the form of data recovery may become necessary depending on test results. Testing in suspected habitation sites should be sufficient to make preliminary determinations regarding chronology (radioisotope dates), nature and extent of any subsurface occupation levels and the collection of information relating to possible preservation and management plans, if necessary.

If you have any questions regarding this report please feel free to contact me.

Aloha,


Joseph Kennedy
Consulting Archaeologist

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VITAE

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Telephone: 808-638-7442

Birthdate/place: September 9, 1948 Chicago, Illinois

Citizenship: USA

Appointments:

President, Senior Archaeologist,
Archaeological Consultants
of Hawaii, Inc.

President, Society for Hawaiian
Archaeology (85-86)

Editor, Hawaiian Archaeology Vol. II

Editor, Native Planters

EDUCATION

Southern Methodist University, Fort Burgwin Research Center,
Archaeological Field School. Ranchos de Taos, New Mexico.
1967

BA John Pershing College, Beatrice, Nebraska.
History/Anthropology, 1970.

MA University of Hawaii, Honolulu, Hawaii
Anthropology/Hawaiian Archaeology, 1974.

ARCHAEOLOGICAL FIELD EXPERIENCE

1966- Upper Republican River Valley Site; John Pershing
College. Position: Student

1967a- Fort Burgwin Historic Renovation Project; Southern
Methodist University. Position: Student

1967b- Pueblo Excavation at Pot Creek; Southern Methodist
University; Position: Student

Joseph Kennedy
Vitae
page2

- 1968- Pawnee Burial Site, John Pershing College; Position:
Supervisor
- 1969- Lapakahi Excavations; University of Hawaii; Position:
Student
- 1970a- Panama Excavation; Luther College, Decorah, Iowa
Position: Supervisor
- 1970b- Black Mesa Excavation; Prescott College. Position:
Supervisor.
- 1970c- Kailua-Kawaihae Archaeological Survey. State of
Hawaii, Department of Transportation. Position:
Supervisor.
- 1971- Lapakahi III; University of Hawaii. Position:
Supervisor.
- 1972- Honopue Valley Archaeological Survey; University of
Hawaii. Position: Supervisor.
- 1973- Waimanalo Archaeological Survey; University of Hawaii.
Position: Supervisor
- 1978- Barbers Point Archaeological Survey. Archaeological
Research Center of Hawaii. Position: Supervisor.
- 1979- Kuliouou Archaeological Excavations. Chiniago Inc.
Position: Supervisor.
- 1980- Paniau Archaeological Survey. Archaeological
Consultants of Hawaii; Position: Principal Investigator
- 1981- Heeia Archaeological Survey. Archaeological Consultants
of Hawaii; Position: Principal Investigator.
- 1982a- Waihee Archaeological Survey. Archaeological
Consultants of Hawaii; Position: Principal
Investigator.
- 1982b- Heeia Kea Archaeological Survey. Archaeological
Consultants of Hawaii; Position: Principal
Investigator.
- 1982c- Management Plan for Ahuimanu Taro Complex.
Archaeological Consultants of Hawaii; Position:
Principal Investigator.

ARCHAEOLOGICAL FIELD EXPERIENCE (cont.)

- 1982d- Kaunakakai Archaeological Survey. Archaeological
Consultants of Hawaii; Position: Principal
Investigator.
- 1982e- Pukoo Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1982f- Makaha Archaeological Monitoring Project.
Archaeological Consultants of Hawaii. Position:
Principal Investigator.
- 1982g- Excavations at the Pyramid of Ra-Nefer-F. Abu Seer,
Egypt. Czechoslovakian Archaeological Institute,
Cairo. Position: Visiting Scholar.
- 1983a- Wailuku Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1983b- Kahului Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1983c- Kaloko Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1983d- Kaloko Intensive Survey. Archaeological Consultants of
Hawaii. Position: Principal Investigator.
- 1984a- Palolo Archaeological Survey. Archaeological
Consultants of Hawaii. Position Principal
Investigator.
- 1984b- Archaeological Interpretive Trail at Ahuimanu.
Archaeological Consultants of Hawaii. Position:
Principal Investigator.
- 1984c- Archaeological Survey at Maile. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1984d- Keaau Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.

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- 1984e- Waianapanapa Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1984f- Archaeological excavations at Hotel and Bethel St.
Archaeological Consultants of Hawaii. Position:
Principal Investigator.
- 1985a- Defense Environmental Restoration Program in American
Samoa. Archaeological Consultants of Hawaii. Position:
Principal Investigator.
- 1985b- Kahuku Archaeological Excavation. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1985c- Waikakalaua Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1985d- Hilton Hawaiian Village Monitoring Project. PHRI,
Inc. Position: Field Supervisor
- 1985e- Preliminary Archaeological Investigations on the
Island of Tutuila, American Samoa. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986a- Kehei Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986b- Haleakala Ranch Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986c- Lahilahi Archaeological Investigations. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986d- Lahina Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986e- Maalaea Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.

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- 1986f- Excavations at Waikiki Aquarium. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986g- Mokuleia Survey. Archaeological Consultants of Hawaii.
Position: Principal Investigator.
- 1986h- Waiehu Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986i- Mokuleia Ranch Survey. Archaeological Consultants of
Hawaii. Position: Principal Investigator.
- 1986j- Keanae Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986k- Lumahai Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1986l- Puna Archaeological Survey. Archaeological Consultants
of Hawaii. Position: Principal Investigator.
- 1986m- Kahana Archival Study. Archaeological Consultants of
Hawaii. Position: Principal Investigator.
- 1986n- Limahuli Excavations. Archaeological Consultants of
Hawaii. Position: Principal Investigator.
- 1986o- Kakaako Archaeology Project. Social Science Research
Center, University of Hawaii. Position: Co-author.
- 1986p- Kihei Archaeological Survey. Archaeological
Consultants of Hawaii. Position: Principal
Investigator.
- 1987a- Kihei II. ACH. Position: Principal Investigator.
- 1987b- Kihei III. ACH. Position: Principal Investigator.
- 1987c- Old Kona Airport Survey for SeaGrant. Position:
Principal Investigator.
- 1987d- Old Kona Archaeological Survey for County of Hawaii.
Position: Principal Investigator.

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- 1987e- Naalehu Archaeological Survey. Position: Principal Investigator.
- 1987f- Waikoloa Archaeological Survey. Position: Principal Investigator.
- 1987g- Subsurface Testing at Heeia. Position: Principal Investigator.
- 1987h- Subsurface Archaeological Testing at Kihei. Position: Principal Investigator.
- 1987i- Archaeological Monitoring At Hawaii Kai. Position: Principal Investigator.
- 1987j- Subsurface Archaeological Testing at Kahana. Position: Principal Investigator.
- 1987k- Subsurface Testing at Limahuli. Position: Principal Investigator
- 1987l- Archaeological Survey at Ewa. Position: Principal Investigator
- 1987m- Archaeological Archival Study of Transmission Line Corridor, South Oahu. Position: Principal Investigator.
- 1987n- Palolo Survey and Osteological Recovery. Position: Principal Investigator.
- 1987o- Archaeological Survey at Proposed Ewa Gentry, Oahu. Position: Principal Investigator.
- 1988a- Archaeological Survey at Holualoa. Position: Principal Investigator.
- 1988b- Subsurface Testing at Tula and Onenoa, American Samoa. Position: Principal Investigator.
- 1988c- Archaeological Survey at Kihei. Position: Principal Investigator.
- 1988d- Archaeological Survey at Mokuleia. Position: Principal Investigator.
- 1988e- Archaeological Survey at Kula. Position: Principal Investigator

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- 1988f- Subsurface Testing at Hanalei. Position: Principal Investigator.
- 1988g- Archaeological Survey at Waioli. Position: Principal Investigator.
- 1988h- Archaeological Survey at Ewa. Position : Principal Investigator.
- 1988i- Data Recovery at Holualoa. Position: Principal Investigator.
- 1988j- Archaeological Survey at Kona Village. Position: Principal Investigator.
- 1988k- Archaeological Monitoring at Washington Place. Position: Principal Investigator.
- 1988l- Archaeological Survey at Kahului. Position: Principal Investigator.
- 1988m- Archaeological Monitoring at Kihei. Position: Principal Investigator.
- 1988n- Archaeological Survey at Kihei. Position: Principal Investigator.
- 1989a- Data Recovery at Kamani Tree Subdivision, Kona. Position: Principal Investigator.
- 1989b- Due Diligence, Wailea, Maui. Position: Principal Investigator.
- 1989c- Due Diligence, Kona Village Resort. Position: Principal Investigator.
- 1989d- Due Diligence, Watson Property, Kona. Position: Principal Investigator.
- 1989e- Archaeological Survey at Keonekai Subdivision, Maui. Position: Principal Investigator.
- 1989f- Archaeological Survey, Haena, Kauai: Position: Principal Investigator.
- 1989g- Archaeological Survey, Moloaa, Kauai. Position: Principal Investigator.

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- 1989h- Subsurface testing at Hanalei, Kauai. Position:
Principal Investigator.
- 1989i- Data Recovery Program, Ahalanui, Hawaii. Position:
Principal Investigator.
- 1989j- Reconstructive Preservation Project, Kamani Tree
Subdivision, Kona. Position: Coordinator.
- 1989k- Subsurface Testing, Kiawe Terrace Subdivision, Maui.
Position: Principal Investigator.
- 1989l- Archaeological Monitoring, Lahaina, Maui. Position:
Principal Investigator.
- 1989m- Data Recovery Program Design. Puna, Hawaii. Position:
Principal Investigator.
- 1989n- Expert Witness, Hockena Mauka, Hawaii.
- 1989o- Expert Witness, Hanalei, Kauai.
- 1989p- Archaeological Interpretive Field Check, Waikapu,
Maui.
- 1989q- Archaeological Survey, Meyer's Ranch, Molokai.
Position: Principal Investigator.

**PARTIAL CLIENT LIST FOR ARCHAEOLOGICAL CONSULTANTS OF HAWAII
INC.**

A&O International, Inc.
Ahuimanu Joint Ventures, Inc.
Architects Hawaii
Ashford & Wriston
Associated Engineering Consultants (Auburn CA)
Kep Aluli, Inc.
Belt, Collins & Associates
City and County of Honolulu
Central Pacific Development Corporation
Chee, Will, Planner
CH2MHILL (Denver, Colorado)
C Brewer Properties
Cowell and Associates
Dujardin Development Company
Environment Impact Study Corporation
Ecotropics
Franklin Grey & Associates

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Government of American Samoa
Goodfellow Construction
Grey, Hong, Bills and Associates
Hanalai Properties
Hawaii Electric Renewable Systems
Heidi Helm & Associates
Hawaiian Electric Co.
Mike McCormack Inc.
Mokuleia Development Corp.
Okamoto, Wilson and Associates
Palapala Inc.
Palolo Estates
Pacific-Asian Inc.
Pete Marwick, Co.
Phillips, Brandt, Reddick & Associates
Quinn Anderson (et al)
Sea Grant, University of Hawaii
Schuler and Associates
Steven Pitt, Inc.
State of Hawaii, Department of Land and Natural Resources
Stone Mettenbrink & Associates (Phoenix, Arizona)
Takemasa International (Tokyo, Japan)
True Geothermal
U.S. Army Corps of Engineers
U.S. Government, National Park Service, Dept. of Interior
Uwe Schulz & Associates
Waikiki Aquarium
Warren Unemori & Associates
Wankett, William, Planner
Wavecrest, Molokai, Inc.
Whalers Realty
Wilcox, Gaylord

LECTURES

" Sir Richard Burton - Founder of the Royal Anthropological Institute." Presented to the Hawaii Anthropological Association. Honolulu

" An Overview of a Seven Archaeological Surveys in Hawaii." Presented to the Society for Hawaiian Archaeology. Honolulu

" Traditional Farming Methods in Ancient Hawaii. " Presented to the Institute of Echnotechnics, Kathmandu Conference. Kingdom of Nepal.

Joseph Kennedy
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" Prehistoric Sweet Potato Farming in the Hawaiian Dry Forest." Presented to Natural History of Hawaii classes, Department of General Sciences, UH, Manoa.

" The Ethnohistory of Erythroxyn Coca." Presented to General Science 440, UH, Manoa (five times).

" The Ahuimanu Taro Terrace - An Interpretive Model of Historic Preservation in Hawaii." Presented to the participants of the Pacific Island Cultural Resource Management Workshop." Honolulu

" Historic Preservation in Hawaii." Presented to Anthropology 450. West Oahu College. Honolulu.

" Hawaii's Past as Seen through Archaeological Structures." Presented to several classes at Puanhou School. Honolulu.

" Hawaii's Endangered Archaeological Past. " Presented to the Staff of the Historic Preservation Office, Government of American Samoa. Pago Pago.

" Man and Cocaine: A Historical Overview." Presented to the Wellcome Institute for the History of Medicine. London. UK

" The First Local Anesthetic." Presented to the Osler Society. London. UK

" E. Coca and Early Andean Society." Presented to the Lindsay Club. London. UK

" Archaeological Investigations in Urban Honolulu." Presented at the Annual Meeting of the Society for Historic Archaeology. Sacramento, California.

PUBLICATIONS

1970 - The Kailua-Kawaihae Road Survey: An Archaeological Model for Surface Survey in Hawaii. In: The Archaeology of South Kohala and North Kona. Hawaii State Archaeological Journal #14. Honolulu.

1973 - Lapakahi Burials: Typology and Change. In: Asian and Pacific Archaeology Series #5. Tuggle and Griffin eds. Social Science Research Institute. Honolulu.

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- 1982 - An Introduction to Native Planters. In: Native Planters. Joseph Kennedy ed. Honolulu.
- 1985 - COCA EXOTICA. Fairleigh Dickinson University Press/ Cornwall Books. New York, Toronto, London.
- 1985a- Aboriginal Sweet Potato Farming at 1000 feet in the Hawaiian Dry Forest. In: Hawaiian Archaeology. Joseph Kennedy ed. Honolulu.
- 1987- Hawaiian Archaeology: The Pursuit of Antiquity in a Very Small Place. ARCHAEOLOGY MAGAZINE. Archaeological Institute of America. Vol. 40 # 5. Sept/Oct 1987. COVER STORY.
- ND- RUFFIAN DICK: A LIFE OF SIR RICHARD BURTON, KCMG
In preparation.
- ND- The Archaeology of the Hawaiian Islands. In preparation.
- ND- The Archaeological Recovery of Smallpox Victims in Hawaii: Scientific Investigation of Public Health Threat?

AWARDS

National Science Foundation stipend recipient at the University of Hawaii, 1969.

Historic Hawaii Foundation Preservation Award. Awarded to Archaeological Consultants of Hawaii. 1987

CONFERENCES

Institute of Ecotechnics Sub Continent Conference, Kathmandu, Nepal, April, May. 1982

Excavations at the Pyramid of Ra-Nefer-F. Abu Seer, Egypt. Czechoslovakian Archaeological Institute, Cairo.

Society for Historic Archaeology (Jan. 86) Sacramento, Ca.

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MEMBERSHIPS

Fellow of the Royal Anthropological Institute of Great Britain and Ireland.

Society for Field Archaeology.

Member of the Ethnopharmacological Society.

Professional Member of the Society for Hawaiian Archaeology.

Member, Historic Hawaii Foundation

Member, Society for Historic Archaeology

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX D
COUNTRY COURSES AT KAHUKU,
SOCIAL IMPACT ASSESSMENT

Earthplan

APPENDIX D

COUNTRY COURSES AT KAHUKU

SOCIAL IMPACT ASSESSMENT

**PREPARED FOR
WILLIAM E. WANKET, INC.**

**BY
EARTHPLAN**

October 1989

COUNTRY COURSES AT KAHUKU

SOCIAL IMPACT ASSESSMENT
SECTION 1: INTRODUCTION AND BACKGROUND

1 INTRODUCTION AND BACKGROUND

1.1 DESCRIPTION OF THIS REPORT

1.1.1 Purpose Of This Report

The Estate of James Campbell proposes to develop *The Country Courses at Kahuku* in Koolauloa, Oahu. The project involves the development of four new 18-hole golf courses on two non-contiguous parcels of land. Both sites are located in the State Land Use Agricultural District and are designated Agriculture on the Koolauloa Development Plan Land Use Map. Zoning on these lands are Ag-1, Restrictive Agricultural District and Ag-2, General Agricultural District. Required land use approvals include Urban designation on the State Land Use Map, Parks and Recreation designation on the Koolauloa Development Plan Land Use Map.

An Environmental Impact Statement is required in seeking these land use approvals. This social impact assessment was prepared in conjunction with the Environmental Impact Statement.

1.1.2 Preparers Of This Report

This report was prepared by Earthplan whose office is located at 81 South Hotel Street, Suite 211. *Berna Cabacungan*, principal of Earthplan, was the project manager, and principal researcher and writer. Independent contractor *Michael P. Mays* assisted in research and analysis related to demographics and community issues.

1.1.3 Report Organization

This report contains five major sections. The remaining portions of Section 1 present the following discussions:

- * Section 1.2 describes existing and surrounding uses and the proposed project.
- * To help the reader understand the social impact assessment purpose and function, Section 1.3 describes social impact assessment in general and its application to Country Courses at Kahuku.

Section 2 provides a profile of the existing community to establish the social context in which project impacts may occur. Information includes employment, population, housing and other social characteristics.

Section 3 explores the study area's future without the proposed project. This information extends the baseline data by identifying the possible future scenarios for the community independent of the proposed project. Public policies and major public and private developments are included in this analysis.

Section 4 identifies potential community issues and concerns on this project, based on historical trends to date.

The Country Courses at Kahuku
Social Impact Assessment

Section 5 identifies potential social impacts of the Country Courses at Kahuku. This section discusses how the project will increase the de facto population and the effects of this increase, the addition of recreational resources, the effects on the character of the surrounding community, displacement and the impacts on public services and facilities.

1.2 PROJECT DESCRIPTION

1.2.1 Description of the Subject Property

Encompassing a total of 805 acres, the project site comprises two separate and non-contiguous sites. The locations of these sites are depicted in Figure A.

1. The Punamano site contains 605 acres and includes Tax Map Key 5-6-05: Por. 1 and 2, 5, 6 and Por. 7 and Tax Map Key 5-7-01: Por. 21. This site is located mauka of Kamehameha Highway, across from Kuilima Resort, and is approximately 1.5 miles west of Kahuku Village.

Punamano is currently vacant, with broad open areas and gentle slopes, hills and gulches. Three intermittent stream gulches cross the site.

Previously, the site was used primarily for sugar cane production. After the Kahuku Sugar Mill closed in 1971, the site was used for other agricultural operations, but these were marginally successful.

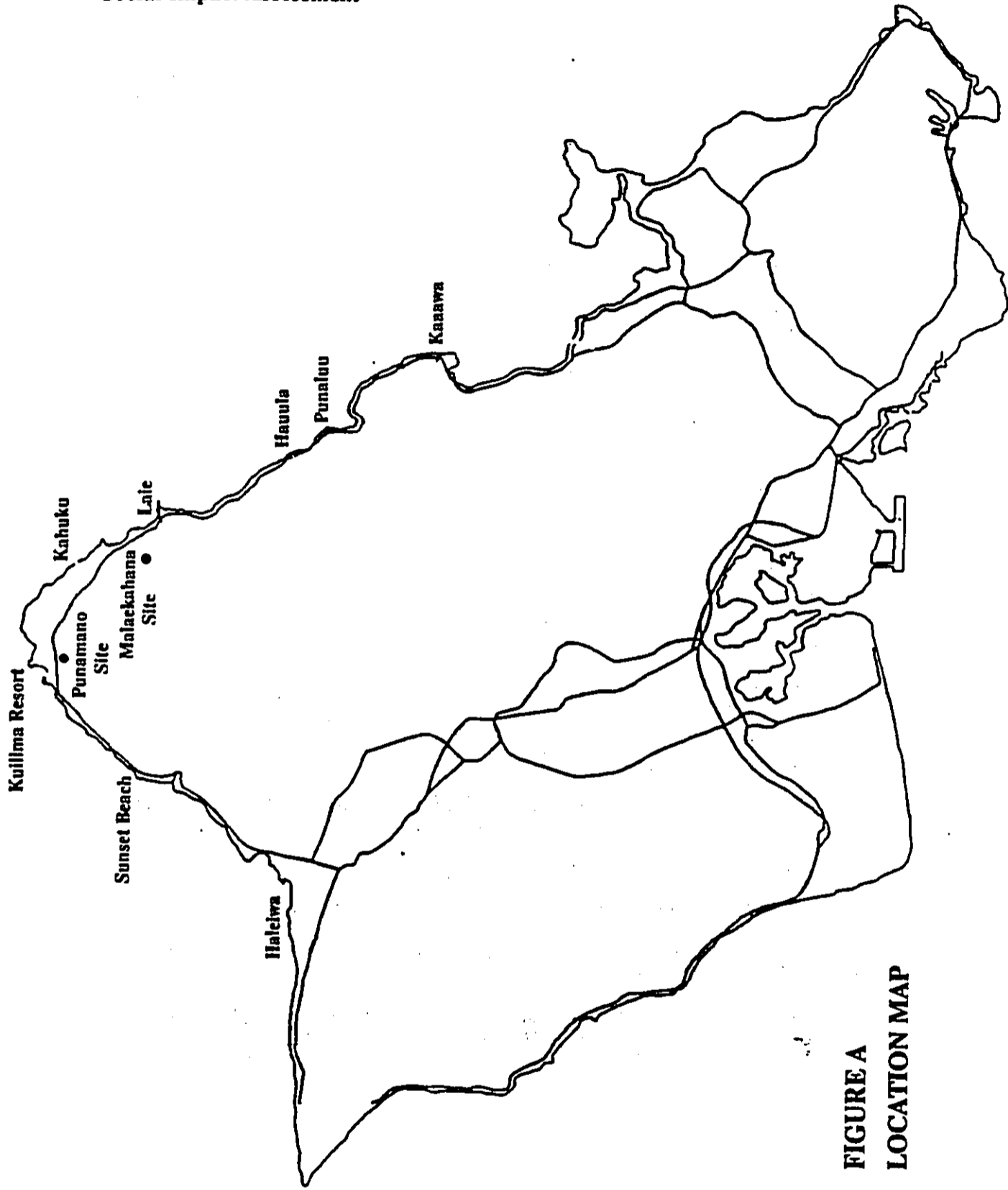
Mauka of the site are the U.S. Army Kahuku Training Area and several windmills. To the east lies vacant agricultural land and west of the project site is a U.S. Air Force telecommunications facility, as well as a small agricultural operation producing a variety of fruits and vegetables.

The site is bounded by Kamehameha Highway on its north, or makai, side. Across Kamehameha Highway are, from west to east, are the Kuilima Resort, the Tanaka Store (a well-known local grocery store and gas station), and a major aquaculture operation.

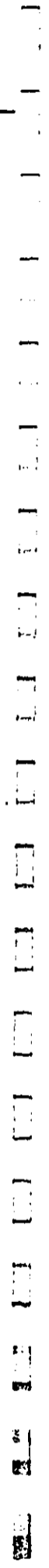
2. The Malaekahana site encompasses approximately 200 acres and is designated as TMK 5-6-06: 2 and Por. 6. This site is also located mauka of Kamehameha Highway, approximately 1.4 miles east of Kahuku Village.

Like Punamano, this site is bounded by Kamehameha Highway on its north, or makai, side. Across this major thoroughfare is the Malaekahana State Park, a large oceanfront park with picnic and camping facilities.

A portion of the site is currently leased for grazing purposes.



**FIGURE A
LOCATION MAP**



The Country Courses at Kahuku
Social Impact Assessment

1.2.2 Project Components

Figures B and C illustrate the site plans for the Punamano and Malaekana sites.

Punamano.

Design -- The Estate of James Campbell proposes to develop three 18-hole golf courses on this 605-acre site. Each golf course will be designed at three different levels of playing difficulty, ranging from the relatively easy golf course similar to Oahu's municipal golf courses to a challenging championship course. The relatively easy course will be located in the lower or makai portions of the site.

Support facilities -- Two clubhouses are planned for Punamano. The two upper or mauka golf course will have driving ranges and parking areas will serve both the clubhouses and the driving ranges.

Access -- A separate entrance will serve the makai course and will be located approximately 2,100 feet east of the entrance to Kuilima Resort. Another entrance will be located along the existing roadway used as the U.S. Army access to the Kahuku Training area. This latter entrance will serve the two mauka courses.

Operation -- All three courses will be daily-fee courses open to the public. No private membership will be offered. The driving ranges will also be open to the public for a fee, and will operate only during daylight hours.

Time frame -- Operation of all three courses is anticipated for 1997. Play on the first course could begin in 1992, depending on the securing of necessary land use and building approvals and permits. Construction of each course is expected to require between 1.5 to two years.

Malaekahana.

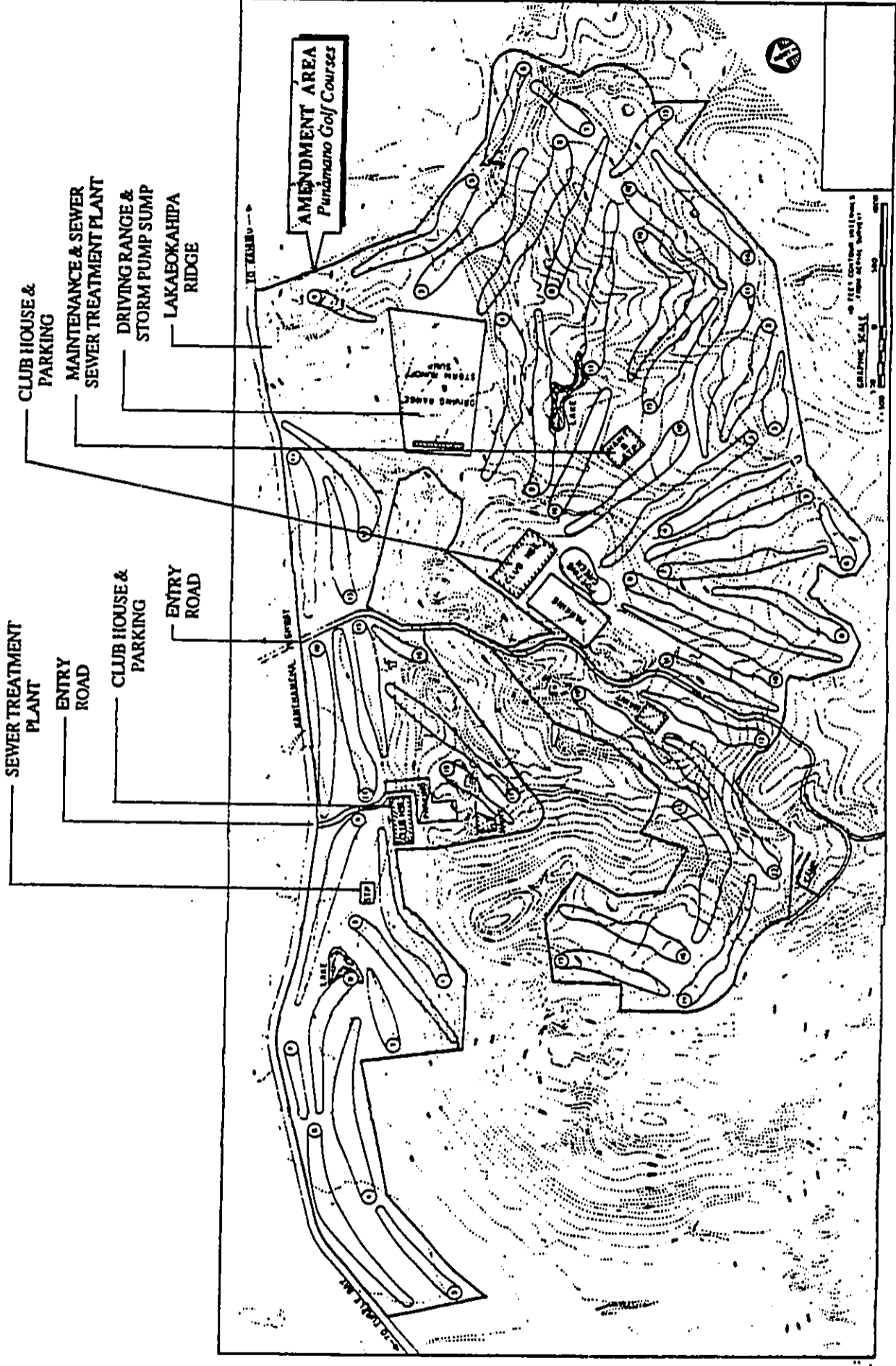
Design -- One 18-hole golf course is planned for this 200-acre site. This will be a tournament-level golf course that will involve complex topography. Of the four proposed courses, this is the most difficult and would offer the most in terms of views.

Support facilities -- Support facilities will be similar to those provided at Punamano.

Access -- Access to the project site will be shared by the proposed golf course and that proposed by the Kuilima Resort Company.

Operation -- This course will also be a daily-fee course open to the public. No private membership will be offered. The driving range will also be open to the public for a fee, and will operate only during daylight hours.

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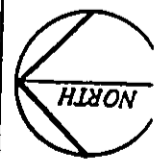
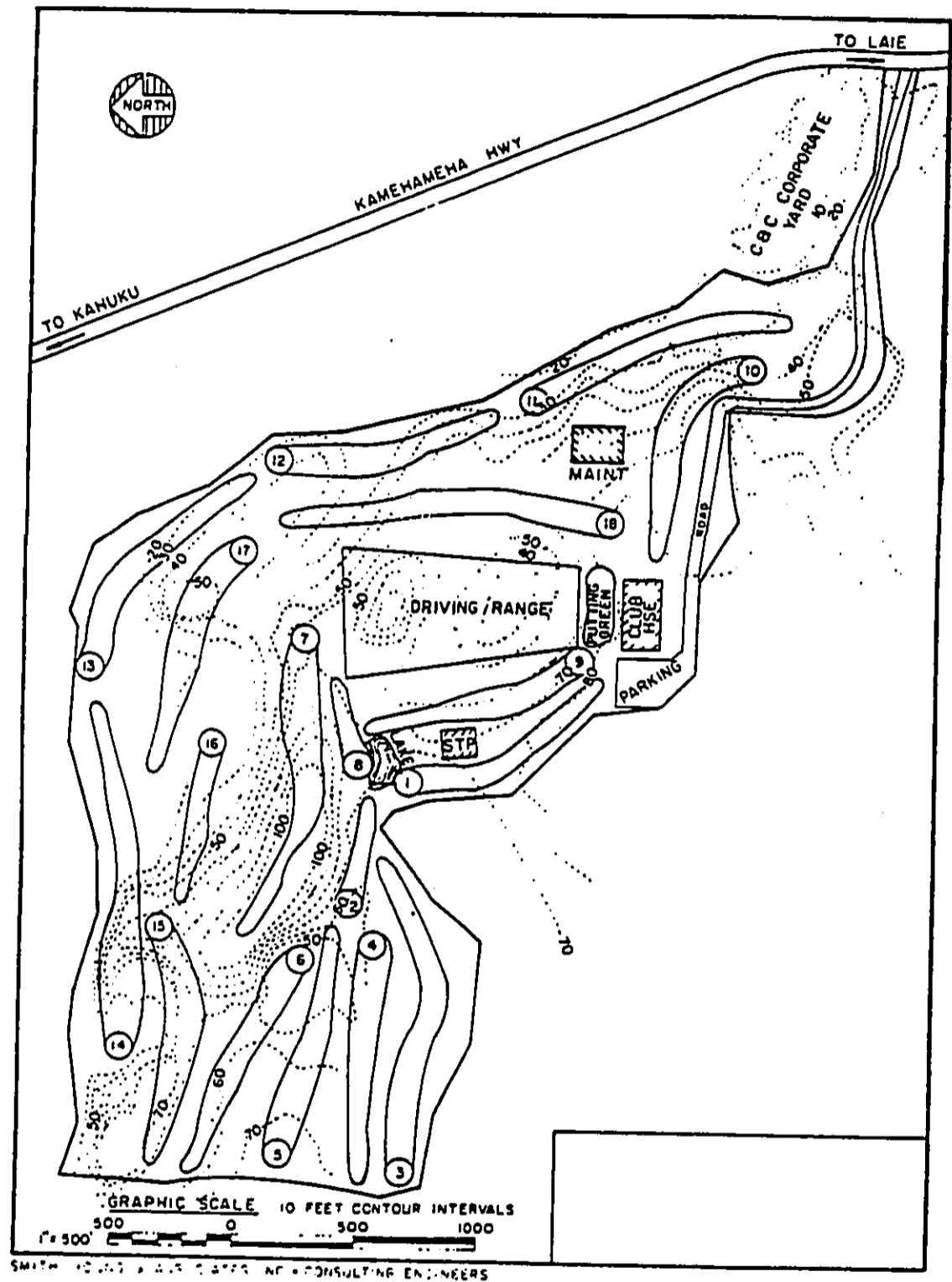
The Country Courses at Kahuku

PRELIMINARY SITE PLAN FOR PUNAMANO

FIGURE B

Prepared for: *The Estate of James Campbell*
 Prepared by: *Michael S. Chu, Land Architect*

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The Country Courses at Kahuku
PRELIMINARY SITE PLAN FOR MALAEKAHANA

prepared for: *The Estate of James Campbell*
 prepared by: *Michael S. Chu, Land Architect*

FIGURE C

The Country Courses at Kahuku
Social Impact Assessment

Time frame -- This golf course is expected to begin operation in 1992, depending on the securing of necessary land use and building approvals and permits. Construction of each course is expected to require between 1.5 to two years.

1.3 SOCIAL IMPACT ASSESSMENTS AND ITS APPLICATION IN THIS PROJECT

Social impact assessment is a field of applied social science which has to do with the development and disclosure of social information relevant to (1) informing the decision-making process, and/or (2) developing management actions to deal with problematic social outcomes of a proposed project. It draws sometimes from social science, but other times from organizational development, political analysis, or simple journalism.

Commonly identified uses of social impact assessments include (1) understanding the ability of a community or group to adapt to changing conditions; (2) defining the problems or clarifying the issues involved in a proposed change; (3) illuminating the meaning and importance of anticipated change, and (4) identifying mitigation opportunities or requirements.

The emphasis of this process varies, based on the particular land use characteristics of a project, the extent of development in nearby areas and the requirements of the different permit processes.

This report serves as the mechanism to identify potential social impacts which should be considered in the request for amendments to the Koolauloa Development Plan.

In the overall social impact assessment *process*, however, this report can be useful in further and ongoing community dialogue between The Estate of James Campbell and the affected parties. The ongoing nature of this process can lead to an informed community and project team, possible project modifications, and, ideally, consensus on proposed actions.

COUNTRY COURSES AT KAHUKU

SOCIAL IMPACT ASSESSMENT

SECTION 2: PROFILE OF THE EXISTING COMMUNITY

2 **PROFILE OF THE EXISTING COMMUNITY**

This section provides information on the "existing community" to establish a baseline of information, upon which potential social impacts can be identified and examined.

Section 2.1 defines the study area used in this report. In Section 2.2, this study area is described in terms of in-area employment, population and housing trends and certain socio-economic characteristics. Kahuku and Laie, the communities nearest to the proposed project, are described further in Section 2.3.

2.1 STUDY AREA DESCRIPTION

The study area for this project includes the Koolauloa Development Plan area, in which both Punamano and Malaekahana are located, and the nearby North Shore Development Plan area.

Koolauloa Development Plan Area.

The economic base of Koolauloa has evolved from being dominated by sugar to one which includes tourism, aquaculture and specialized agriculture. Major employers are visitor-oriented and these include the Kuilima Resort and the Polynesian Cultural Center.

This region comprises a series of residential communities extending from Kahuku in the northernmost portion to Kaaawa in the southernmost area. The following describes major uses and these communities:

Kuilima Resort. This resort complex is located north and makai of the proposed Punamano golf courses. The main feature at Kuilima is the Turtle Bay Hilton and Country Club, which contains 487 hotel and cabana units. The facilities at Kuilima also include two low-rise condominium complexes, a golf course and clubhouse, a riding stable and tennis courts. Expansion plans call for an additional 3,500 hotel and visitor condominium units, another golf course, a commercial area, beach parks and a wildlife preserve.

Kahuku. Kahuku is just south of the Punamano site. This town's history is rooted in sugar, with the sugar mill and the Kahuku Sugar Plantation headquarters located in this town. Even though sugar production ended in 1971, this historic centrality has continued through today and Kahuku contains many area services, such as the high school and hospital. With a relatively small population, Kahuku is in transition because of the resident and government efforts to provide new and rehabilitated housing for original plantation camp residents.

Malaekahana. The Malaekahana site is across from this area which contains the Malaekahana State Park, as well as vacation homes and cottages fronting Malaekahana Bay.

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Laie. This is Koolauloa's largest residential community. Laie is the Hawaii's religious and educational center of the Church of Jesus Christ of the Latter Day Saints, with both the Temple and the Brigham Young University - Hawaii. A major tourist attraction, Laie's Polynesian Cultural Center provides income for the school and jobs for students.

Hauula. South of Laie is Hauula, a Hawaiian Homesteads community and Koolauloa's second largest residential community. This community has a small shopping center and a satellite City Hall.

Punaluu and Kaaawa. These communities are situated south and far from the project site. Punaluu is lightly-populated and some agricultural activities occur in the valley. Beachfront homes tend to be second residences for Honolulu residents and there is an oceanfront multi-story condominium complex (Pat's at Punaluu). Kaaawa also has large beachfront homes and contains a few multi-family units and some employment opportunities.

North Shore Development Plan Area.

The North Shore Development Plan Area extends from the Sunset Beach area, which is over two miles west of the Punamano site, to Kaena Point. Whereas Koolauloa tends to have pockets of residential communities, North Shore's population is more dispersed and homes in the North Shore region are found all along Kamehameha Highway. Except for the retail centers in Haleiwa and Waialua, commercial establishments are few and scattered.

The North Shore region has both major and diversified agricultural activities, the former of which is found in and near Haleiwa and Waialua. This region is also known for its high surf which attracts local and international surfing competitors.

Sunset Beach and Pupukea. Sunset Beach is located about a mile southwest of the Punamano site. Encompassing the Sunset Beach homes along the beach, Waimea and Pupukea, this area is primarily residential. Waimea Falls Park and small agricultural operations are the major non-residential uses. The types of homes range from the large cliffside homes in the Sunset Hills to the smaller homes in Pupukea along the highway.

Haleiwa. This town is the regional commercial and retail center. Pockets of residential communities are interspersed around the shopping complexes and stores along the highway. The Haleiwa Scenic District Design Ordinance protects this area's low-rise and colorful character and requires new buildings to be consistent with existing architecture.

Waialua. The Waialua area includes both the plantation town of Waialua and Mokuleia. The diversity in residential makeup ranges from the smaller homes near the mill to the beach frontage homes and agricultural lots in Mokuleia.

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For the purposes of describing the study area, the two sources of information include (1) 1980 census information and (2) estimates provided by Traffic Assessment Zones as available at the City Department of General Planning, Planning Information Branch. The following indicates the delineation of communities and areas, based on these sources:

Koolauloa Development Plan and Area. Traffic Assessment Zone (TAZ) 166 includes Kahuku and the Kuilima Resort. The Punamano project site is located in this zone. This TAZ is *part of* Census Tract 101.

TAZ 168 is conterminous with Census Tract 102.02 and includes Laie and Malaekahana. The Malaekahana project site is located in this zone.

Hauula, Punaluu and Kaaawa are located in TAZ 167 and Census Tract 102.01.

North Shore Development Plan Area. TAZ 165 includes the Sunset Beach area and is *part of* Census Tract 101.

The area between Waimea Bay and Haleiwa Town is in TAZ 164 and Census Tract 100.

Haleiwa Town is in TAZ 163 and Census Tract 99.02.

TAZ 162, which is conterminous with Census tract 99.01, includes Waialua, from the edge of Haleiwa Town to Kaena Point.

Note that statistics generated by the U.S. Bureau of the Census includes Sunset Beach in the Koolauloa Census District. Otherwise, Sunset Beach is considered part of the North Shore Development Plan and Neighborhood Board areas.

2.2 DESCRIPTION OF THE EXISTING COMMUNITY

2.2.1 Population and Housing

In the first half of the 1980s, the City and County of Honolulu's resident population grew by five percent, from 762,564 in 1980 to 801,096 persons in 1985. Housing characteristics are summarized as follows:

- * Housing units increased by 7.12 percent, from 254,785 to 272,936 units, during this five-year period.
- * This disproportionate growth between housing and population correlates to the decrease in household size. The islandwide household size decreased from 3.20 persons in 1980 to 3.14 persons in 1985.
- * Approximately 55 percent of the islandwide housing stock, or 128,643 units, were single-family residences in 1980. With the increase in multi-family units, the share of single family

The Country Courses at Kahuku
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residences decreased slightly to 53 percent in 1985, indicating an increase in multi-family residential units. In 1985, Oahu had 135,101 single family units and 118,559 multi-family units (*Single family + multi-family = total housing units*).

- * Oahu's 9,324 "adjusted visitor units" (modification of Hawaii Visitor Bureau's report of housing units used for visitor accommodations) accounted for only 3.6 percent of the total housing stock in 1980 (*Adjusted visitor + dwelling units = total housing units*). This share decreased to 2.2 percent, as the total adjusted visitor units decreased to 5,965 units (City and County of Honolulu Department of General Planning, Traffic Assessment Zones, October 1987).

Population and housing trends for the study area are presented in Table 1, and the following summarizes this information:

1. Between 1980 and 1985, the study area population grew by 4.91 percent, which is a proportion slightly lower than the islandwide growth of five percent. In 1985, an estimate of 25,203 people lived in the combined Koolauloa and North Shore regions; 12,061 people, or 48 percent, of the total study area, were Koolauloa residents. Slightly over 13,000 people lived in the North Shore region.
2. Koolauloa grew at a faster pace than North Shore. Koolauloa experienced a population increase of 6.29 percent between 1980 and 1985, whereas the North Shore population grew by 3.68 percent.
3. The study area had an estimated 9,003 housing units in 1985, which represent a 6.49 percent (or 549 units) increase from 1980.
4. Corresponding to the larger proportion of population increase, the housing stock in Koolauloa also increased at a faster pace than that of the North Shore region. Koolauloa's 3,963 housing units in 1985 represent an 8.66 percent increase over the 1980 housing count. Contributing to this increase were over 300 new single family units and almost a hundred new visitor units.
5. Reflecting the rural character of the area, a significant 84 percent of study area housing units, or 7,555 units, were single-family homes, as compared to the 55 percent of the islandwide housing stock. Almost three-fourths of all the new 423 single-family units were built in the Koolauloa region.
6. Though lesser in numbers, multi-family housing units are increasing at a faster pace than single family units. The 124-unit increase between 1980 and 1985, which resulted in a total of 1,416 multi-family units in 1985, occurred in the North Shore region.

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Table 1

Population and Housing Trends, 1980 and 1985:
Total Study Area, Koolauloa and North Shore

	TOTAL STUDY AREA			PRIMARY STUDY AREA KOOLAULOA			SECONDARY STUDY AREA NORTH SHORE		
	1980	1985	% change	1980	1985	% change	1980	1985	% change
Population	24,023	25,203	4.91%	11,347	12,061	6.29%	12,676	13,142	3.68%
% of total study area	N/A	N/A	N/A	47%	48%	N/A	53%	52%	N/A
Total Housing Units	8,454	9,003	6.49%	3,647	3,963	8.66%	4,807	5,040	4.85%
Single Family Units	7,132	7,555	5.93%	2,816	3,138	11.43%	4,316	4,417	2.34%
Multi-family Units	1,292	1,416	9.60%	833	825	-.96%	459	591	28.76%
Military Units	32	32	.00%	0	0	.00%	32	32	.00%
Visitor Units	97	221	127.84%	97	191	96.91%	0	30	100.00%
Household Size	2.87	2.87	-.15%	3.20	3.20	.06%	2.64	2.62	-.52%

Koolauloa includes Traffic Assessment Zones 166 through 168. North Shore includes Traffic Assessment Zones 162 through 165.

Source: City and County of Honolulu Department of General Planning, Planning Information Branch. Traffic Assessment Zones. October 1987. Calculations performed by Earthplan.

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7. The reported housing units used as short-term visitor accommodations totaled 221 units in 1985 for the entire Study area. This represented over twice the number of such units in 1980. Almost all of these units were reported in Koolauloa, and the North Shore region accounted for only 30 visitor units.
8. Household sizes were smaller in the North Shore region, when compared to islandwide averages, while Koolauloa household sizes were similar to that of Oahu. Overall study area household sizes remained stable between 1980 and 1985, with 2.87 persons per household. In 1985, household sizes ranged from 3.25 persons in Koolauloa to 2.62 persons in North Shore.

2.2.2 Employment and Labor Force

Tables 2 and 3 presents estimated 1985 employment figures based on information generated by the City Department of General Planning. The following summarizes this information:

1. The study area contained approximately 9,202 jobs in 1985. Over half, or 5,154 jobs, were found in the Koolauloa region.
2. The Koolauloa region contained all of the area's hotel jobs, and most of these were in the Kuilima Resort located in Kahuku. Koolauloa also had almost three-fourths of the study area's service jobs and over 60 percent of the jobs in transportation, communications, and utilities. This region also had almost half of the study area's jobs in government and 54 percent of retail jobs.
3. On the other hand, the North Shore region contained all of the study area's military jobs, and 88 percent of the industrial jobs. Seventy three percent of the study area's agricultural jobs were in this region, as were 61 percent of the construction jobs.
4. The largest category of jobs for both regions is service, although the relative proportions differ greatly. In the Koolauloa region, service jobs accounted for 53 percent of the total area jobs. Only about a quarter of North Shore's total jobs were service-related, even though this was the largest category.
5. In Koolauloa, the distant second category of jobs was retail, at 17 percent. All other job categories added up to only 28 percent of the total Koolauloa jobs.
6. The second category of jobs in the North Shore region was also retail, at 19 percent, followed by agriculture and industry at 13 and 12 percent, respectively.

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Table 2 .

**STUDY AREA EMPLOYMENT
NUMBER AND BREAKDOWN BY STUDY AREA**

1985

**PRIMARY STUDY AREA
KOOLAULOA**

	TOTAL STUDY AREA	PRIMARY STUDY AREA KOOLAULOA			SECONDARY STUDY AREA NORTH SHORE
		Total	Kahuku	Laike	
Military	336	0	0	0	336
% of total	100%	0%	0%	0%	100%
Government	662	326	127	97	336
% of total	100%	49%	19%	15%	51%
Hotel	328	328	299	29	0
% of total	100%	100%	91%	9%	0%
Transportation Communications					
Utilities	374	227	146	26	147
% of total	100%	61%	39%	7%	39%
Industry	558	66	27	12	492
% of total	100%	12%	5%	2%	88%
Finance, Insurance					
Real Estate	371	209	54	74	162
% of total	100%	56%	15%	20%	44%
Service	3,784	2,750	260	2,166	1,034
% of total	100%	73%	7%	57%	27%
Retail	1,673	899	330	219	774
% of total	100%	54%	20%	13%	46%
Construction	415	162	37	97	253
% of total	100%	39%	9%	23%	61%
Agriculture	701	187	90	81	514
% of total	100%	27%	13%	12%	73%
TOTAL	9,202	5,154	1,370	2,801	4,048
	100%	56%	15%	30%	44%

Koolauloa includes Traffic Assessment Zones 166 through 168. North Shore includes Traffic Assessment Zones 162 through 165.

Source: City and County of Honolulu Department of General Planning, Planning Information Branch. Traffic Assessment Zones. October 1987. Calculations performed by Earthplan.

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Table 3

**STUDY AREA EMPLOYMENT
BREAKDOWN BY TYPE OF JOB**

1985

**PRIMARY STUDY AREA
KOOLAULOA**

	TOTAL STUDY AREA	PRIMARY STUDY AREA KOOLAULOA			SECONDARY STUDY AREA NORTH SHORE
		Total	Kahuku	Lane	
Military	4%	0%	0%	0%	8%
Government	7%	6%	9%	3%	8%
Hotel	4%	6%	22%	1%	0%
Transportation Communications Utilities	4%	4%	11%	1%	4%
Industry	6%	1%	2%	0%	12%
Finance, Insurance Real Estate	4%	4%	4%	3%	4%
Service	41%	53%	19%	77%	26%
Retail	18%	17%	24%	8%	19%
Construction	5%	3%	3%	3%	6%
Agriculture	8%	4%	7%	3%	13%
TOTAL	100%	100%	100%	100%	100%

Koolauloa includes Traffic Assessment Zones 166 through 168. North Shore includes Traffic Assessment Zones 162 through 165.

Source: City and County of Honolulu Department of General Planning, Planning Information Branch. Traffic Assessment Zones. October 1987. Calculations performed by Earthplan.

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Based on the 1980 census, the study area had similar civilian unemployment rates as Oahu, as indicated in Table 4. The occupational characteristics differed as follows:

1. Corresponding to the relatively high proportion of area service jobs in 1985, and compared to the islandwide occupational profile, the Koolauloa population had a significantly higher proportion of residents working in service-related occupations. Koolauloa also had higher proportions of residents in agricultural-related occupations. Relatively fewer residents held the higher-paying occupations related to managerial/professional and technical/sales/administration.
2. Compared to the Oahu-wide occupational profile, a similar proportion of North Shore residents had service occupations. Like Koolauloa residents, proportionally less North Shore residents held the higher-paying occupations related to managerial/professional and technical/sales/administration.
3. Significantly higher proportions of both Koolauloa and North Shore employed residents had to travel 45 minutes or more to get to work.

2.2.3 Other Characteristics

Table 5 presents social and economic characteristics of Oahu, the entire Study Area and the Koolauloa and North Shore Development Plan areas. Based on 1980 census information, the following are highlights of this comparison:

Ethnicity. When compared to the islandwide profile, the study area had similar proportions of Caucasian residents. Koolauloa tended to have more Caucasian residents than the North Shore. As a whole, the Study area had less Japanese and Chinese residents and more residents who were of Filipino, Hawaiian or other ethnic extractions.

Age. The study area tended to be younger than the islandwide population. Koolauloa, in particular, had a relatively low median age of 23.8, when compared to the Oahu-wide median age of 28.1. Both Koolauloa and North Shore had higher proportions of children under five and lower proportions of residents between 18 and 64 years old. Further, the North Shore region had a relatively large elderly population, while Koolauloa had a smaller proportion of people 65 years and older.

Place of Birth. The study area population was generally similar to the islandwide population in terms of where residents were born. Of note is that both Koolauloa and North Shore had high proportions of people born in another country, with 17.7 and 17.8 percent respectively, when compared to the islandwide 14.8 percent.

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**Table 4.
Labor Force Characteristics, 1980:
City and County of Honolulu and Study Area**

	CITY AND COUNTY OF HONOLULU	TOTAL STUDY AREA	PRIMARY STUDY AREA: KOOLAULOA	SECONDARY STUDY AREA: NORTH SHORE
Total Potential Labor Force	574,903	17,207	9,833	7,374
Civilian labor force	59.1%	53.0%	62.2%	52.0%
Unemployed civilian labor force	4.6%	4.7%	4.9%	4.6%
Occupation of Employed Civilian Labor Force				
Service	17.6%	23.3%	28.6%	15.1%
Managerial and professional	24.7%	20.6%	22.2%	18.1%
Technical, sales and administration	33.7%	22.6%	23.5%	21.3%
Farming, fishing and forestry	1.8%	7.5%	5.8%	10.4%
Precision, craft and repair	11.3%	12.4%	10.7%	.151
Operators, fabricators and laborers	10.9%	13.4%	9.2%	27.2%
Commute to Work				
45 minutes or more	11.9%	23.1%	21.1%	27.2%
Mean travel time	22.9 minutes	25.5 minutes	25.1 minutes	25.9 minutes

Note: Statistics generated by the U.S. Bureau of the Census includes Sunset Beach in the Koolauloa Census District. Otherwise, Sunset Beach is considered part of the North Shore Development Plan and Neighborhood Board areas.

Sources: U.S. Bureau of the Census, 1981a and 1981b.

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Table 5

**Population Characteristics, 1980:
City and County of Honolulu and Study Area**

	CITY AND COUNTY OF HONOLULU	TOTAL STUDY AREA	PRIMARY STUDY AREA: KOOLAULOA	SECONDARY STUDY AREA: NORTH SHORE
Ethnicity				
Caucasian	33.1%	35.3%	38.2%	31.2%
Japanese	24.9%	11.6%	7.4%	17.7%
Chinese	6.9%	2.3%	3.2%	1.0%
Filipino	12.8%	17.5%	7.1%	34.2%
Hawaiian	10.5%	18.3%	22.9%	11.6%
Other	11.8%	15.0%	21.2%	6.0%
Age				
Less than 5 years	7.9%	10.5%	11.6%	9.0%
5 to 17 years	20.2%	21.7%	22.8%	20.0%
18 to 64 years	64.6%	60.4%	59.3%	61.9%
65 years and older	7.3%	7.4%	6.3%	9.1%
Median Age	28.1	25.1	23.8	26.3
Place of Birth				
Hawaii	55.1%	52.7%	50.9%	55.2%
Other U.S.	30.1%	29.6%	31.4%	27.0%
Another country	14.8%	17.7%	17.7%	17.8%
Residence Five Years Previous				
Same house	48.2%	47.8%	46.0%	50.4%
Same county	25.5%	26.6%	28.3%	24.2%
Other county	1.3%	5.9%	.8%	2.8%
Other state	18.4%	16.5%	14.8%	18.9%
Other country	6.6%	8.8%	10.0%	3.7%
Education (25 years and older)				
Up to 11 years completed	24.4%	30.2%	24.7%	37.4%
Graduated from high school	35.5%	31.9%	31.9%	32.0%
Some post high school	18.3%	20.0%	23.3%	15.6%
College (4+ years)	21.7%	17.9%	20.1%	15.0%
Population in Families	85.6%	83.8%	82.3%	86.0%
Families Below Poverty Level	7.5%	11.5%	13.5%	9.0%
Median Family Income	\$23,554	Not available	\$19,556	\$16,895

Note: Statistics generated by the U.S. Bureau of the Census includes Sunset Beach in the Koolauloa Census District. Otherwise, Sunset Beach is considered part of the North Shore Development Plan and Neighborhood Board areas.
Sources: U.S. Bureau of the Census, 1981a and 1981b.

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Residence Five Years Previous. The study area tended to have more people who lived on other Hawaiian island (5.9 percent) or in another country (8.8 percent), when compared to the islandwide proportions of 1.3 and 6.6 percent, respectively.

Education. A significantly higher proportion of North Shore residents did not graduate from high school, with 37.4 percent having completed up to eleven years of schooling, when compared to the islandwide 24.4 percent. Correspondingly, only 15 percent attended a four-year college, as compared to 21.7 percent of the islandwide population.

Families. When compared to Oahu as a whole, the study area had similar proportions of its residents in families. A significantly high proportion of study area families were met poverty standards and the median family incomes for Koolauloa and the North Shore were respectively between \$4,000 and \$6,700 lower than the 1980 Oahu median family income of \$23,554.

2.3 PROFILE OF NEARBY COMMUNITIES

The communities nearest to the Punamano and Malaekahana project sites are Kahuku and Laie, respectively. Because of the proximity and potential for interaction with the Country Courses at Kahuku, these communities are further described.

Population and Housing Trends. As Table 6 indicates, Kahuku's population grew by 34.7 percent between 1980 and 1985, resulting in a 1985 population of 2,240. Much of this growth is attributable to the addition of over 278 new single family housing units during this five-year period. The Kahuku community has had a series of housing-related organizations to provide new and/or rehabilitated housing for original plantation camp residents. The City's 1982 housing project provided new homes for longtime residents and newcomers, the latter of which contributed significantly to the area's growth.

During that time, Laie's population experienced only nominal growth and its 1985 count of 5,820 persons represented only a 1.54 percent increase over the 1980 population.

Unlike other communities in the study area, Kahuku has a large proportion of multi-family units, which accounted for 39 percent of the total housing stock; no new multi-family units were added in the first five years of this decade, however. Many of the multi-family units are townhouses at the Kuilima Resort. Household size was relatively small at 2.21 persons in 1985.

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Table 6

Population and Housing Trends, 1980 and 1985:
 Total Study Area, Kahuku and Laie

	TOTAL STUDY AREA			KAHUKU			LAIE		
	1980	1985	% change	1980	1985	% change	1980	1985	% change
Population	24,023	25,203	4.91%	1,663	2,240	34.70%	5,732	5,820	1.54%
% of total study area	N/A	N/A	N/A	7%	9%	N/A	24%	23%	N/A
Total Housing Units	8,454	9,003	6.49%	909	1,187	30.58%	1,084	1,111	2.49%
Single Family Units	7,132	7,555	5.93%	450	728	61.78%	1,076	1,105	2.70%
Multi-family Units	918	1,416	54.25%	459	459	.00%	8	6	-25.00%
Military Units	32	32	.00%	0	0	.00%	0	0	.00%
Visitor Units	97	221	127.84%	55	172	212.73%	0	1	100.00%
Household Size	2.87	2.87	-.15%	1.95	2.21	13.33%	5.29	5.24	-.84%

Kahuku is in Traffic Assessment Zones 166. Laie is in Traffic Assessment Zones 168.

Source: City and County of Honolulu Department of General Planning, Planning Information Branch.
Traffic Assessment Zones, October 1987. Calculations performed by Earthplan.

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Laie's housing stock is virtually all single-family units and experienced only a nominal increase of 29 units between 1980 and 1985. Further, Laie's large and stable household size indicates a pressing need for increased housing supply in this area.

Note that both Kahuku and Laie have characteristics of a typical small town. They both evolved around a central focus. Kahuku grew around the sugar mill and Laie expanded around the church and its other facilities. In these towns, there are business or service centers and neighborhoods are easily discernible. Hence, residential densities are relatively high, when compared to other areas of the study area which are more rural in character, such as Kaaawa, Punaluu, Sunset and Pupukea.

Employment and Labor Force. Tables 2 and 3 present employment information on these nearby communities. Table 2 shows that Kahuku accounted for 15 percent of the study area's total jobs, and the bulk of the hotel jobs. Laie contained almost a third of the study area's jobs, and 57 percent of the area's service jobs.

Table 3 shows that the almost a fourth of Kahuku's 1,370 jobs in 1985 were in retail operations, and 22 percent were hotel-related. Of Laie's total 2,801 jobs, over three fourths were service-related.

Census information indicates that in 1980, the Kahuku Census Designated Place (CDP) had a very low unemployment rate of 1.3 percent, as compared to Oahu's 4.6 percent. As shown on Table 7, a significant portion of Kahuku CDP residents (25.9 percent) held agricultural-related jobs, when compared to Oahu's 1.8 percent, the Study Area's 7.5 percent and Laie CDP's 2.2 percent. At the same time, there were smaller proportions of residents in service, managerial, administrative and precision/craft/repair occupations.

Laie CDP residents also had a low unemployment rate at 3.7 percent. Except for a high proportion of residents in service (32.5 percent as compared to the island's 17.6 percent), Laie's labor profile was similar to that of the island and the Study area.

Other Population Characteristics. Table 8 compares 1980 population characteristics of nearby communities with the overall study area and Oahu.

Kahuku CDP had significantly more Filipinos (51.8 percent) than Oahu as a whole (12.8 percent), the study area (17.5) and Laie CDP (1.6 percent). Laie, on the other hand, had a significantly high proportion of people of other extractions (46.5 percent), and this is attributable to the large number of Pacific Islanders affiliated with the Church of Jesus Christ of the Latter Day Saints and the Polynesian Cultural Center.

In terms of age, Kahuku CDP tended to be older, while Laie CDP had a much younger population. Almost a fourth of Kahuku CDP's population was in the 65-years-and-older category, as compared to Oahu's 7.3

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percent and Laie CDP's 2.8 percent. Correspondingly, the median age in Kahuku CDP of 37.3 years was high, and Laie's median age of 20.6 was low, when compared to the islandwide median age of 28.1 years.

Both the Kahuku and Laie CDPs had large proportions of residents born in another country at 28.9 and 31.9 percent, respectively, when compared to the Oahu proportion of 14.8 percent.

With over 60 percent of its residents not graduating from high school, Kahuku CDP residents had generally less education than Oahu, the Study Area and Laie CDP.

Statistics indicate that, as a whole, Laie CDP residents were slightly less family-oriented, with 77.9 percent of the population living in families, as compared to Kahuku CDP's 87.7 percent. The former lower proportion is due to the presence of students at the Brigham Young University - Hawaii. Had these students not been counted in the overall count, however, Laie residents would undoubtedly exhibit strong family orientations, given the cultural and religious backgrounds which typifies Pacific Islanders and those of the Mormon religion.

Both communities had higher proportions of families below poverty level, with Laie CDP's proportion being over twice that Oahu and Kahuku CDP.

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Table 7

**Labor Force Characteristics, 1980:
 City and County of Honolulu, Total Study Area
 and Kahuku and Laie Census Designated Places**

	CITY AND COUNTY OF HONOLULU	TOTAL STUDY AREA	KAHUKU CENSUS DES. PLACE	LAIE CENSUS DES. PLACE
Total Potential Labor Force	574,903	3,171	659	2,512
Civilian labor force	59.1%	287.9%	56.4%	80.4%
Unemployed civilian labor force	4.6%	4.7%	1.3%	3.7%
Occupation of Employed Civilian Labor Force				
Service	17.6%	23.3%	14.4%	32.5%
Managerial and professional	24.7%	20.6%	17.7%	24.9%
Technical, sales and administration	33.7%	22.6%	21.8%	27.0%
Farming, fishing and forestry	1.8%	7.5%	25.9%	2.2%
Precision, craft and repair Operators, fabricators and laborers	11.3%	12.4%	2.7%	6.4%
	10.9%	13.4%	17.4%	6.9%
Commute to Work				
45 minutes or more	11.9%	23.1%	6.0%	9.0%
Mean travel time	22.9 minutes	25.5 minutes	15.0 minutes	12.6 minutes

The Total Study Area includes the Koolauloa and North Shore Development Plan areas.

Sources: U.S. Bureau of the Census, 1981a and 1981b.

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Table 8

**Population Characteristics, 1980:
City and County of Honolulu, Total Study Area
and Kahuku and Laie Census Designated Places**

	CITY AND COUNTY OF HONOLULU	TOTAL STUDY AREA	KAHUKU CENSUS DES. PLACE	LAIE CENSUS DES. PLACE
Ethnicity				
Caucasian	33.1%	35.3%	16.4%	30.0%
Japanese	24.9%	11.6%	15.6%	4.1%
Chinese	6.9%	2.3%	.4%	6.3%
Filipino	12.8%	17.5%	51.8%	1.6%
Hawaiian	10.5%	18.3%	9.7%	11.5%
Other	11.8%	15.0%	6.1%	46.5%
Age				
Less than 5 years	7.9%	10.5%	6.7%	14.7%
5 to 17 years	20.2%	21.7%	23.1%	22.6%
18 to 64 years	64.6%	60.4%	46.5%	59.9%
65 years and older	7.3%	7.4%	23.6%	2.8%
Median Age	28.1	25.1	37.3	20.6
Place of Birth				
Hawaii	55.1%	52.7%	57.8%	35.1%
Other U.S.	30.1%	29.6%	13.3%	33.0%
Another country	14.8%	17.7%	28.9%	31.9%
Residence Five Years Previous				
Same house	48.2%	47.8%	41.2%	32.7%
Same county	25.5%	26.6%	44.2%	22.4%
Other county	1.3%	5.9%	.0%	.6%
Other state	18.4%	16.5%	2.4%	19.6%
Other country	6.6%	8.8%	12.2%	24.7%
Education (25 years and older)				
Up to 11 years completed	24.4%	30.2%	61.6%	15.0%
Graduated from high school	35.5%	31.9%	18.2%	26.2%
Some post high school	18.3%	20.0%	11.7%	33.7%
College (4+ years)	21.7%	17.9%	8.5%	25.1%
Population in Families	85.6%	83.8%	87.7%	77.9%
Families Below Poverty Level	7.5%	11.5%	9.9%	20.3%
Median Family Income	\$23,554	Not available	\$13,611	\$15,183

The Total Study Area includes the Koolauloa and North Shore Development Plan areas.

Sources: U.S. Bureau of the Census, 1981a and 1981b.

COUNTRY COURSES AT KAHUKU

**SOCIAL IMPACT ASSESSMENT
SECTION 3: POLICIES AND PROPOSALS WHICH WILL AFFECT THE
COMMUNITY'S FUTURE**

3 **POLICIES AND PROPOSALS WHICH WILL AFFECT
THE COMMUNITY'S FUTURE**

This section examines public policies and proposed changes to understand what is anticipated to occur in the study area independent of the proposed project. Section 3.1 describes public policies for Koolauloa and North Shore, and identifies proposed amendments to the respective Development Plans. Section 3.2 provides an overview of proposed changes to the area. In Section 3.3, a description of a likely scenario *without* The Country Courses at Kahuku is provided.

3.1 DIRECTION OUTLINED IN GENERAL AND DEVELOPMENT PLAN POLICIES

The City and County of Honolulu General Plan recognizes the entire Study Area as rural. The residential population targeted for the study area is designed to be consistent with the character of development and environmental qualities desired for these areas.

Consistent with this policy is the General Plan's residential population distribution for the year 2010. As shown in Table 9, Koolauloa and the North Shore are targeted to collectively accommodate up to 3.2 percent of the island's population in 2010, as follows:

- * The Koolauloa Development Plan area is currently targeted to accommodate between 1.3 and 1.4 percent of Oahu's 2010 population. The current distribution policy implies that, in 2010, between 12,994 and 13,993 people could be residing in this area. Given the 1985 residential population of 12,061 persons (see Table 1), the population could increase by between 1,000 and 2,000 people, or by eight to 16 percent.
- * The North Shore Development Plan area is currently targeted to accommodate between 1.6 and 1.8 percent of Oahu's 2010 population. By that time, between 15,992 and 17,991 people could be living in the area, which implies a population increase of between 22 and 37 percent over the 1985 population of 13,142 persons.

In addition, the City Department of General Planning proposes to amend the Special Provisions for the both Development Plan areas to change the agricultural density to a maximum of one unit per acre, rather than the current one unit per two acres.

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Table 9

Population Projections by
 Development Plan Area, 2010

	General Plan Distribution of Residential Population ¹	2010 Population Range Based on Series M-K Projections ²
Primary Urban Center	45.1% - 49.8%	450,775 - 497,751
Ewa	12.0% - 13.3%	119,940 - 132,934
Central Oahu	14.9% - 16.5%	148,926 - 164,918
East Honolulu	5.3% - 5.8%	52,974 - 57,971
Koolaupoko	11.0% - 12.2%	109,945 - 121,939
Koolauloa	1.3% - 1.4%	12,994 - 13,993
North Shore	1.6% - 1.8%	15,992 - 17,991
Waianae	3.8% - 4.2%	37,981 - 41,979
Total Oahu	95.0% - 105.0%	949,525 - 1,049,475

1. City Council, Resolution Relating to Amending the General Plan of the City and County of Honolulu, No. 88-404, CD-1, FD-1.
2. Table 18 of the The State of Hawaii Data Book: 1988 (State Department of Business and Economic Development, 1988) provides a population projection of 999,500 persons for the City and County of Honolulu in 2010.

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Further, development priorities for each of these Development Plan areas are proposed as follows:

Koolauloa Development Plan Area:

1. Improvement of wastewater management services;
2. Expansion of public beach parks and beach access;
3. Encourage the improvement of the State highway system;
4. Improvement of water resources to support agriculture, aquaculture and needed urban uses; and
5. Encourage drainage facilities improvements.

North Shore Development Plan Area:

1. Improvement of water resources to support agriculture, aquaculture and needed urban uses;
2. Further expansion, acquisition and development of beach parks and preservation of beach access;
3. Encourage development of employment opportunities for North Shore residents;
4. Improvement of wastewater management services; and
5. Encourage the improvement of the State highway system, particularly the Haleiwa bypass road (City and County of Honolulu Department of General Planning, 1989a and 1989b).

3.2 MAJOR DEVELOPMENT PROPOSALS IN THE STUDY AREA

Neither the Koolauloa nor the North Shore Development Plan areas have specific land use amendments proposed in the current annual Development Plan review. Further, the only major approved proposal for these areas is the Kuilima Resort expansion which is located makai of the Punamano project site. This section provides a profile of changes which could occur in the study area independent of the proposed project.

Job-Generating Uses. The Kuilima Resort Expansion is expected to be the major employment-generating force for the study area in the near future. The proposed expansion, which already has Development Plan and zoning approvals, includes (1) 4,000 visitor units, (2) an 18-hole championship golf course, (3) an 8.5 acre shopping village complex; (4) a tennis club, beach club and equestrian facilities; and (5) various recreational amenities for the general public. These efforts are anticipated to create 3,555 new direct, indirect and induced jobs in the region (Community Resources, Inc. and A. Lono Lyman, Inc., November 1984).

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Other job-generating potential uses would be generated by the development of land held by major landowners. The following summarizes potential uses which may generate employment in the Study Area. It is stressed, however, that these plans are very long-range in nature and implementation would require major approvals. Further, some of these plans are in very preliminary stages and have not been formally adopted by the respective landowners.

The Estate of James Campbell -- The Estate owns about 14,000 acres in Kahuku. The master plan of these lands is expressed in three "components." The first component is open space and agriculture, which would occupy most of their holdings and includes lands to be used in agriculture (including the State agricultural farm) and aquaculture, and lands leased to the U.S. Army. The second component is development in and around Kahuku Village. This includes residential development and a light industrial park. The third component is the Kuilima Resort expansion which was previously discussed (Helber, Hastert and Kimura, 1988 and personal communication with Charles Ehrhorn, Asset Manager, November 27, 1989). Not including the Kuilima Resort expansion, the job-generating efforts which would result from implementing this master plan are the industrial, agricultural and aquacultural operations.

Zions Security Corporation -- The Laie master plan is currently being revised, so specific components are still being identified. The revised master plan is expected to be presented to the public in February 1990.

In the short term, job-generating uses include an Imax screen theater, for which permits were recently received, and the 27,000-square foot expansion of the Laie Shopping Center. Both are anticipated for completion in 1990 (personal communication with Marvin Stone, Land Manager, Zion Securities Corporation, November 27, 1989).

Kamehameha Schools/Bishop Estate (KS/BE) -- KS/BE is currently preparing a master plan for its 800 acres in the North Shore region. The plan's preliminary concept includes enhancing the Haleiwa town core with a Main Street program, and adding a small golf course and residences. For the area just east of Haleiwa town, KS/BE is considering establishing outdoor recreational uses, such as a demonstration site for traditional Hawaiian aquaculture, a wildlife refuge and a championship golf course. Other plan elements include residential infill and resident and visitor attractions with small-scale lodgings (Kamehameha Schools, 1989a and 1989b and personal communication with Paul Cathcart, Land Development Manager, Bishop Estate, November 28, 1989).

Based on this preliminary information, the commercial and recreational/visitor activities proposed in this plan would generate many jobs for this area.

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Castle and Cooke -- Castle and Cooke, Inc. and its subsidiaries Waialua Sugar Company and Oceanic Properties, Inc., owns lands in Haleiwa and Waialua. Long range plans call for urban/recreational development adjacent to the proposed Mokuleia resort development, residential infill in both Haleiwa and Waialua, a commercial center at the Haleiwa Gateway, an 18-hole golf course near Waialua and an agricultural theme park near Haleiwa. The major job-generating efforts in this plan are the resort and commercial efforts (Helber, Hastert, Van Horn and Kimura, Planners, 1986).

Residential Development. In Koolauloa, two-thirds of the 1980 housing stock were rentals. This is high, compared to the one-third in Oahu suburbs and one-half of the islandwide housing stock which are rented. When adding the high proportion of crowding in this region, affordable housing is a critical need in Koolauloa. At present, there is a 400-unit publicly-assisted housing project in Kahuku. Two hundred more units of rental housing are being considered in Hauula, and additional units may be built in Kahuku as employee housing for the expanded Kuilima Resort (City and County of Honolulu, 1989a).

No housing developments are planned in the immediate future for the North Shore Development Plan area (City and County of Honolulu, 1989b).

A potential for increasing the study area's residential supply is the development of lands held by major landowners. The following outlines the residential of long-range plans of the study area's major landowners:

The Estate of James Campbell -- The Estate's long-range plans call for the development of 400 to 600 residential units in and around Kahuku Village. These units would include the employment housing for the expanded Kuilima Resort, as well as an expansion of the Kahuku Elderly Housing Project (personal communication with Charles Ehrhorn, Asset Manager, November 27, 1989).

Zions Security Corporation -- In very preliminary stages, the Laie master plan may propose 350 new residential units near the Malaekahana project site (personal communication with Marvin Stone, Land Manager, Zion Security Corporation, November 27, 1989).

Kamehameha Schools/Bishop Estate (KS/BE) -- Three areas have been designated for residential development on the Kawailoa Master Plan; no specific unit count has yet been provided (Yamaguchi, 1989).

Castle and Cooke -- Castle and Cooke owns a number of remnant parcels in and around the communities of Haleiwa and Waialua, and these are targeted for residential infilling (Helber, Hastert, Van Horn and Kimura, 1986).

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Infrastructure and public facilities. The study area is targeted for two major roadway improvements, both of which are located in the North Shore region. The most extensive proposed change is the Haleiwa Bypass Road, which will divert through-traffic away from the more congested areas of Haleiwa. As indicated in Section 3.1, this project is a proposed development priority in the North Shore Development Plan. With planning and engineering funds already budgeted, the Haleiwa Bypass Road is scheduled for construction this year. Completion of this roadway should be in the latter part of 1991. The State Department of Transportation is also planning to realign Kamehameha Highway at Waimea Bay.

The improvement of the wastewater management system in Koolauloa and North Shore regions is also a priority on the respective Development Plans. In Koolauloa, three small sewage treatment plants serve the Kuilima Resort, the vicinity of the Kahuku Hospital and the center of Laie. All three systems are operating near capacity and must be either expanded or replaced. Further, more sewage treatment plants will be needed to service other areas (City and County of Honolulu Department of General Planning, 1989a). In the North Shore region, a proposed Haleiwa-Waiialua Wastewater Treatment Plant is expected to replace all cesspools in the Haleiwa-Waiialua-Mokuleia area, the Paalaa Sewage Treatment Plant and 17 small, private sewage treatment plants. Construction is scheduled to begin within six years (City and County of Honolulu Department of General Planning, 1989b).

Another priority in these Development Plan areas is the improvement of the water system to support agricultural and necessary urban uses. In Koolauloa, the Board of Water Supply system stops short of Laie, which has its own private water system, and resumes near the Kuilima Resort. Kahuku town has its own special Board of Water Supply system (City and County of Honolulu Department of General Planning, 1989a). Proposed Board of Water Supply projects in the North Shore area include six wells to provide potable water, and reservoir facilities to increase overall storage capacity. Three of these wells are scheduled in the BWS six-year (1985-1991) Capital Improvement Program. (City and County of Honolulu Department of General Planning, 1989b).

Golf courses. The study area's two existing golf courses are both in Koolauloa. These include a nine-hole municipal golf course in Kahuku, and an 18-hole Turtle Bay course at the Kuilima Resort. A second 18-hole golf course at the Kuilima Resort has been approved.

Recently, four golf courses have been proposed in the North Shore region. Landowner Sankyo Tsusho, through its Mokuleia Land Company, proposes to develop two golf courses on its Mokuleia property. Its application was not accepted by the City Department of Land Utilization, and no subsequent application was filed (Wiles, 1988). Two golf courses are proposed in Pupukea by Ohbayashi Hawaii Corporation. The Land Use Boundary Change petition has been withdrawn by the developer, although planning for this development continues.

Adjacent to the Malaekahana project site is an 18-hole championship golf course proposed by the Kuilima Resort Company.

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The City is considering expanding the Kahuku Golf Course into an 18-hole course (Wagner, 1987). Currently, the implementation of this proposal is still being studied (personal communication with Steve Salis, Advanced Planning, City and County of Honolulu Department of Parks and Recreation, December 1, 1989).

Further, two additional courses are included in the master plans of Castle and Cooke and KS/BE (preliminary).

Thus, including the potential expansion of the Kahuku Golf Course, six golf courses have been discussed in the Study Area, *not including The Country Courses at Kahuku.*

Recreation. Recreational facilities and resources are major ingredients of most private development proposals, as well as of the government entities. The private developments have been presented previously in this section. Based on personal communication with Steve Salis (Advanced Planning, City and County of Honolulu Department of Parks and Recreation, December 1, 1989), the following are current actions being planned or considered by the City in the Koolauloa Development Plan area:

- * The City is considering the acquisition of the four acres in Hauula and eleven acres in Laie, as well as smaller parcels along the shoreline, for beach parks and public shoreline access.
- * The establishment of a nature reserve along four miles of Kahuku's shoreline (between Kuilima and Kahuku Point) is viewed as a long-range target.
- * Inland recreation facilities include the improvement of the Kahuku Recreation Center, and the addition of a community park in Laie.

In the North Shore Development Plan area, the City is looking at acquiring various parcels of land for public access. The State is transferring the Wailee Beach to the City. In Kawaiiloa, the City is planning to meet the parking needs of nearby surfing beaches on two sites mauka of the highway. Further, the Haleiwa Beach Park and the Mokuleia Beach Park are in various stages of expansion.

3.3 STATUS OF GOLF COURSE DEVELOPMENT IN THE APPROVAL PROCESS

Recently, public officials have sought to revise rules pertaining to golf courses on both State and City levels.

In 1988, State legislators reacted to community concern about golf course on agricultural land (see Section 4.1) by proposing to repeal a 1985 state law which allows golf course on non-prime agricultural land (Yamaguchi, 1988a and 1988b). Proponents of the repeal bill argued that stricter requirements would improve the State's ability to monitor golf course impacts (Yamaguchi, 1988b).

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Bill opponents felt that the 1985 law contained adequate provisions for control over golf courses (Yamaguchi, 1988c). The bill failed to pass (The Honolulu Advertiser, 1988b).

The Honolulu City Council also responded to the growing concern over golf course development. In March of this year, the Council adopted Resolution 89-91 which requested that the City Department of Land Utilization assess various issues related to further golf course development. Also, Resolution 89-36 was passed which established a one-year moratorium on golf course development, from which golf courses approved after January 1, 1989 were excluded.

The City administration found that the "magnitude of golf course development is clearly an excessive commitment of limited land and water resources, given other competing needs for these resources, particularly affordable housing." In the report to the City Council, the City administration suggested stricter controls over such development through (1) requiring Development Plan amendments for all new golf courses; (2) approvals of no more than three courses per year; and (3) the discouragement of "stand-alone" golf courses in rural and agricultural areas. The administration further recommended that new golf courses be part of an integrated plan for the area by having dual purposes, such as drainage and buffers (City and County of Honolulu, 1989).

The City Council is currently considering Bill 152 (1989) which, if passed would amend the Land Use Ordinance with regards to the approval process for golf course development. The bill proposes to ensure that golf courses are reviewed in a public hearing through the Plan Review Use process. Further, Bill 152 would instruct Council to take into consideration items such as the encouragement of the use of non-potable water for irrigation and provisions to enhance the opportunities for public play. The City Council is also re-evaluating the need to reinstate the moratorium imposed by Ordinance 89-36.

3.4 LIKELY SCENARIO WITHOUT THE COUNTRY COURSES AT KAHUKU

Changes in the Study Area are expected to be gradual, due to the public policies calling for the retention of the area's rural character.

1. **Change in economic base.** The hotel and commercial development of the Kuilima Resort expansion will essentially change the economic base for the area. The economic development in the Study Area has been limited, and unless an economic base such as tourism is developed, the area's future economic development should continue to lag behind that of the rest of the island. The projected 3,555 new direct, indirect and induced jobs resulting from the proposed actions will help the region in improving the overall economy.
2. **Continued need for affordable housing.** As discussed in previous sections of this report, the Study Area already has a major housing problem, as reflected in low vacancy rates and crowding. The only near-term solution is the affordable housing project in Kahuku. The potential residential development in Laie may help the situation, but planning is in preliminary stages, as is the potential new housing by the KS/BE.

With the Kuilima Resort expansion, pressures for affordable units will increase as people move into the area to be near the Kuilima job site. Kuilima's housing impacts can be mitigated through job training of the area's current residents, thereby decreasing the need for out-of-area employees, and through the off-site affordable housing to be developed by Kuilima Resort Company.

Although these residential and other projects may help relieve the housing pressure, a major increase in the area's housing stock is constrained by the City General Plan and Development Plan policies which allow only enough zoning for the Study Area to maintain roughly its present proportion of islandwide population over the next several years.

3. **Increased presence of visitors.** Study Area residents will experience increased interactions with visitors as the Kuilima Resort expansion brings more visitors into the area. Currently, resident-visitor interaction is enabled by the facilities at the Polynesian Cultural center in Laie, the Waimea Falls Park and accommodations and facilities at the Turtle Bay Hilton.
4. **Expansion and enhancement of the recreational resources.** As discussed in Section 3.2, the area's beaches are major recreational resources for Study Area and islandwide residents, as well as visitors. Efforts to expand and enhance these resources are expected to continue because of public efforts to acquire more land and private proposals to develop recreation-oriented facilities.

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5. **Roadway changes and other infrastructure improvements.** The physical landscape is expected to gradually take on a more urban character as roadways are widened and added, the water system is expanded and sewers are upgraded and expanded.
6. **Increased community awareness of change.** Though preliminary and requiring major land use approvals, the master plans of major landowners can influence the type and pace of change in the Study Area. The master plans which were discussed in Section 3.2 were prepared with community input, and presumably incorporates the desires of at least some of the area's residents. Hence, change in the area's character is being discussed as a possibility, and, in some cases, as inevitable directions for the community's future.
7. **Development of more golf courses.** As discussed in Section 3.2, six golf courses, not including the proposed project, are being discussed for the Study Area. It is likely that some these will be developed, if they meet land use and planning criteria.

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**SECTION 4: POSSIBLE COMMUNITY ISSUES ON COUNTRY COURSES AT
KAHUKU**

POSSIBLE COMMUNITY ISSUES ON THE COUNTRY COURSES AT KAHUKU

This section explores potential community issues and concerns on Country Courses at Kahuku. Section 3.1 discusses issues and concerns independent of the proposed project. Section 3.2 identifies possible community issues on Country Courses at Kahuku.

4.1 ISSUES AND CONCERNS INDEPENDENT OF THE PROJECT

4.1.1 Neighborhood Board Issues

The Neighborhood Board system is a formal mechanism for citizen input to public entities regarding islandwide City policies, specific community problems and other matters, and proposed changes. Often, the types of issues addressed by a Neighborhood Board and subsequent actions reflect values and concerns of the constituent population.

To understand the values, concerns and issues of Study Area residents, the meeting minutes of the Koolauloa Neighborhood Board No. 28 and the North Shore Neighborhood Board No. 27 from 1987 through October 1989 were reviewed.

In general, these Boards tended to support changes which would directly benefit the current population, but were apprehensive about changes which would cause or lead to major growth. For example, although roadway improvements were supported if they relieved localized congestion, Board members tended to oppose proposed improvements which would "open up" an area, such as the road around Kaena Point, or improve through-traffic, such as road widening north of Kaneohe.

The following are major topics discussed by these two Boards:

Proposed development. In reviewing development proposals, the Koolauloa Neighborhood Board generally favors efforts which increase economic opportunities for nearby communities, but tempers such support if there are negative impacts on agriculture or increased traffic congestion. Central to the North Shore's review of development proposals is the Haleiwa Historical, Cultural and Scenic Special Design District. This latter Board consistently expressed the desire to preserve the rural character of the town and region.

Beach parks. Both Boards have consistently supported City efforts to expand recreational resources, particularly those near the ocean. In February of this year, the Koolauloa Neighborhood Board reaffirmed its support of City efforts to acquire beach front property for beach parks, although protecting the rights of the private landowner is also a major concern. The North Shore Neighborhood Board also supports such efforts in this region and is anticipating the expansion of the Haleiwa Beach Park.

Housing. Although the Koolauloa Board acknowledges the need for affordable housing in this region, members are very concerned about the adequacy of existing infrastructure.

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Traffic. Both Boards are increasingly concerned about peak hour and weekend traffic, roadway safety, and tour busses. In addition to the daily peak traffic, both regions experience heavy weekend traffic resulting from island residents and tourists visiting area beaches, shops and facilities. Certain areas reportedly have recurrent speeding problems. Further, there are numerous complaints about tour busses and sightseeing vehicles slowing down traffic.

The increase in housing units used for visitor accommodations has been an emerging issue with Windward Oahu residents, particularly those in Kailua. Concerned citizens complained to the City Council that such resort uses are inappropriate in a residential neighborhood. The Save Kailua Coalition opposed a bill which would allow bed and breakfast operations as a special accessory use in residential and country districts. The group was particularly concerned that those facilities in operation before October 22, 1986 may be allowed to continue if their operators can establish such use (Waite, 1989a, and Bill 151 (1989), CD-1, City Council).

On November 7, 1989, the North Shore Neighborhood Board held a special meeting with transient vacation rentals being an agenda item. The Board voted to support the Council bill.

4.1.2 Community Issues Related to Golf Courses

The islandwide community has had a wide range of reactions to proposed golf course developments throughout Oahu. Although many of golf course issues were raised in reaction to specific proposals, some common concerns have emerged. The following summary of golf course-related issues is based on a review of news articles regarding golf courses over a three-year period:

1. **Golf course versus agriculture.** Because of the land availability in rural areas, numerous golf courses have been proposed for the non-developed portions of Oahu. Over the past few years, golf course proposals have been met with vociferous opposition if the subject land is being farmed at the time of the proposal.

Last year, the competition between golf course and agriculture was the key issue. Proposed golf courses in Lualualei (Yamaguchi, 1988), Maunawili (Honolulu Advertiser 1988a and 1988b, Young, 1988b) and Ohikilolo (Young, 1988a) have been opposed by community groups because of various degrees of farming activities.

Nearby farmers are also concerned that the golf course will compete with agricultural operations for water. These issues are further exacerbated when displacement of existing farmers is necessary for project implementation.

2. **Ecological effects.** Golf course impacts on the water supply are frequent concerns, in terms of competition for use and chemical impacts from herbicides and pesticides normally applied to golf courses.

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3. **Change in rural lifestyle.** Golf courses are commonly appreciated as open space, and this attribute complements the rural landscape. Rural communities often acknowledge that the development of a golf course will prevent large-scale residential development on that site.

Nevertheless, there is concern that the improvement of a golf course site may increase nearby property values. The subsequent increase in property taxes may, in turn, pressure nearby landowners to urbanize their properties (Community Resources, Inc., 1988 and Oshiro, 1989).

4. **Foreign investment.** During 1988 and continuing into 1989, there growing concern over foreign investment particularly as related to real estate speculation in Hawaii. Hotel investment by Japanese reached 35 percent of the total hotel rooms in Waikiki, 27 percent statewide, by the end of 1988, and more purchases were anticipated (Harpham, 1988).

In an Advertiser/Channel 2 News poll, over half of the respondents, or 54 percent, felt that foreign purchases of land for development of hotels was bad for Hawaii, and 51 percent to 28 percent felt foreign purchase of land for the development of hotels should not be allowed (Keir, 1988b).

This attitude towards Japanese-based hotel development may spill over into Japanese-developed golf courses, particularly because foreign membership at these courses correlates to the visitor industry. All Oahu privately-owned golf courses which allow public play are partially or fully owned by Japan-based entities. In 1988, 21 golf courses in Hawaii, ten of which are located on Oahu, were owned by Japanese (Dooley, 1988).

4.2 POSSIBLE COMMUNITY ISSUES ON COUNTRY COURSES AT KAHUKU

This section discusses *preliminary* social issues on The Country Courses at Kahuku. Whereas social impacts are those changes which are likely to occur, social issues are community concerns which arise *in response* to a proposed action. Social issues often shift over time, as people's priorities, environment and lifestyles change.

As the project is presented to the community, the preliminary issues presented in this section need to be re-evaluated and re-assessed based on people's actual reactions to the project.

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1. **Need for more golf courses.** As shown in the previous section, public awareness of golf course development is heightened by numerous proposals. Based on the recent report on golf course development prepared by the City Department of Land Utilization (1989), five golf courses, including the proposed project, have been proposed for the Study Area in recent years. In this study, Earthplan has found that, including those courses of preliminary long range master plans of major landowners, six golf courses have been discussed in the Study Area, *not including The Country Courses at Kahuku.*

Further, seven golf courses on other parts of Oahu are scheduled to operate in the near future or are close to construction. Applications or inquiries have been made for more than 30 more golf courses (City and County of Honolulu Department of Land Utilization, 1989).

As Section 3.2 discusses, this recent attention towards golf course development is often accompanied by apprehension about the long-term effects of this type of development. The need for more golf courses in the Study Area as well as throughout the island is likely to be questioned as more courses are proposed and constructed. Hence, the need for four more golf courses in the Study Area would probably be a major question among Study Area residents.

2. **The value of golf courses as a recreational resource.** A golf course is traditionally considered a recreational resource because it accommodates a relaxing physical leisure-time activity. As more private profit-oriented golf courses are proposed, however, the emphasis of golf course development shifts from its recreational value to economics.

Instead of focusing on the potential to increase a recreational resource, the community is directing its attention to the Japanese developer, the high cost of development and the potential for economic exclusion of the local golfer.

Although the operation and management of the Country Courses at Kahuku have not been determined at this time, preliminary project plans call for a daily-fee course, and not a membership club. The proposed courses may therefore be accessible and affordable to many resident golfers.

Nevertheless, because of the numerous proposals for golf courses and because some degree of public play is being required of recent proposals, the community may perceive that there is a sufficient number of golf courses to serve the recreational needs of the resident population.

3. **Competition for land resources with "more desirable" uses.** Some people may view the proposed use of this land as "extravagant" considering the critical need for more jobs and housing. The

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number of jobs generated by the proposed project may be low for some, considering the amount of land being used. Further, some community members may prefer that at least a portion of this land be used for affordable housing because of the current housing crisis in the area. These issues may be especially relevant for those who would question the overall need for more golf courses in the area.

4. **Change in rural character of the area.** Even though some people may prefer job-generating uses or residential units on these sites, most would probably choose uses dominated by open space to retain the rural quality of the Study Area. In fact, rural communities often acknowledge that the development of a golf course will prevent large-scale residential development on that site.

Some people will likely be concerned, however, about the long-term effects of "urbanizing" this open space. They may fear that putting the project sites into more intense and exclusive use will eventually pressure the surrounding areas into becoming more urban.

5. **Impact on water supply.** The competition between golf courses and agricultural activities often focus on water supply. It is likely that nearby farmers will be concerned about the impact of the project on their irrigation water. Further, some will likely be apprehensive about the impacts on the water supply generated by the use of herbicides, pesticides and fertilizers on the golf course.
6. **Potential for foreign investor.** Given the number of Japanese-owned and -proposed golf courses, Study Area residents will likely be concerned about whether any of the Country Courses at Kahuku will be so owned and/or operated.
7. **Origin of employees at Country Courses at Kahuku.** Area residents are aware that the Kuilima Resort Expansion will generate several thousand jobs and that the area labor supply will not adequately fill these resort jobs. The project will add more jobs to the market, and thus increase the potential for out-of-area residents filling these jobs. Area residents will likely want some assurances that the golf course operators will hire nearby residents as much as possible.
7. **Community benefits.** The Study Area has numerous experiences of community involvement in private development efforts, including the proposals for the Kuilima Resort expansion and the Lihī-Lani community, as well as the master planning efforts of major landowners. A common thread in all of these efforts is the assurance that the proposed uses will somehow benefit the nearby communities, either through employment, recreational resources, off-site facilities or in-kind contributions.

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8. **Traffic.** Because traffic is a major problem now (refer to Section 4.1.1), the community will likely express concern about the project's potential for increasing the number of cars and busses in the area.

COUNTRY COURSES AT KAHUKU

**SOCIAL IMPACT ASSESSMENT
SECTION 5: POTENTIAL SOCIAL IMPACTS OF COUNTRY COURSES AT
KAHUKU**

5 **POTENTIAL SOCIAL IMPACTS
OF THE COUNTRY COURSES AT KAHUKU**

This section identifies potential social impacts related to the Country Courses at Kahuku, as follows:

Section 5.1 describes the project's impact on population.

Section 5.2 looks at the effects of this de facto population on the Study Area.

In *Section 5.3*, the project's effect on recreational resources is evaluated, and includes a discussion on the resident use of this resource.

Section 5.4 discusses the potential effects of the proposed project on the character of the nearby neighborhood.

Section 5.5 identifies displacement impacts.

Project impacts on public services and facilities are discussed in *Section 5.6*.

5.1 De Facto Population Impacts

Having no residential component, the Country Courses at Kahuku will not increase residential population. The project will, however, increase the area's de facto population through its (1) on-site employment and (2) golf course and clubhouse users.

Each golf course is expected to generate between 30 and 50 jobs, which implies a total job count ranging from 120 to 200. Two-thirds of these jobs, or between 90 and 150 jobs, will be located at the Punamano site.

When fully operational, the Country Courses at Kahuku could accommodate approximately the following:

- * 288 playing golfers, assuming one foursome per hole and 72 holes;
- * 48 golfers waiting to play, based on an average of three foursomes could be waiting to play at each of these golf course at any given time;
- * After play, golfers may choose to use other facilities such as the clubhouses. If two foursomes at **each** golf course use other on-site facilities after their play, then these post-play golfers could amount to 32 players.

Hence, a total of 368 golf course users could be on-site at the Country Courses at Kahuku at one time, and when the courses are fully operational.

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All four courses would be operational in 1997. At that time, the Punamano and Malaekahana project sites could result in a total de facto population of 488 to 568 persons, including employees and facility users.

5.2 Effects of Increasing the de facto Population

The Country Courses at Kahuku is intended to serve primarily the visitor market, including the guests at the Kuilima Resort and participants in tour groups. The proposed project will therefore bring more people into the area and increase the potential for resident - visitor interaction.

Currently, Study Area residents have opportunities to interact with tourists who stay at the Kuilima Resort and/or use their facilities, as well as visitors to the Polynesian Cultural Center. Such interactions will greatly increase with the total development of Kuilima Resort expansion, which is expected to result in an estimated de facto resort population of 5,523 persons (Community Resources and A. Lono Lyman, 1984).

In addition, the Malaekahana Golf Course proposed by the Kuilima Resort Company (adjacent to the Country Courses at Kahuku Malaekahana site) would have a total de facto population of 130 to 150 people on a peak day (Community Resources, Inc., 1989).

In this context, the proposed project's contribution to the area's de facto population would result in a total de facto population of about 6,200 people. Hence, the Country Courses at Kahuku would account for eight percent of the area's increase in de facto population.

Although the project-related increase is relatively small, it is still necessary to consider the effects of increased resident-visitor interaction since the Country Courses at Kahuku would contribute to the overall changes. The following are presented as factors which influence increased resident-visitor interactions:

1. Additional cultural diversification.

Non-project effects -- The diversity of visitors, mainland and foreign born, can be a culturally enriching experience for workers and nearby residents. Opportunities to meet these people at work or in recreation or commercial areas will prove stimulating if mutual respect for the other's differences is demonstrated. The downside to this is that, with the increasing emphasis on high-spending tourists and foreign tourists, the possibility of communication barriers increases.

For example, though Japanese visitors are generally perceived to be respectful of local cultural differences, their tendency to move in large groups and to isolate themselves could be misinterpreted. Large bus loads of non-English speakers visiting a golf course, restaurant or beach park might test the patience of many local employees or residents present. These things will take time and understanding as is true elsewhere in Hawaii.

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Project effects -- The project will add to this cultural diversity, since most of the golf course users are expected to be visitors. The project's contribution is negligible, however, within the context of the regional increase in visitors.

2. Competition for recreational resources.

Non-project effects -- It is likely that the effects of the influx of visitors will be felt by adolescents and young adults who will find their recreation areas, surfing spots and beaches infringed upon by those wanting these area for alternate activities. Adolescents are typically the most vocal and demonstrative toward tourists who infringe on what are considered local recreation areas. Though most young people welcome the excitement of new faces, tourists from Waikiki and Kuilima Resort will undoubtedly frequent these same areas and compete for recreation space. This could compel youth gangs or other locals to establish their territory either through incidents of confrontation or opportunistic crimes or misdemeanors.

The current government effort to expand and increase shoreline parks and accesses will help alleviate this competition for recreational resources. Further, the Kuilima Resort expansion includes various recreational areas for visitors and residents alike.

Project effects -- The effects of the proposed project on recreational resources are discussed in Section 5.3.

3. Visitor tendency to remain at self-contained area.

Non-project effects -- Tourists tend to remain on-site at the larger resorts, except for occasional side trips around the island or into Honolulu or Waikiki. Compared to Waikiki tourists who rent cars and visit off-site recreation areas, rural resort visitors leave their destination area at about 15 percent total per day (Community Resources and Lyman, 1984).

From experience gained from Kuilima (Community Resources and Lyman, 1984), visitors from the resort complex do not frequent public recreation areas near the resort site but prefer going some distance, such as Waikiki when they do travel off-site. The area may therefore experience additional traffic because of the rental cars/tour buses servicing these needs.

On one hand, the tendency for non-Waikiki visitors to remain on-site is positive in that this would lessen traffic and crowding a public beaches and facilities. On the other hand, this lack of interaction also implies minimal cultural exchanges and patronizing of local off-site businesses.

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Project effects -- Ongoing experience of residents exposure to increased visitor population at the Kulima Resort and the Polynesian Cultural Center would act to ameliorate any additional adaptation required by the Country Courses at Kahuku.

4. Potential for feelings of economic disparity.

Non-project effects -- The increasing presence of affluent tourists who patronize new hotels and other golf courses could create a us-them perception in the minds of some residents. This perception might become a focal aggravation to the extent that Hawaii-born residents are committed to employment within the visitor industry or are excluded from employment because of lack of skills or training. Research (Knox, 1979) has shown that, as the economic dependency on tourism increases, there is not necessarily a corresponding increase "Aloha Spirit" toward the industry.

Rather, one study (Noronha, 1979) concluded that, as people feel that they are losing political and economic control over their fate to absentee power-brokers in the industry, residents are more likely to direct their animosity toward the visible tourist. Though research in Hawaii is inconclusive as to which pattern may prevail, much will depend on the community's reaction to resort development in the area independent of the proposed project.

Another potential for an increasing sense of economic disparity is the prevalence of foreign-owned or proposed golf courses and correlating affluence. As discussed in Section 4.2, the media has given considerable attention to the popularity of expensive golf course memberships among affluent Japanese people. Many of these memberships extend outside Japan, and Hawaii is increasingly a golf destination for these people.

Project effects -- The Country Courses at Kahuku are expected to be daily fee courses. Specific rates have not been determined, however, and the potential for perceptions of economic disparity between golf course users (visitor and resident alike) may still occur if fees for the proposed courses are high.

Maintaining positive and productive resident-visitor interactions will be important for all visitor-oriented development in the Study Area. Positive interactions will help residents feel a sense of belonging and ownership with these facilities, and will be less likely to view visitor facilities as "necessary evils." The quality of resident-visitor interactions is also of direct import to the long-term economic viability of visitor-oriented facilities.

To work towards mutually beneficial resident-visitor relationships, the Estate of James Campbell should consider the following approaches as a collective strategy:

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- * Community input in planning process -- The Country Courses at Kahuku has already been presented to some community groups. These efforts should continue with the explicit purpose of soliciting community reactions and ideas on the proposed project.
- * Ongoing communication -- Project planning is an ongoing process and the Estate should keep the nearby communities abreast of plan modifications and general project status. This is especially important if plan revisions are made in response to community input.
- * Participation in community events and programs -- The Estate has already established a relationship with the community by participating in community efforts. The future operators of the proposed golf courses should be encouraged to continue these efforts by contributing resources, such as expertise, in-kind help and monetary participation, to events and programs important to the nearby community. It is also suggested that developer/operator participation be considered for educational programs involving the visitor industry. Developer/operator support for such programs can help familiarize young people with the proposed facilities, reduce alienation and help improve attitudes towards visitors.

5.3 Employment and Labor Supply

5.3.1 Estimated Project Long-Term Employment

It is estimated that the proposed golf courses will generate between 30 and 50 jobs per course, or a total of about 120 to 200 jobs. The actual number of jobs will depend on a number of factors, including terrain and difficulty in greens maintenance, the level of service provided in the clubhouses and pro shops, and the extent of resource-sharing at the Punamano courses.

Four general categories of jobs are anticipated for Country Courses at Kahuku:

1. Grounds -- These include the superintendent, assistant superintendents, maintenance superintendents, mechanics, equipment operators, groundskeepers and laborers.
2. Golf and Pro Shops -- These include the directing and teaching golf professionals, attendants, and golf pro shop sales assistants.
3. Administration and Support -- These include the clubhouse manager, assistant manager, accountant, secretary, receptionist, janitors, locker attendants parking attendants, and security.
4. Clubhouse: Food and Beverage -- These include the cooks, cashier, waitstaff and busstaff, and bartender.

Table 10 provides a breakdown of these jobs.

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Table 10

Breakdown of Estimated Jobs For Country Courses At Kahuku

	Maiekahana (18-hole, 1 clubhouse, 1 pro shop)		Punahoa (54 holes, 2 clubhouses, 2 pro shops)		Total Project	
	<u>Low range</u>	<u>High range</u>	<u>Low range</u>	<u>High range</u>	<u>Low range</u>	<u>High range</u>
Grounds	12	- 20	38	- 63	50	- 83
Golf and Pro Shops	7	- 11	20	- 33	26	- 44
Administration and Support	5	- 8	15	- 26	20	- 34
Clubhouse: Food and Beverage	<u>7</u>	- <u>11</u>	<u>17</u>	- <u>29</u>	<u>24</u>	- <u>40</u>
Total	30	- 50	90	- 150	120	- 200

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The various jobs generated by the project will offer both indoor and outdoor work, as well as jobs suitable for full-time breadwinners, part-time workers supplementing family incomes, and first-time workers.

Most of the jobs require little technical training or experience. Those jobs requiring *specialized or previous experience* are as follows:

Grounds: superintendent, assistant superintendents, maintenance superintendents, and mechanics.

Golf and Pro Shops: directing and teaching golf professionals.

Administration and Support: clubhouse manager, assistant manager, accountant, secretary.

Clubhouse: Food and Beverage: cooks, cashier, bartender.

5.3.2 Effect on Labor Supply

The employment generated by the proposed project could benefit residents of nearby communities, as follows:

- * Country Courses at Kahuku will provide job options for the several thousand workers who currently spend more than 45 minutes traveling to their job site.
- * The proposed project will further increase job diversity in the area, thus accommodating a wide range of job skills.
- * The project will increase the number of "outdoor" jobs. This may appeal to those who are currently in agricultural jobs. Note that this percentage is high for Kahuku.
- * Because many of the jobs require little or no experience, students, graduates and currently non-working spouses may qualify for part- and full-time employment.
- * Finally, the project will provide job opportunities for the currently-unemployed. Even though there is a small percentage of unemployed persons in Kahuku, these people nevertheless need jobs.

It is noted, however, that in 1980, the overall Study Area had unemployment rates similar to that of Oahu, and both the Kahuku and Laie CDPs had very low unemployment rates. As discussed in Section 3, without the Country Courses at Kahuku, new jobs generated by other developments in the area, namely the Kuilima Resort expansion, will clearly outpace unemployment.

When considered in the context of the Kuilima Resort expansion, the proposed project will therefore add to the demand for labor supply and could increase the need for in-migrant workers.

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The Estate and future golf course operators could minimize the hiring of out-of-area residents by providing job training to assist area residents in successfully competing with out-of-area residents for golf course jobs. A possible vehicle for job training is the "Turtle Bay Resort Employment Center," which is being established by the Kuilima Development Company (KDC) to help the area residents secure as many of the new jobs as possible.

As presented in the *Action Plan: Turtle Bay Resort Employment Center* (KDC, 1988), the KDC is creating a nonprofit entity to address only job training and related issues. This entity is the "Resort Training, Inc." or RTI.

In a support capacity, the Employment Resource Center would complement hotel training programs by providing additional support services that might be needed to maximize training benefits for the area residents. The Resource Center would (1) maintain a list of qualified potential applicants, (2) maintain contact with personnel directors to match applicants with jobs, (3) provide linkages with schools and employment services, and (4) other types of "facilitating" services.

Direct Resource Center services would focus on improving residents' awareness, skills and qualifications before they apply for specific resort jobs. A focal point of the Center is the direct provision of "basic skills" training to assist disadvantaged residents in meeting minimum job qualifications.

The Action Plan was approved by community representatives in 1988. This job training program is in early stages and Country Courses at Kahuku is not part of this resort-oriented program.

A possible participation for the Estate is financial contribution to the job training program. In compliance with the Unilateral Agreement for the Kuilima Resort Expansion, KDC has committed \$500,000 for job training purposes. KDC may solicit other funding.

5.4 Addition of Recreational Resources

The proposed project will add four golf courses to the Study Area and therefore play a major role in enhancing the area's non-shoreline recreational resources. As noted in Section 4.1.1 and 4.2, however, the value of golf courses as recreational resources is increasingly being weighed against other values, such as the role of golf courses as visitor attractions, the competition with agricultural uses and foreign investment interests.

The following factors are apt to influence the value of Country Courses at Kahuku as recreational resources:

1. **The type of golf course.**

The resident golfer on Oahu has three types of courses from which to choose: municipal, resort and private daily-fee courses. In addition, resident golfers may become members of exclusive private clubs or may qualify to play on military golf courses.

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On Oahu, there are currently 28 golf courses, nine of which are military courses (Table 245, Hawaii State Department of Business and Economic Development, 1988). Four are private clubs for members only.

This leaves 15 golf courses which are available for public play. Of the 15, four are municipal courses, two are resort and nine are privately-owned golf courses open to the public (City and County of Honolulu, 1989).

Project effect -- The Country Courses at Kahuku are proposed as privately-owned courses open to the public. As daily-fee courses, the proposed golf courses will benefit the resident golfer by increasing the number of courses which would be open to any golfer.

2. Affordability and desirability.

In evaluating the proposed project, resident golfers will undoubtedly want to know if rates will be affordable to local players. Kamaaina rates and special rates for certain groups will likely elicit favorable responses.

The lowest rates do not necessarily imply the most desirable golf courses. As of the end of 1988, weekday green and cart fees for 18-hole golf courses on Oahu ranged from a low of \$19 to a high of \$95. Weekend fees ranged from \$23 to \$95 (Exhibit 10, City and County of Honolulu, 1989).

The lowest fees for both weekday and weekend play were offered by the municipal courses. If one were to base desirability solely on affordability, then municipal courses would apparently be the most desired. Further, it would be expected that municipal golf courses would be a priority among City recreational facilities because of financial accessibility.

A recent survey commissioned by the City did not verify this expectation, however. Municipal golf courses ranked the lowest among other recreational facilities, in terms of both importance and usage (Exhibits 11 and 12, City and County of Honolulu, 1989). This relative non-popularity of municipal golf courses on Oahu may be attributed to a number of factors, such as the proportion of golfers to the islandwide community, the quality of existing municipal courses, and the preference for privately-owned golf courses.

Project effect -- Project planners have likened the proposed courses to the Mililani Golf Course and Hawaii Kai Championship Golf Course. The average rates for these courses range from \$24 to \$42 for weekday play, and from \$28 to \$42 for weekends. Greens and carts fees for the Country Courses at Kahuku are therefore expected to be in the mid-range of current fees, and

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are expected to meet the affordable criteria of many of the local golfers, since they already pay similar fees for existing golf courses.

The proposed project will not add to the supply of the more affordable municipal golf courses. The Country Courses at Kahuku will, however, contain golf courses to match various levels of skill in attractive settings. Further, golf course operators should consider establishing incentives for local play, such as kamaaina rates.

3. Resident vs. visitor use.

Correlating to the affordability of golf courses is the intended market. The more a golf course is intended to attract the local resident golfer, the less likely the golf course will be used by visitors. Only two percent of the total rounds at municipal golf courses were played by visitors, as compared to 17 to 19 percent at private or semi-private courses. This proportion of visitor play increases greatly for resort courses (City and County of Honolulu, 1989).

A golf course is more likely to be valued as a recreational resource if the rates and amenities are primarily aimed at the local resident golfer. A resort golf course is considered more a visitor attraction, one which is intended to serve the recreational needs of the visitor.

Project effects -- The primary market for the Country Courses at Kahuku is the visitor, including guests at the Kuilima Resort and participants of arranged tours. To promote the project's recreational value for the local golfer, operators of the Country Courses at Kahuku should consider establishing incentives for local play, such as kamaaina rates. Also, management initiatives, such as community input in the planning of the project and ongoing communication, will help establish a community sense of belonging.

The proposed project is not anticipated to directly impact the numerous recreational resources in the area, nor is Country Courses at Kahuku likely to impact the planned expansion and addition of shoreline parks and accesses.

By attracting non-residents to the area, the proposed project could indirectly contribute to crowding at popular recreational sites if golf course users choose to return to or remain in the area to visit beaches. On the other hand, the new golf courses may encourage beach users to use the golf courses, thereby relieving some of the present crowding.

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5.5 Project Effects on Character of Surrounding Community

5.5.1 Regional Character

To date, six golf courses have been proposed for the Study Area, not including the proposed project. These six courses are located in Waialua, Mokuleia, Kawaihoa, Pupukea (two) and Malaekahana. The Country Courses at Kahuku raises this count to ten. If all of these courses are developed, the Study Area could become a major golf destination for Hawaii.

The most apparent effect of these golf courses would be the visual impression. The present rural landscape is characterized by a few small towns – containing clusters of houses, neighborhood stores, and public facilities – separated by strips of housing along the highway, undeveloped and agricultural land, and relatively large country lots. The golf courses would punctuate this pattern with frequently-maintained and well-manicured green open space, although some of the proposed golf course, including three of the Country Courses at Kahuku, are *not* expected to be visible from the highway.

The long-range effect of numerous golf courses on the regional character can be approached or viewed in two ways. On one hand, the large open space of a golf course will provide an attractive background for the Study Area, which would complement the vast ocean. The golf courses would also be permanent open space which would *not* be used for housing sprawl or other development. Town dwellers and those who wish to retain or "beautify" open space would likely appreciate the visual effects of golf courses.

On the other hand, the open space quality of a golf course differs from the existing openness. The placement of trees, waterways and support facilities would be deliberate and essentially urbanize what is now natural or agricultural. For those who prefer the "country" atmosphere, golf courses may be another introduction of urbanization.

5.5.2 Character of Nearby Communities

As discussed in Section 2.3, the nearby communities of Kahuku and Laie have characteristics of a typical small town. They both evolved around a central focus. Kahuku grew around the sugar mill and Laie expanded around the church and its other facilities. In these towns, there are business or service centers and neighborhoods are easily discernible. Hence, residential densities are high, compared to the country atmosphere of Kaaawa, Punaluu, Sunset and Pupukea.

The visual effects on these neighboring Kahuku and Laie would essentially be the same as those discussed relative to regional character (please refer to previous section).

Another potential impact the proposed project may have on these nearby communities is its effect on land value and urban encroachment. The Country Courses at Kahuku may contribute to urbanization of adjacent lands in following ways:

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1. Potential increase in land values -- A current concern about golf course development is whether the values of adjacent lands will appreciate because of the higher value of golf course property. The apprehension about the potential property value increase of nearby lands is related to possible development pressures. If values of nearby properties increase, then property taxes will increase. The increased taxes may cause some landowners to (1) establish a use with higher revenue-generating potential to help pay taxes, or (2) sell the land at its higher value.

Recently, property tax assessments for private golf courses increased greatly because of increases in assessed values. Increases ranged from 20 percent to over five times the current values (City and County of Honolulu, 1989).

Whether these increased values will directly cause value appreciation of adjacent lands is undetermined at this time, however. In a study of the proposed Lihi-Lani Recreational Community potential effects on the surrounding property values, it was found that there was no significant effect on appreciation rates or historical price movements in the surrounding neighborhoods of a newly built golf course oriented subdivision. Rather, the more important factors impacting prices were the trends in sales activity and appreciation in the overall marketplace (Locations Inc. Research Department, 1989).

Further, the socio-economic study for the proposed Waikane Golf Course suggests that, although nearby property owners may reap the benefits of increased values, this impact will likely not extend to the entire region. That study also speculated that a short period of land speculation near the project site could occur, due to the *expectation* of large-scale international investment (Community Resources, Inc., 1988).

2. A "backyard" for expensive housing -- Proposed planned communities on Oahu will often contain a golf course which would be fronted by higher-priced executive homes. The impetus for this is the market assumption that the golf course is a visual and recreational amenity which justifies higher prices. Although the project does not include a residential component, it may attract developers who want to build golf course frontage homes.

It is stressed that current public policy for the nearby communities, as well as the overall Study Area, *prohibits major urbanization*. Thus, if the proposed project or any of the other proposed courses stimulate more development, particularly residential development, then *major policy changes will be needed*.

If the Country Courses at Kahuku does encourage more urban uses in the nearby communities, then the character of the nearby Kahuku and Laie communities will change. Currently, the most intense activities are resort uses, and these are

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confined to the Polynesian Cultural Center and the Kuilima Resort. Further, Kahuku and Laie are socially and economically are relatively separate from each other, although both are internally homogeneous.

Potential urbanization of lands around the Malaekahana project site could form a physical connection between the two communities. Further, the two adjacent Malaekahana golf courses (one of which is proposed by Kuilima Development Company) would introduce a new force for change in the Laie. Currently, most of Laie's activities center around the church entity. Both of the proposed courses would add new entities which may influence the community.

As for Kahuku, the proposed project could be viewed as a "gateway" on both sides of Kahuku. If there is more development around the Punamano sites, then there will be less of an undeveloped, open space "buffer" between the Kuilima Resort and Kahuku town.

5.5.3 Kuilima Resort

The Country Courses at Kahuku will complement the Kuilima Resort by increasing visitor attractions for resort guests and promoting the area as a resort golf destination. This would especially be a major selling point for Japanese clientele, in light of the current popularity of the sport in Japan. Further, the project would bring more Waikiki visitors to the area, thus providing more business exposure for the Kuilima Resort.

Developing the Punamano site into three golf courses would result in an attractive backdrop for the Kuilima Resort. Note, however, that the Kuilima Resort currently enjoys a unique setting. The resort destination provides most of the comforts of urban living in the midst of rural, undeveloped landscape. Hence, the resort is a physically-cohesive development which is isolated from a city-like environment. The Country Courses at Kahuku would alter the landscape by being deliberately-landscaped open space. This landscape alteration would be further dramatized, if development occurs on the fringes of the proposed project.

The proposed Malaekahana golf course would not be in direct competition with the adjacent course proposed by the Kuilima Resort if the former targets non-Kuilima visitors as the primary market.

5.6 Displacement

The proposed project will cause the displacement of the operations of two tenants at the Malaekahana site.

A portion of the site is currently leased for grazing purposes. Max Smith, the owner of Gunstock Ranch, has month-to-month lease for approximately 250 acres, about half of which are part of the project site. He maintains 100 head of cattle, 40 horses and a small stable for boarding a dozen horses. The operation is marginally profitable to profitable, depending on beef prices and the amount of rainfall. Revenues are about \$60,000 per year, which support one employee and cover feed, rent, water, and other operating costs.

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If the proposed project is implemented, Gunstock Ranch will either close because of insufficient grazing land needed for a viable operation and the land for the headquarters would be lost, or relocate to other lands (letter from Bruce Plasch (President of Decisions Analysts Hawaii) to Charles Ehrhorn (Assets Manager, The Estate of James Campbell) dated December 18, 1989 *and* personal communication with Max Smith, December 1, 1989).

About ten acres of the Malaekahana project site is part of a combined long-term and monthly lease. Abigail Kawanakoa currently leases a total of 88.7 acres and 11 percent of these lands are affected by the proposed development (personal communication with Charles Ehrhorn, Asset Manager, December 6, 1989).

5.7 Public Facilities

5.7.1 Police Protection

The Country Courses at Kahuku is located in District 4 of Area 2 of the Honolulu Police Department. The region extends from Kailua to Kahuku. Police protection services is provided by officers at the Kahuku Police Substation, which patrols from Kaaawa to the Haleiwa Bridge. Six police officers are on duty during each shift and response time is five to ten minutes to locations near the project site.

The de facto population generated by the proposed project will cause occasional demand for police protection. Further, additional police officers will be required to control traffic and pedestrians related to major events at the project site.

To help minimize the need for police protection, golf course operators should take measures to provide on-site security during construction and operation.

5.7.2 Fire Protection

The Kahuku Fire Station is located between the Punamano and Malaekahana sites, at approximately 1.5 miles and two miles, respectively. Fire trucks are expected to be able to access the project sites in approximately five minutes.

Backup services would be provided by other fire stations with a response time of about ten minutes. The other fire station closest to the Punamano site is the Sunset Beach Fire Station, which is located six miles away. Next closest to the Malaekahana site is the Hauula Fire Station, which is approximately four miles south.

The structures supporting the Country Courses at Kahuku, which include the clubhouses and maintenance buildings, will require fire protection. On-site water lines and storage, as well as fire hydrants, will be designed to meet the required capacity. Further, the design of these buildings will follow City fire protection standards and safety precaution measures.

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5.7.3 Schools

The Kahuku Elementary and High School and the Laie Elementary School are located near the project site. With no residential component, the Country Courses at Kahuku will not increase the residential population and is therefore not expected to impact these facilities.

5.7.4 Health Care and Hospitals

The Kahuku Hospital is a 26-bed facility which provides ambulance service and a helipad for medical evacuation by helicopter. Located in Kahuku Village, this hospital offers 24-hour comprehensive medical services. Other facilities at the hospital include a private dental office and a medical office/clinic with five physicians in private practice.

Because the project will not increase the resident population, the Country Courses at Kahuku is not expected to generate significant demand for services provided by these facilities.

The hospital staff and directors have indicated full support of the project, based on their review of the Preparation Notice for the Environmental Impact Statement. This support is based on (1) the project indirectly encouragement of more service industries in the Kahuku Sugar Mill Business Center and adjoining business communities, and (2) the employment-generating potentials (based on letter from Rikio Tanji, Chief Executive Officer, Kahuku Hospital, dated November 24, 1989).

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Yamaguchi, Andy. *Golf course furor: Evicted farmer's plight ignites controversy over law's repeal.* The Honolulu Advertiser. February 28, 1988a.

Yamaguchi, Andy. *Golf course vs. farm hearing draws a crowd.* The Honolulu Advertiser. March 2, 1988b.

Young, Lucy. *Ranch may be lost to golf course.* The Honolulu Star-Bulletin. October 7, 1988a.

Young, Lucy. *Golf developer charges many tenants 'squatters.'* The Honolulu Star-Bulletin. November 2, 1988b.

Earthplan

Berna Cabacungan

Principal

Ms. Cabacungan is a **community planner and communications specialist**. She provides services in community development and planning, particularly in the areas of

Plan input and preparation,

Management of the community planning process, and

Synthesis of physical and social plan components to achieve a feasible and workable plan.

Specific products of her efforts include:

Social impact assessments,

Documents comprising planning, social and environmental studies, and

A working relationship with various community segments.

She has contributed these skills to a diversity of projects, including:

Regional and community plans

Resort complexes

Residential projects

Recreational facilities

Medical and long term care facilities

Energy alternatives, and

Public facilities.

Ms. Cabacungan often incorporates both the community dialogue and analysis products in planning and development projects. She designs and implements dialogue programs for projects which could benefit from community participation.

These programs often result in a working relationship between developers and communities. Through these programs, community issues and concerns are identified, and, with input from all concerned parties, often mitigated.

The information gathered during community dialogue is used in preparing studies submitted to public agencies in the public approval and permit processes. Ms. Cabacungan has prepared studies which were then incorporated in Environmental Impact Statements, Development Plan Assessments and Land Use Commission petitions.

Education Modern English, Bachelor of Arts, College of Arts and Sciences, University of Hawaii, 1976

Professional Affiliation American Planning Association
International Association for Impact Assessment

Earthplan
Berna Cabacungan

Social Impact Assessments *

(Reference to "assistance in. . ." indicates that Earthplan was a *sub-consultant* to an intermediary firm)

Bypass for Honoapiilani Highway: *Social impact assessment for Potential Residential Displacement* of three alternative bypass routes proposed by the State Department of Transportation in Lahaina, Maui.

Chinatown Gateway Plaza: *Social impact assessment* for a proposal of the City and County of Honolulu for a residential, commercial and park complex in Oahu's Chinatown

Circle K: Assistance in *social impact assessment* for a proposed convenience store in Keauhou, Kona

Diamond Head Racquet Club: *Social impact assessment* for a proposed tennis complex on 17 acres situated on a portion of Diamond Head

Ewa Marina, Increment I, Central Oahu: *Social impact factors* for rezoning application for 174.7 acres

Ewa Marina, Increment II, Central Oahu: *Social impact factors* for rezoning application for 444.6 acres

Fort DeRussy, Honolulu, Hawaii: *Manager of informant interviews for social impact assessment* for Army's proposal to redevelop the site to include a 400-room hotel, two parking structures, roadway realignment, recreational and entertainment facilities and relocation of the U.S. Army Reserves.

Hawaiian Riviera, Kau, Hawaii: Assistance in *social impact assessment* for the Environmental Impact Statement for a proposed 3,000-unit resort destination on 3,200 acres near South Point on the Big Island

Heeia Kea Development, Windward Oahu: *Social impact assessment* for Supplemental EIS for the residential development of 102 acres

Honolulu Convention Center: *Social impact assessment* for a Planned Review Use application for a multi-tower privately-funded convention center between Waikiki and the Ala Moana Shopping Center

Kohala Ranch, North Kohala, Hawaii: Assistance in *social impact assessment* for Land Use Petition for a proposed 3,300-unit residential community on 1,300 acres

Kuilima Resort, Kahuku, Oahu: Assistance in *social impact assessment* for the Environmental Impact Statement for proposed resort expansion

Mixed Use Project in Wahiawa: *Social impact assessment* for a 40-unit single family project with 100 units for the elderly proposed by the State Housing Finance and Development Corporation

Mokuleia Development, North Shore, Oahu: *Community interface for social impact assessment* for the Development Plan Amendment Request and the Environmental Impact Statement; and preparation of certain sections of the Environmental Impact Statement. Proposed project consisted of resort development on 1,100 acres

Current and Past Projects

Earthplan

Berna Cabacungan

Ocean Thermal Energy Conversion (OTEC), Kahe, Oahu: Assistance in *social impact assessment* for Environmental Impact Statement for proposed 40-Megawatt OTEC plant on the Waianae Coast

Pacific Basin Conference Resort, Makaha, Oahu: *Social impact assessment* for Environmental Impact Statement for proposed 300-room executive conference resort on 23.5 acres

Pupukea Golf Course: Assistance in *social impact assessment* for two golf courses and residential development proposed by Ohbayashi Hawaii Corporation

Royal Kunia Phase II, Central Oahu: *Social impact assessment* for Environmental Impact Statement and Development Plan Amendment for a 2,400-unit residential community on 660 acres

Village Park Expansion, Central Oahu: Assistance in *social impact analysis* for Environmental Assessment for residential development on 690 acres

Waiola Estates, Central Oahu: *Demographic impacts* for planned residential development proposed by the City and County of Honolulu

Waiola Estates, Central Oahu: *Update on community issues and concerns* for modified planned community proposed by the City and County of Honolulu

West Loch: Assistance in the *social impact assessment* for a proposed residential development by the City and County of Honolulu

Planning Projects, Community Dialogue and Other Areas

Alexander Manor, Oahu: Research and writing for the *Business Plan* of a proposed 150-bed elderly care home

Bayview Golf Course Expansion: Assistance in preparation of environmental assessment and impact statement for an 18-hole championship golf course and upscale residential units

Ewa Marina Golf Course: *Report on planning, environmental and engineering considerations* for Ewa Marina Golf Course for use in the Petition for a Land Use Boundary Amendment

Kauai Beach Villas, Kauai: Facilitation of *community dialogue* for proposed resort on 33 acres

Haggai Institute at Mauna Lahilahi, Makaha, Oahu: Identification of community issues and concerns and recommendations for *community dialogue* to resolve issues for religious training facility on 14 acres

Heeia Kea Development, Windward Oahu: Assistance in facilitation of *community dialogue*, including coordinating relocation agreements for existing residents, for the development of 102 acres

Honolulu Waterfront Project: *Planning input regarding social impacts* in State comprehensive planning effort for the waterfront project area extending from Ala Moana Beach Park to Keehi Lagoon, including Sand Island

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Honolulu Youth Sports Facility: *Feasibility study* for a multi-use sports complex of the City and County of Honolulu; includes community dialogue, site selection, facility concepts and recommended sports program

Honpa Hongwanji Pali Expansion, Oahu: Design and implementation of *community dialogue* program for proposed expansion of religious and educational facilities

Kawaihae Master Plan, Kawaihae, Hawaii: Assistance in preparing the *Development Plan and Environmental Assessment* for long range planning recommendations concerning 10,000 acres of the State Department of Hawaiian Home Lands

Kuilima Resort, Kahuku, Oahu: Assistance in facilitation of *community dialogue* for the proposed resort expansion and job training program

Leeward Job Study: Assistance in *employment study* conducted in conjunction with the proposed Final Increment of Mililani Town, Central Oahu

Mahukona Resort, North Kohala, Hawaii: Facilitation of *community dialogue* for proposed resort on 1,100 acres

Makaiwa Sanitary Landfill, Ewa, Oahu: Facilitation of *community dialogue* for a proposed privately-operated landfill

Mauli-ola, Central Oahu: *Certificate of Need* for the proposed comprehensive medical complex, including hospital, long-term care facility and medical office building

Mokuleia Development, North Shore, Oahu: Design and implementation of *community dialogue* program for a proposed resort development

Ocean Thermal Energy Conversion (OTEC), Kahe, Oahu: *Community dialogue* for proposed 40 Megawatt plant in Waianae

Pokai Bay Development, Waianae, Oahu: Identification of *social impacts* and recommendations for a *community dialogue* program

Small Wahiawa Residential Cluster, Central Oahu: Preparation of social impact, housing and public policy sections for the *Development Plan Amendment* for proposed 14-unit cluster

Village Park Expansion, Central Oahu: Facilitation of *community dialogue* for proposed 690-acre expansion

Waialua Golf Course, North Shore, Oahu: Coordination and assistance in preparation of *Environmental Impact Statement* for a 218-acre 18-hole championship golf course proposed by Oceanic Properties

Wailuku Police Station Relocation: *Environmental Assessment*

Waiola Estates, Central Oahu: *Development Plan Amendment Request* for 270-acre residential development proposed by Castle and Cooke

Current and Past Projects

page 3

List Of Clients

- Alexander Manor, Inc.
- City and County of Honolulu
Department of Housing and Community Development
Department of Parks and Recreation
- Community Resources, Inc.
- Environmental Communications, Inc.
- Finance Realty/Mahukona Properties
- First Development, Inc.
- Larry Fukunaga, Inc.
- GACI, Inc.
- GMP and Associates, Inc./Oahu Land Engineering Partners
- Greatwest Hospitals, Inc.
- Haggai Institute
- Hawaii Kau Aina/ Hawaiian Palace Development
- Hawaiian Dredging and Construction
- State of Hawaii
Department of Transportation
Office of State Planning
- Home Properties, Inc./ Honolulu Federal Savings and Loan, Inc.
- Helber, Hastert and Kimura, Planners
- Honpa Hongwanji Hawaii Betsuin
- Kohala Ranch
- Kuilima Development Company/Prudential Life Insurance Company
- Tyrone Kusao, Inc.
- Malama-Gentry Joint Venture, comprising Hawaiian Electric
Industries and The Gentry Companies
- Mitsunaga and Associates, Inc.

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Mokuleia Development Company/ Northwestern Mutual Insurance
MSM and Associates, Inc.
The Myers Corporation
Oceanic Properties/Castle and Cooke, Inc.
Ocean Thermal Corporation
Pacific Atlas, Inc. (Hawaii)
Pacific Standard Life Insurance Company
U.S. Army Engineer District Honolulu
Waitec Development, Inc.
William E. Wanket, Inc.
Wilson Okamoto and Associates, Inc.

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX E

**NOISE IMPACT EVALUATION FOR
THE COUNTRY COURSES AT
KAHUKU, MALAEKAHANA, OAHU,
HAWAII**

Darby & Associates



APPENDIX E

#J89-34M
December 14, 1989

WILLIAM E. WANKET, INC.
Pacific Tower, Suite 660
1001 Bishop Street
Honolulu, Hawaii 96813

Attention: Mr. William Wanket

Subject: Noise Impact Evaluation for The Country Courses
at Kahuku, Malaekahana, Oahu, Hawaii

Dear Mr. Wanket:

A study has been performed to assess noise impact due to the proposed project. The following is provided as a result of this study:

I. EXECUTIVE SUMMARY

- A. Noise sensitive locations which may be potentially be impacted by the project development are:
Malaekahana State Recreation Area, and residences, schools, churches, and a hospital within the towns of Kahuku and Laie. Only the recreation area is located in the immediate vicinity of the project site.
- B. The existing acoustical environment at these noise sensitive areas varies depending on their locations relative to Kamehameha Highway and the coastline.

Traffic and surf noise dominate at locations near the highway and the coastline, respectively. At locations away from the highways and the coastline, the typical neighborhood self-generated sound dominates the ambient sound levels.

- C. Additional traffic on Kamehameha Highway generated by the project will not increase the future traffic noise level significantly.
- D. Noise generated by clubhouse and ground maintenance activities should not increase the ambient noise levels at the Maiaekahana State Recreation Area, which is the nearest noise sensitive area located at a distance of at least 750 feet from the project site. If needed, implementation of noise mitigation measures could readily ensure compliance with applicable noise limits at any property line.
- E. Noise from construction activities associated with the development could be audible at Malaekahana State Recreation Area. If problems arise, a permit will be obtained from the State Department of Health (DOH). Any construction vehicles using trafficways

will satisfy the noise level requirements specified in DOH vehicular noise regulation.

- II. PROJECT DESCRIPTION -- The proposed project involves the development of one eighteen-hole golf course on the mauka side of Kamehameha Highway across from Malaekahana State Recreation Area. The development will include a clubhouse, a maintenance building, a driving range, and improvement and realignment of an existing access road. Refer to Figures 1 and 2 for the location and the layout of the proposed project. It should be noted that the subject project will be located adjacent to another proposed golf course (by Kuilima Resorts International) which is anticipated to be completed by the year 1994.
- III. EXISTING ACOUSTICAL ENVIRONMENT -- Noise measurements have been performed in the vicinity of the proposed project area to assess the existing acoustical environment. The measurement results indicate that the locations near Kamehameha Highway are dominated by traffic noise with an average A-weighted sound level of about 63 to 64 dBA at a distance of 65 feet. Refer to Appendix I for an explanation of A-weighted sound level. Ambient sound levels at residential locations away from the highway are dominated by neighborhood self-generated

sounds, e.g., occasional local vehicle movements, lawn mowers, weed wackers, TV's, radios, and sounds from children and animals. Wind blowing in the foliage is often the dominant source of sound, along with intermittent muffled noise events from traffic on Kamehameha Highway. Occasional military helicopters from Kahuku Training Center cause audible noise throughout the project area and may be the dominant noise source at times. The sound of surf dominates the acoustical environment at locations near the coastline, especially during the periods when the traffic movement is minimal. A-weighted sound levels ranging from about 60 to 62 dBA generated by surf were measured at a distance of about 100 feet from the coastline during the night-time hours. Appendix II provides a complete listing of the measurement data including those from previous projects in the vicinity of the project site.

IV. ASSESSMENT OF POTENTIAL NOISE IMPACT -- The nearest noise sensitive area to the proposed golf course site is the Malaekahana State Recreation Area located on the makai side of Kamehameha Highway. The town of Kahuku is located to the northwest of the project site. Noise sensitive locations within the town are homes, hospital,

schools, and churches. The town of Laie is located to the southeast of the project site with homes, schools and churches as its noise sensitive areas.

Of primary concern regarding noise impact at these noise sensitive locations is the increase in noise levels due to additional traffic generated by the project. Also considered as a potential source of impact are various activities associated with the clubhouse operations and golf course maintenance. Construction activities involved with the development of the project are also discussed as a potential source of noise impact.

- A. Traffic Noise - Traffic noise level estimates have been made using the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (Reference 1). In order to calibrate the model, noise measurements have been obtained at locations on Kamehameha Highway together with traffic counts, including the mix of vehicles. Table 1 summarizes the comparison of the measured short term Equivalent Noise Levels, (e.g. Leq [10 minutes] and Leq [20 minutes]) with predicted hourly noise levels (Leq [60 minutes]). The fact that the

two values agree within one dBA is considered acceptable. Also presented in Table 1 are maximum A-weighted sound levels (Lmax) generated by the traffic and ambient levels recorded during the measurement periods.

Table 1. Summary of Measured and Predicted Leq, Measured Lmax and Measured Ambient Noise Levels

Measurement Location	Meas. Leq	Predicted Leq(60 min)	Measured Lmax	Measured Ambient
Kamehameha Hwy. Town of Kahuku 65' from the highway	63.9 dBA	63.4 dBA	85.3 dBA	52.6 dBA
Kamehameha Hwy. East of Malaekahana Site, 119' from the highway	61.3	62.0	75.3	43.4

Traffic noise calculations were performed using the above calibrated traffic noise prediction model along with traffic data provided in Reference 2. The results of the calculations for the existing and future (1994) years with and without the project at two segments of Kamehameha Highway are summarized in Table 2. As can be seen from the table, the increases in the future noise levels due to the

project development are negligible. Therefore, the project development is not expected to cause any significant impact in terms of traffic noise. Note that the future noise levels with or without the project are about 2 dBA higher than the existing levels.

Table 2. Summary of Existing and Future Traffic Noise Predictions

Location	Peak Hour Leq(60 min)		
	existing (1989)	future(1994) w/out project	future w/ project
Kamehameha Hwy. west of the access road, 100' from the centerline of the hwy.	62.1 dBA	64.3 dBA	64.4 dBA
Kamehameha Hwy. east of the access road, 100' from the center of the hwy.	62.3	64.2	64.3

B. Clubhouse and Ground Maintenance Activities -- There are no noise sensitive areas in the immediate vicinity of the project site, except for the Malaekahana State Recreational Area. The clubhouse and the maintenance building will be located at about 1750 and 1250 feet from the recreation area, respectively. Noise sources such as kitchen

WILLIAM E. WANKET, INC.
Attention: Mr. William Wanket

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activities; refrigeration; air conditioning equipment; fans; golf cart chargers; pumps; and other stationary equipment should not cause the ambient noise levels in the recreation area to exceed the allowable noise levels specified in local noise regulations (References 3 and 4), when such long sound propagation distances are involved. If required, using standard noise mitigation measures, noise generated by such sources can readily be less than the allowable noise levels specified in local noise regulations (References 3 and 4). A public address sound system and entertainment activities should not cause "unreasonable" or "excessive" noise as defined in Reference 3 in the recreational area due to (a.) the attenuation of sound over the long propagation path; and (b.) the relatively high ambient noise levels in the park due to traffic and the surf. Thus, sound levels which would be audible in the park would have to be excessive to those in the club house.

Noise from equipment associated with ground maintenance activities, including lawn mowers and leaf blowers, should be substantially reduced to

less than ambient noise levels in the recreation area since they will be at a nearest distance of greater than 750 feet. This statement takes into account that noisy equipment is also incompatible and disruptive with golf play. All equipment powered by internal combustion engines will have exhaust mufflers. Ground maintenance should not cause "unreasonable" or "excessive" noise at any noise sensitive locations as defined in Reference 3.

- C. Noise Impact from Construction --Development of the project site will involve grubbing, grading, and the construction of infrastructure and buildings. The various construction phases of a development project may generate significant amounts of noise; the actual amounts are dependent upon the methods employed during each stage of the process. Typical construction equipment noise ranges in dBA are shown on Figure 3. Earthmoving equipment such as bulldozers and diesel powered trucks will probably be the loudest equipment used during construction. If noise generated during construction exceeds allowable limits specified in Reference 3, a permit will be obtained from DOH. DOH may grant permits to

WILLIAM E. WANKET, INC.
Attention: Mr. William Wanket

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operate vehicles, construction equipment, power tools, etc. which emit noise levels in excess of the allowable limits. Required permit conditions for construction activities are:

"No permit shall allow construction activities creating excessive noise...before 7:00 a.m. and after 6:00 p.m. of the same day."

"No permit shall allow construction activities which emit noise in excess of ninety-five dBA...except between 9:00 a.m. and 5:30 p.m. of the same day."

"No permit shall allow construction activities which exceed the allowable noise levels on Sundays and on...[certain] holidays. Activities exceeding ninety-five dBA shall [also] be prohibited on Saturdays."

In addition, construction equipment and on-site vehicles or devices requiring an exhaust of gas or air must be equipped with mufflers. Also, construction vehicles using trafficways must satisfy the noise level requirements defined in Reference 5.

- V. Noise Mitigation Measures -- The design of the facilities will include noise mitigation measures in the planning of the location and orientation of the air conditioning equipment, exhaust fans, etc. such that

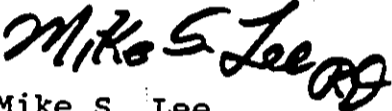
WILLIAM E. WANKET, INC.
Attention: Mr. William Wanket

December 14, 1989
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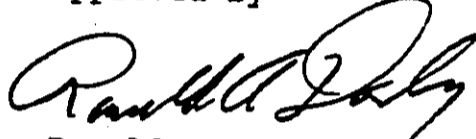
local noise regulations (Reference 3 and 4) will be
satisfied.

Sincerely,

Prepared by


Mike S. Lee
Senior Consultant

Approved by


Ronald A. Darby, P.E.
President

MSL;RAD:msl

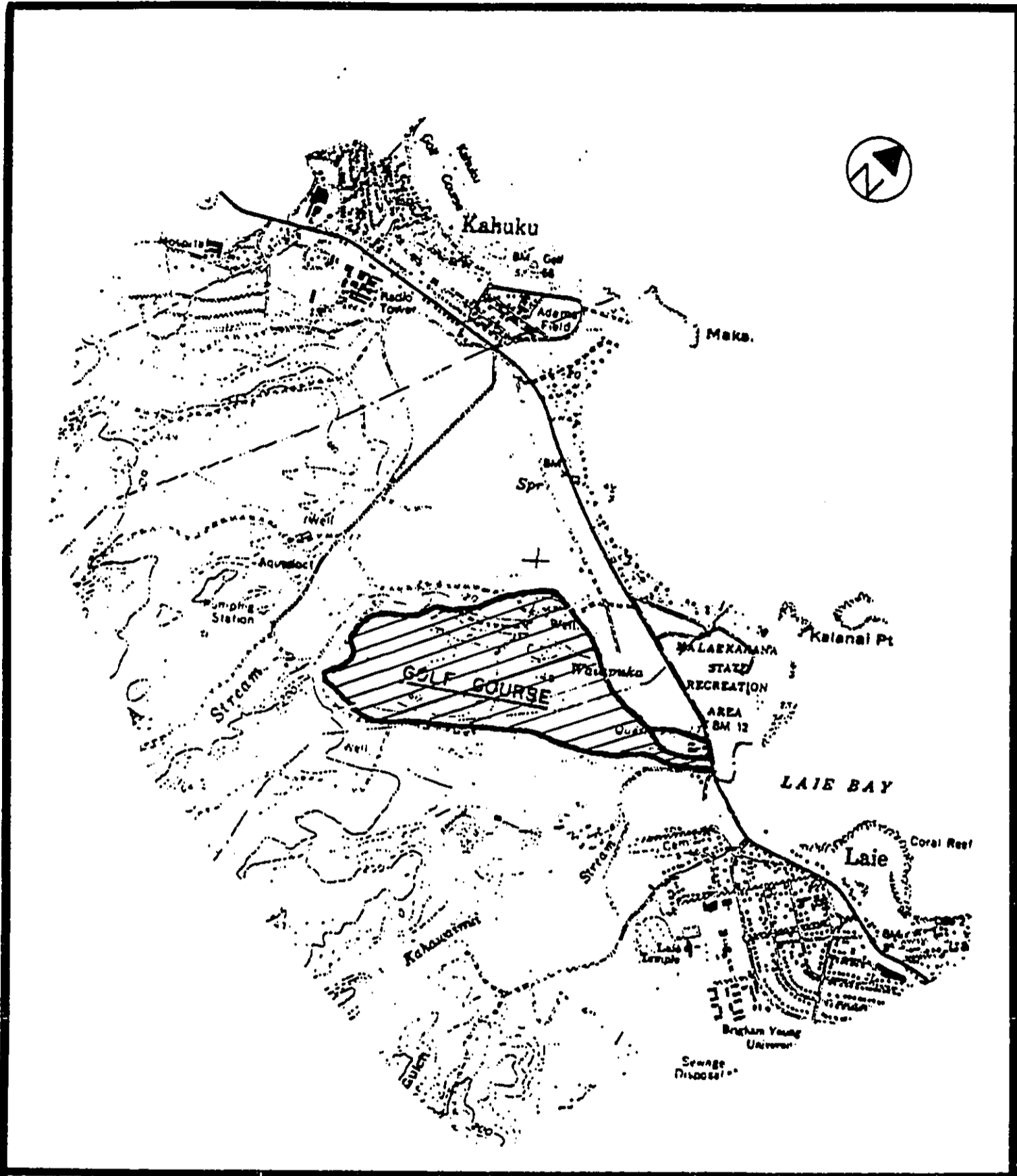
WILLIAM E. WANKET, INC.
Attention: Mr. William Wanket

December 14, 1989
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REFERENCES

1. "FHWA Highway Traffic Noise Prediction Model", Federal Highway Administration, December 1978
2. Traffic data for the proposed golf course, provided by Pacific Planning & Engineering, Inc., received December 1989
3. "Chapter 43 - Community Noise Control for Oahu", Department of Health, State of Hawaii, Administrative Rules, Title 11, 1981
4. "Section 3.100, Noise Regulations", Land Use Ordinance, City and County of Honolulu, October 22, 1986
5. "Chapter 42 - Vehicular Noise Control for Oahu", Department of Health, State of Hawaii, Administrative Rules, Title 11, 1981
6. "Noise Impact Evaluation for the Proposed Kahuku Golf Courses (The Country Courses at Kahuku: Punamano and Malaekahana), Oahu, Hawaii", Darby & Associates, February 7, 1989

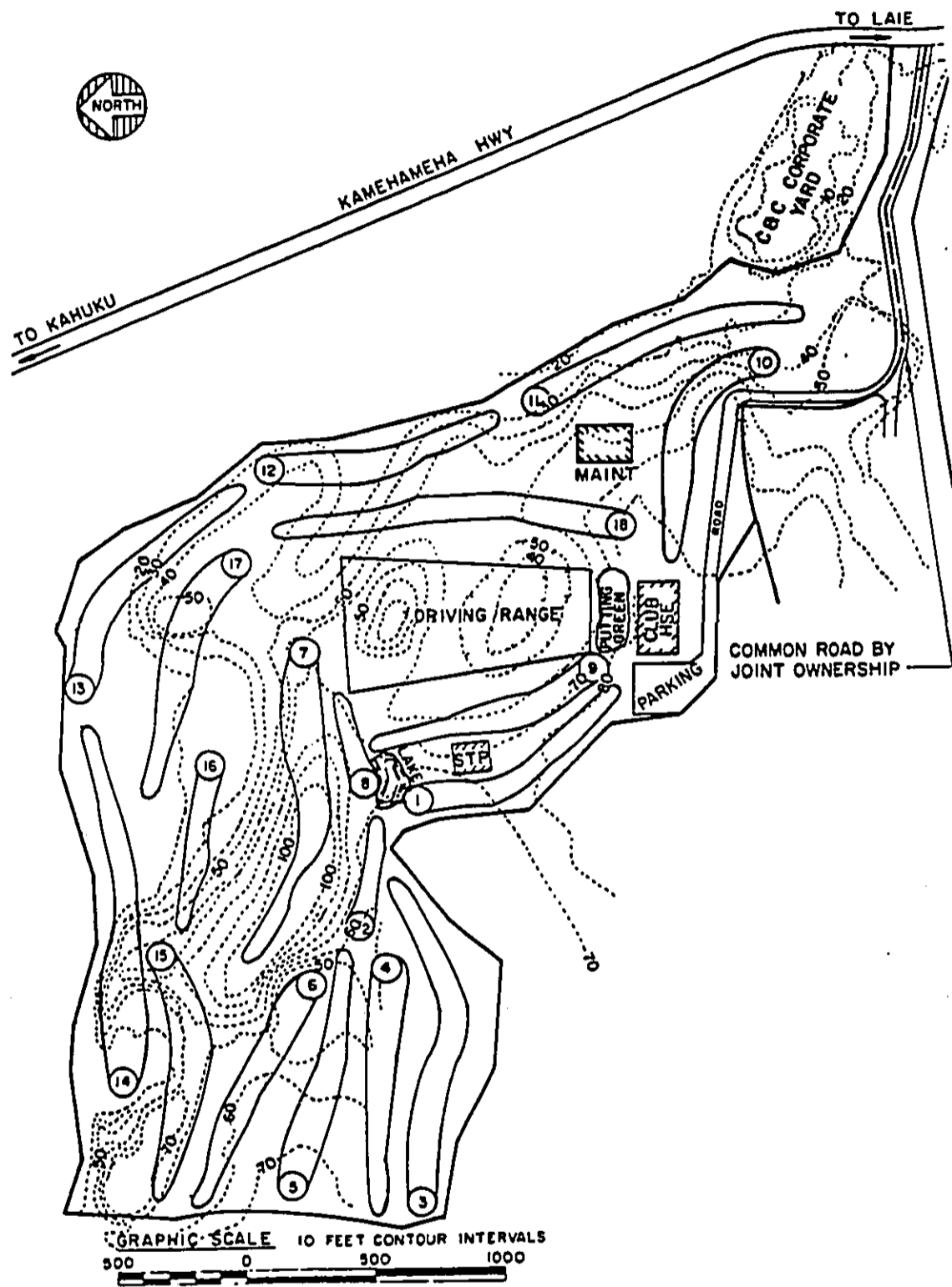
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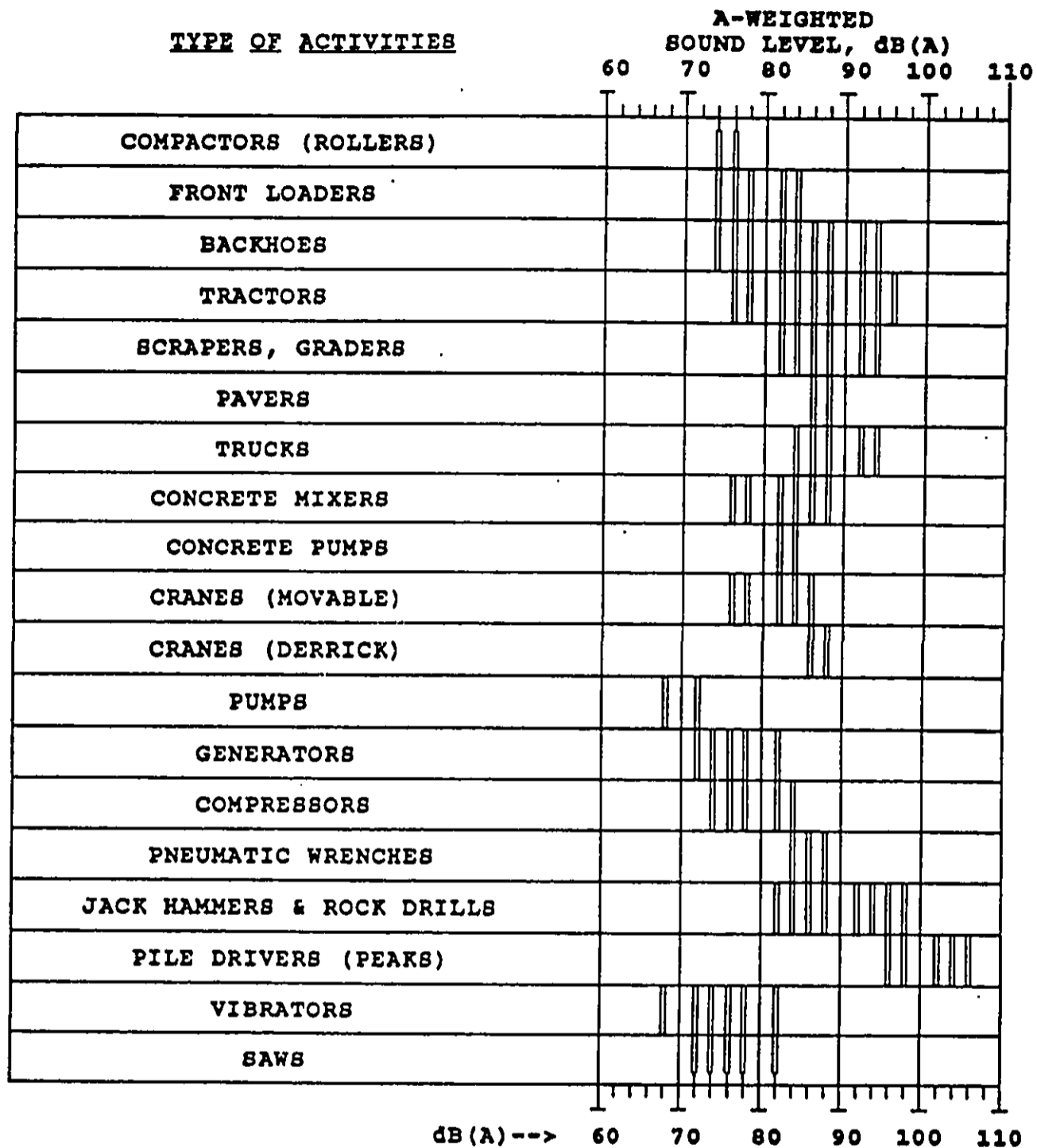
Figure 1 Location of the Project Site
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Figure 2 Project Layout



CONSTRUCTION EQUIPMENT NOISE RANGES

NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

APPENDIX I

A-WEIGHTED SOUND LEVEL

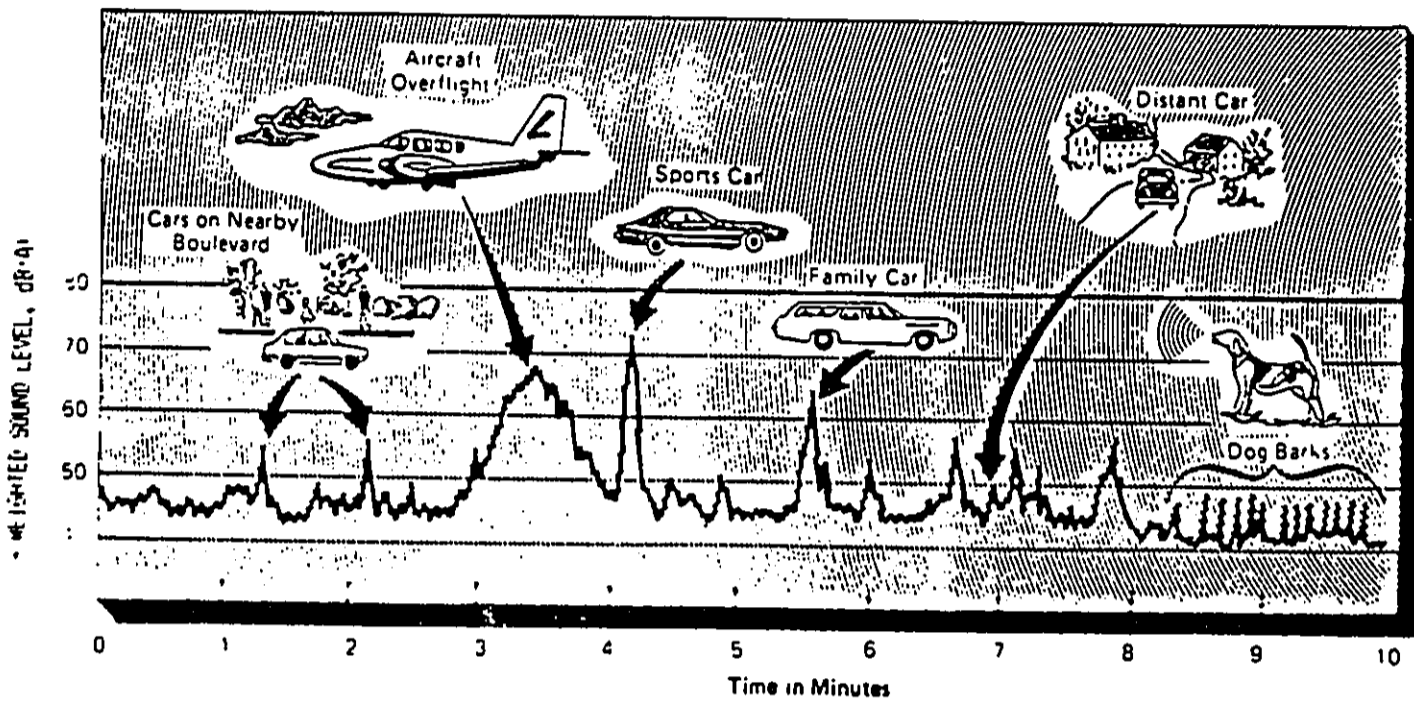
The human ear is more sensitive to sound with frequencies above 1000 cycles per second, or Hertz (Hz), than with frequencies below 125 Hz. Due to this type of frequency response, a weighting system, namely a A-weighting, was developed to approximate the sound response of the human ear. A-weighted sound level is a single number rating of a sound signal which de-emphasizes the low frequency portion of the spectrum of a signal, and is denoted either dB(A) or dBA. The A-weighted sound pressure levels of a few typical sources are listed in Figure I-1.

The A-weighted sound levels of long term noise producing activities such as traffic movement, aircraft operations, etc. can vary considerably with time. In order to obtain a single number rating of such a signal, several special noise indices have been developed and instrumentation are available to measure them. The following are two of commonly used noise indices:

- * **Leq** -- The Equivalent A-weighted sound level (the energy averaged level)
A single number rating which represents the fluctuating sound signal measured over a given time period as a constant level with the same amount of the total acoustic energy during that period (refer to Figure I-2). In this report, Leq assume a measurement period of one hour. This number is widely used to assess community noise annoyance and hearing damage potential.

- * **Ln** -- The A-weighted exceedence level
A single number rating which represents a A-weighted sound level that is exceeded for n% of total samples taken. For example, an L10 of 60 dB(A) for a traffic noise measurement for 20 minutes would mean that 10 percent of all the noise signals measured during the 20 minute period exceeded 60 dB(A). Note that 'n' can take any values (usually integers) between 1 and 99, where L1 and L99 represent the near maximum and the near minimum sound levels, respectively. This number is primarily used to assess community noise annoyance.

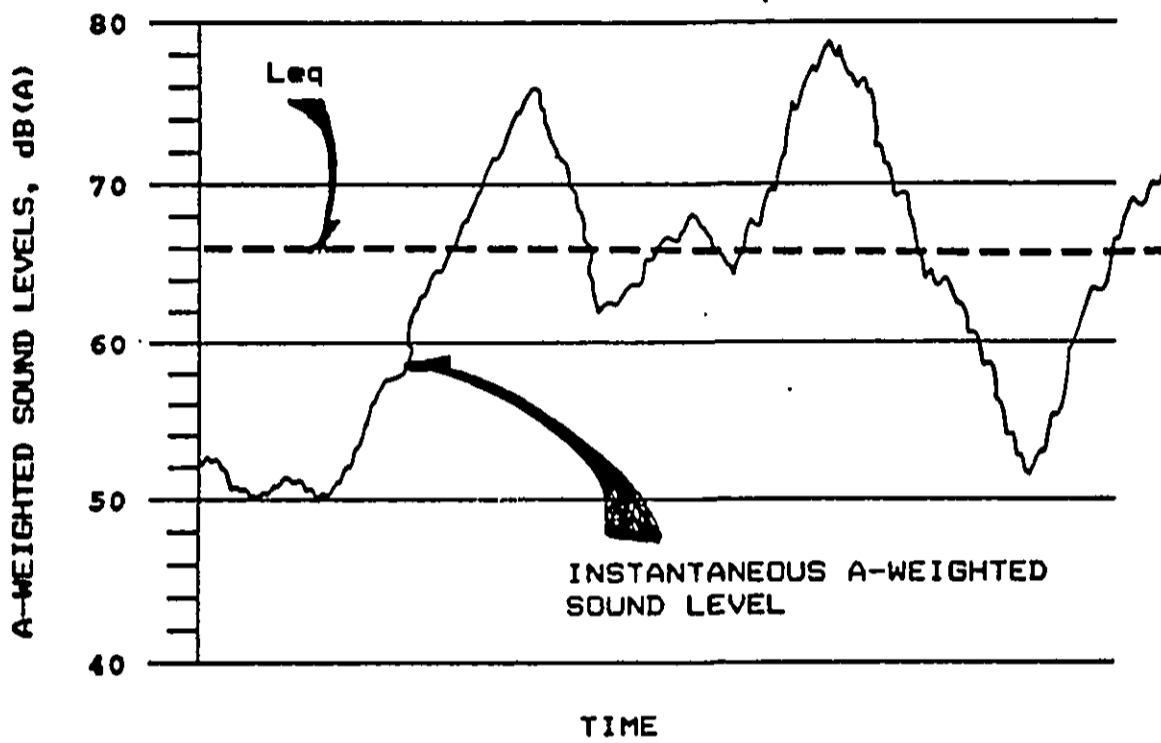
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FIGURE I-1. TYPICAL OUTDOOR A-WEIGHTED SOUND LEVELS MEASURED ON A QUIET SUBURBAN STREET

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FIGURE 1-2. COMPARISON OF THE INSTANTANEOUS A-WEIGHTED SOUND LEVELS AND THE L_{eq}

APPENDIX II
MEASUREMENT DATA LISTING

<u>Table</u>	<u>Descriptions</u>
1.	A-Weighted Ambient Noise Measurement Data, Position 1
2.	A-Weighted Ambient Noise Measurement Data, Position 2
3.	A-Weighted Ambient Noise Measurement Data, Position 3
4.	A-Weighted Ambient Noise Measurement Data, Position 3A
5.	A-Weighted Ambient Noise Measurement Data, Position 4
6.	A-Weighted Ambient Noise Measurement Data, Position 5
7.	A-Weighted Ambient Noise Measurement Data, Position 6
8.	A-Weighted Ambient Noise Measurement Data, Position 7
9.	A-Weighted Ambient Noise Measurement Data, Position 8
10.	Traffic Noise Measure Data, Position 9
11.	Traffic Noise Measure Data, Position 10

Sheet II-1 -- Notes and Legend for Tables 1 through 9

Figure II-1 -- Location of the Measurement Positions

TABLE 1 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAHUKU ENERGY PROJECT, LOCATION 1, HOSPITAL

Meas. Period	1981 Date	Start Time	Noise Levels - dBA							Traffic**					Meteorological Data					Dominant Source**	NOTES					
			L ₉₉	L ₉₀	L ₅₀	L ₃₃	L ₁₀	L _{max}	L _{eq}	Car	Pick up	Van	Trk	Cycle	Plane	Wind mph	°	RH %	Pressure in. of HG			Cloud Cover %	*** Surf			
Thur "DAY"	11/12	1430	44	45	48	50	56	70	54.7	(4)	5	1	3	1	1	8	90	88	53	30.75		H	T	A	S	
Fr 1 "DAY"	11/13	1500	42	44	47	49	54	63.1	51.1	(3)	(3)	(2)				6-8	90	82	62	30.57		H	T	S	P	
Sat "DAY"	11/14	1150	43	45	49	50	52	60.1	50.4	(1)	4	3				5-6	45	77	74	30.62		M	T	S	M	1
Sat "NIGHT"	11/14	2140	46	46	48	48	49	51.1	48.3	9	1					45	45	70	75	30.58		M	T	S	M	
Sun "NIGHT"	11/15	2230	41	41	42	42	44	53.1	43.3	(1)	1					6-9	90	70	74	30.56	90	M	T	P	S	
Mon "DAY"	11/16	1300	45	46	48	50	57	67.1	53.4	(7)	(1)	(1)	(1)	1	1	7	90	78	75	30.54	95	M	A	T	S	
Mon "NIGHT"	11/16	1310	44	46	48	49	54	66.1	51.9	(5)	(5)	(1)	3	4		7	90	78	75	30.54	95	M	T	S	P	
Wed "NIGHT"	11/18	2210	41	42	43	44	46	59.1	45.5	(2)				1	1	8	90	68	84	30.60		M	T	S	P	1
11/19	0300	40	41	41	41	42	49.1	42.0	1						6	90	73	84	30.62		M	S	T	P		

TABLE 2 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KARIUKU ENERGY PROJECT, LOCATION 2, CONDO

Meas. Period	1981 Date	Start Time*	Noise Levels - dBA							Traffic**				Meteorological Data					Dominant Sources* 1 2 3	NOTES					
			L ₉₉	L ₉₀	L ₅₀	L ₃₃	L ₁₀	L _{max}	L _{eq}	Car	Pick up	Van	Trk	Cycle	Plane	Mind mph	°F	RH %			Pressure in. of HG	Cloud Cover %	*** Surf		
Thur "DAY"	11/12	1800	44	45	46	46	50	70.1	51.7	1					6	90	74	62	30.72		H	T	S	P	
Fr 1 "DAY"	11/13	1100	45	46	49	50	53	67.1	51.9	1					8	90	80	64	30.62		H	T	M	P	
Sat "DAY"	11/14	0800	41	43	46	48	52	71.1	52.3		(11)				<5	68	76	30.60		M	P	T	S		
Sat "NIGHT"	11/15	0810	43	44	46	47	51	59.1	49.6						<5	68	76	30.60		M	P	T	S		
		0240	50	51	52	53	54	55.1	53.2						<5	66	78	30.62		M	S	P		2	
		0250	51	52	54	54	55	56.1	54.1						<5	66	78	30.62		M	S	P		2	
Sun "NIGHT"	11/16	0220	41	42	43	44	44	54.1	44.0						6-7	90	69	81	30.54	80	M	M	P	S	
		0230	40	41	42	43	44	59.1	43.6						6-7	90	69	81	30.54	80	M	P	M	S	
Mon "DAY"	11/16	1640	45	46	48	49	51	63.1	49.5		(11)				8	90	73	80	30.54		M	T	S	M	
Mon "NIGHT"																					M				
Wed "NIGHT"	11/18	2250	45	46	47	48	49	52.1	48.1						6	90	74	81	30.66	50	M	S	M		
	11/19	0230	43	44	45	45	46	48.1	45.5						6-8	90	74	85	30.64		M	S	M		

TABLE 3 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAHUKU ENERGY PROJECT, LOCATION 3. CABANAS

Meas. Period	1981 Date	Start Time	Noise Levels - dBA										Traffic**					Meteorological Data							Dominant Sources						
			L ₉₉	L ₉₀	L ₅₀	L ₃₃	L ₁₀	L _{max}	L _{eq}	Car	Pick up	Van	Trk	Cycle	Plane	Wind mph	Wind dir	RH %	Pressure in. of HG	Cloud Cover %	Surf ***	1	2	3							
Thur "DAY"	11/12																														
Fr 1 "DAY"	11/13	1130	58	59	60	60	61	63.1	60.5								8	90	81	63	30.62							H	S		
Sat "DAY"	11/14	0830	55	56	57	58	59	77.1	60.5								<5	70	78	30.60							H	S	P	M	
Sat "NIGHT"	11/15	2110	54	55	56	57	59	60.1	57.3								<5	66	78	30.60							M	S			
Sun "NIGHT"	11/16	0150	57	58	59	59	60	60.1	59.4								7-9	90	69	81	30.54							M	S		
		0200	57	57	58	59	59	61.1	59.0								7-9	90	69	81	30.54							M	S		
Mon "DAY"	11/16	1620	58	59	60	61	61	63.1	60.9 (1)								12	90	74	79	30.50			98				M	S	T	
Mon "NIGHT"																												M			
Wed "NIGHT"	11/18	2230	59	60	60	61	62	63.1	61.1								12	90	74	80	30.66							M	S		
	11/19	0220	59	60	61	61	62	64.1	61.6								10-14	90	74	85	30.65							M	S		

TABLE 4 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAHUKU ENERGY PROJECT, LOCATION 3A, HI-RISE

Meas. Period	1981 Date	Start Time	Noise Levels - dBA							Traffic**					Meteorological Data					Dominant Sources				
			L99	L90	L50	L33	L10	Lmax	Leq	Pick up.	Van	Trk	Cycle	Plane	Wind	oF	RH %	Pressure in. of Hg	Cloud Cover %	*** Surf	1	2	3	
			mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph	mph
Thur "DAY"	11/12	2150	60	61	62	63	63	65.1	63.0						8-10	74	64	30.62		H	S			
Fr1 "DAY"	11/13	0800	59	61	62	62	63	65.1	62.8						<5	80	64	30.62		H	S			
Sat "DAY"	11/14																			M				
Sat "NIGHT"																				M				
Sun "NIGHT"																				M				
Mon "DAY"	11/16																			M				
Mon "NIGHT"																				M				
Wed "NIGHT"																				M				

TABLE 5 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAHUKU ENERGY PROJECT, LOCATION 4, KAMELA BAY

Meas. Period	1981 Date	Start Time	Noise Levels - dBA							Traffic**				Meteorological Data					Dominant Source#				
			L ₉₉	L ₉₀	L ₅₀	L ₃₃	L ₁₀	L _{max}	L _{eq}	Car	Pick up	Van	Trk	Cycle	Plane	Wind mph	°F	RH %		Pressure in. of HG	Cloud Cover %	*** Surf	
Thur "DAY"	11/12	1520	50	51	52	53	55	65.1	53.8						2	<5	85	55	30.72		H	S	A
Fri "DAY"	11/13	1430	49	50	51	52	53	56.1	52.1							<5	80	64	30.56		H	S	P
Sat "DAY"	11/14	0910	49	50	52	53	55	63.1	53.6					(1)			73	78	30.62		H	S	
Sat "NIGHT"	11/14	2240	49	50	51	51	52	53.1	51.5							<5	68	78	30.59		M	S	
Sun "NIGHT"	11/15	2250	49	50	51	51	52	54.1	51.3							<5	68	78	30.59		M	S	
Sun "NIGHT"	11/15	2310	47	48	49	49	50	58.1	49.8							<5	71	74	30.60		M	S	
Sun "NIGHT"	11/15	2320	47	48	49	49	50	52.1	49.6							<5	71	74	30.60		M	S	
Mon "DAY"	11/16	1540	49	50	51	52	54	59.1	52.3	(2)				1	<5	75	79	30.50		M	S	A	
Mon "NIGHT"																					M		
Tue "NIGHT"	11/18	2310	48	49	50	51	52	55.1	51.3							<5	74	82	30.66		M	S	
Tue "NIGHT"	11/19	0200	48	49	51	51	52	55.1	51.5							<5	74	83	30.65		M	S	

TABLE 6 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAHUKU ENERGY PROJECT, LOCATION 5, BEACH PARK

Meas. Period	1981 Date	Start Time*	Noise Levels - dBA							Traffic**					Meteorological Data					Dominant Source†	NOTES					
			L99	L90	L50	L33	L10	Lmax	Leq	Pick up	Van	Trk	Cycle	Plane	Wind	RH	Pressure	Cloud	***							
										Car					mph	%	In. of Hg	%	Surf							
Thur "DAY"	11/12	1550	61	62	64	65	67	78.1	66.0	(9)	8	1	1	2	2	8	88	53	30.70		H	S	A	T		
Fri "DAY"	11/13	1323	59	60	62	63	66	73.1	64.3	(4)	4	7	4	4		8	83	56	30.61		H	S	T			
Sat "DAY"	11/14	0950	61	62	63	65	69	84.1	68.6	51	5	1	3			5-7	90	74	75	30.64		M	S	T		
Sat "NIGHT"	11/15	1000	62	63	64	65	67	79.1	66.1	30	2	6	2	1		5-7	90	74	75	30.64		M	S	T		
Sun "NIGHT"	11/16	0050	59	59	60	61	62	70.1	61.5	5						<5	66	78	30.58		M	S				
Mon "DAY"	11/16	0040	58	58	59	60	61	74.1	61.3	4						<5	70	78	30.55	90-100	M	S				
Mon "DAY"	11/16	0050	58	59	60	60	61	68.1	60.7	5						<5	70	78	30.55	90-100	M	S				
Mon "NIGHT"	11/16	1350	59	60	62	63	66	75.1	64.1	(9)	4	5	1			6	90	77	77	30.54	100	M	S	T		
Wed "NIGHT"	11/18	2320	58	59	60	61	63	72.1	62.0	12						<5	74	82	30.64		M	S	T			
11/19	0050	58	59	60	60	61	67.1	60.7	1							<5	72	82	30.62		M	S				

TABLE 7 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAHUKU ENERGY PROJECT, LOCATION 6, MAIALEE, MAUKA

Meas. Period	1981 Date	Start Time	Noise Levels - dBA							Traffic**					Meteorological Data					Dominant Sources					
			L99	L90	L50	L33	L10	Lmax	Leq	Car up	Pick up	Van	Trk	Cycle	Plane	Wind mph	0	RH %	Pressure in. of HG	Cloud Cover %	Surf	1	2	3	
Thur "DAY"	11/12	1620	51	51	53	54	56	63.1	54.5	(2)	(1)	2	3	1	1	6-9	45	82	53	30.64		H	T	A	S
Fr1 "DAY"	11/13	1300	48	49	51	53	57	78.1	58.5	(2)	3	2	4	1	1	6-11	90	86	52	30.58		H	A	T	S
Sat "DAY"	11/14	1020	54	54	55	56	57	73.1	57.3	(2)	5	1	2			5-8	90	74	76	30.62		M	T	S	P
Sat "NIGHT"	11/14	1030	54	54	55	55	57	71.1	56.8	(1)	3	2		1	1	5-8	90	74	76	30.62		M	T	S	P
Sun "NIGHT"	11/15	2340	47	48	49	50	53	63.1	51.7	4						<5	78	70	30.58		M	S	T	2	
Sun "NIGHT"	11/15	2350	47	48	49	50	52	63.1	51.3	13						<5	78	70	30.58		M	S	T	2	
Mon "DAY"	11/16	1410	48	49	53	54	60	70.1	57.7	(3)	(1)	6	3	2	2	7-11	90	76	78	30.51		M	A	T	S
Mon "NIGHT"	11/16	1420	49	50	53	55	59	70.1	56.6	(1)	(2)	2	4	2	2	7-11	90	76	78	30.51		M	A	T	S
Wed "NIGHT"	11/18	2340	46	47	48	49	52	64.1	50.6	(1)						5-8	90	74	82	30.66		M	T	S	M
11/19	0120	46	47	48	48	49	66.1	49.3	2						<5	72	84	30.61		M	S	T	M		

TABLE 8 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAHUKU ENERGY PROJECT, LOCATION 7, MAIALEE, MAKAI

Meas. Period	1981 Date	Start Time	Noise Levels - dBA										Traffic**					Meteorological Data					Dominant Source 1 2 3	NOTES		
			L99	L90	L50	L33	L10	Lmax	Leq	Pick up	Car	Van	Trk	Cycle	Plane	Wind mph	O F	RH %	Pressure in. of Hg	Cloud Cover %	*** Surf					
Thur "DAY"	11/12	1650	47	48	50	51	55	70.1	55.1	48	(1)	9	2	1	3	6-9	45	78	57	30.65		H	A	T	S	
Fr1 "DAY"	11/13	1240	46	47	51	53	61	75.1	59.8	55	5	3	5	1	1	6-10	45	88	48	30.64	<10	H	A	T	S	
Sat "DAY"	11/14	1050	44	46	50	51	53	71.1	54	46	(1)	6	3			8	90	78	73	30.66		M	T	S		
Sat "NIGHT"	11/15	0020	47	48	50	52	57.1	51.0	6	1						5	68	76	30.56		M	S	T	2		
Sun "NIGHT"	11/16	0030	48	48	50	51	52	55.1	51.1	4	1					5	68	76	30.56		M	S	T	2		
Sun "NIGHT"	11/16	0010	45	46	47	47	48	54.1	47.6	2						6	90	71	78	30.56	90	M	S			
Sun "NIGHT"	11/16	0020	46	46	47	48	48	56.1	48.0	2	1	1				6	90	71	78	30.56	90	M	S			
Mon "DAY"	11/16	1440	45	46	51	53	60	85.1	60.9	74	(1)	7	5	1	1	5	73	78	30.50	100	M	A	T	S		
Mon "NIGHT"	11/16	1450	46	47	51	53	57	74.1	56.8	45	(1)	1	7	1	1	5	73	78	30.50	100	M	T	S			
Wed "NIGHT"	11/19	0000	42	43	44	45	48	56.1	46.5	7	1	1				7	90	74	84	30.62		M	T	S	M	
Wed "NIGHT"	11/19	0140	44	45	45	46	46	51.1	46.1							5-8	90	74	82	30.62		M	S			

TABLE 9 - "A" WEIGHT AMBIENT NOISE LEVEL DATA - KAIROKU ENERGY PROJECT, LOCATION 8, CORNFIELD

Meas. Period	1981 Date	Start Time	Noise Levels - dBA						Traffic				Meteorological Data					Dominant Source	NOTES						
			L ₉₉	L ₉₀	L ₅₀	L ₃₃	L ₁₀	L _{max}	L _{eq}	Pick up	Van	Trk	Cycle	Plane	Wind mph	°F	RH %			Pressure in. of Hg	Cloud Cover %	Surf			
Thur "DAY"	11/12	1730	54	54	55	55	55	56.1	55.5	50	2	4	2	7-8	90	78	58	30.67		H	S	M	T		
Fr 1 "DAY"	11/13	1410	43	44	46	47	76	77.1	64.3	48	6	7	3	1	8-10	90	82	59	30.56		H	A	P	S	
		1630	54	54	54	55	56	60.1	55.8	49	10	3	1	8	90	82	58	30.60		H	S	T	M		
Sat "DAY"	11/14	0930	48	49	50	55	55	56.1	53.4	45	3	3	3	6-7	90	74	77	30.64		M	S	T	M		
Sat "NIGHT"	11/15	0140	50	51	53	53	55	57.1	53.8	9				6-7	90	66	78	30.56		M	S		2		
Sun "NIGHT"	11/16	0120	40	41	42	42	43	48.1	42.7	6										M					
		0130	41	42	42	43	43	48.1	43.1	1				7	90	70	82	30.54		M	S				
Mon "DAY"	11/16	1510	46	47	48	49	50	57.1	49.3	52	8	2	6	1	7	90	70	82	30.54		M	S			
		1520	45	46	48	49	59	77.1	58.6	42	2	4		9-10	90	75	80	30.50	100	M	S	T	A		
Mon "NIGHT"														1	9-10	90	75	80	30.50	100	M	A	S	T	A
Wed "NIGHT"	11/19	0020	41	43	46	46	46	48.1	46.1	3										M					
		0030	39	40	45	46	46	54.1	45.5	2				7	90	74	82	30.64		M	M	S			
														7	90	74	82	30.64		M	M	S			

SHEET II-1

NOTES

* Start time for the 10-minute sample period.

** Traffic counts are on the highway. () is count of vehicles moving off the highway on side roads or parking lot. "Trucks" include buses. Planes are either 1 or 2 prop fixed wing aircraft or helicopters.

*** Surf heights are: H = 11' to 15', M = 6' to 10',

+ Dominant Noise Sources: S = Surf
T = Traffic
A = Aircraft
N = Natural Sources
P = Miscellaneous Sources

1. Highway pavement sufficiently wet to increase traffic noise.
2. Higher than normal surf noise levels believed due to sound refraction caused by thermal inversion.
3. Threshing machine in field.
4. Helicopter noise dominated sample.

TABLE 10

TRAFFIC NOISE MEASUREMENT DATA

PROJECT NO.: 88-50

MEASUREMENT DATE: December 21, 1988

MEASUREMENT PERIOD: 20 minutes

NOISE SOURCE: Traffic on Kamehameha Highway

REMARKS: _____

MEASUREMENT LOCATION: Position No. 9

MEASUREMENT RESULTS

Leq: 63.9 dB(A)	NO. OF PASSENGER AUTO COUNTED: 222
	NO. OF PASSENGER AUTO / HOUR: 666
Lmax: 85.3	NO. OF MEDIUM TRUCKS COUNTED: 4
	NO. OF MEDIUM TRUCKS / HOUR: 12
POSTED	NO. OF HEAVY TRUCKS COUNTED: 4
SPEED: 35 MPH	NO. OF HEAVY TRUCKS / HOUR: 12
ESTIMATED	TOTAL NO. OF VEHICLES COUNTED: 230
AVERAGE	TOTAL NO. OF VEHICLES / HOUR: 690
SPEED: 35-40 MPH	

MIC. DISTANCE TO THE SOURCE: 65 feet

MIC. HEIGHT RELATIVE TO THE SOURCE: 7 feet

TABLE 11

TRAFFIC NOISE MEASUREMENT DATA

PROJECT NO.: 87-41

MEASUREMENT DATE: February 18, 1988

MEASUREMENT PERIOD: 10 minutes

NOISE SOURCE: Traffic on Kamehameha Highway

REMARKS: _____

MEASUREMENT LOCATION: Position No. 10

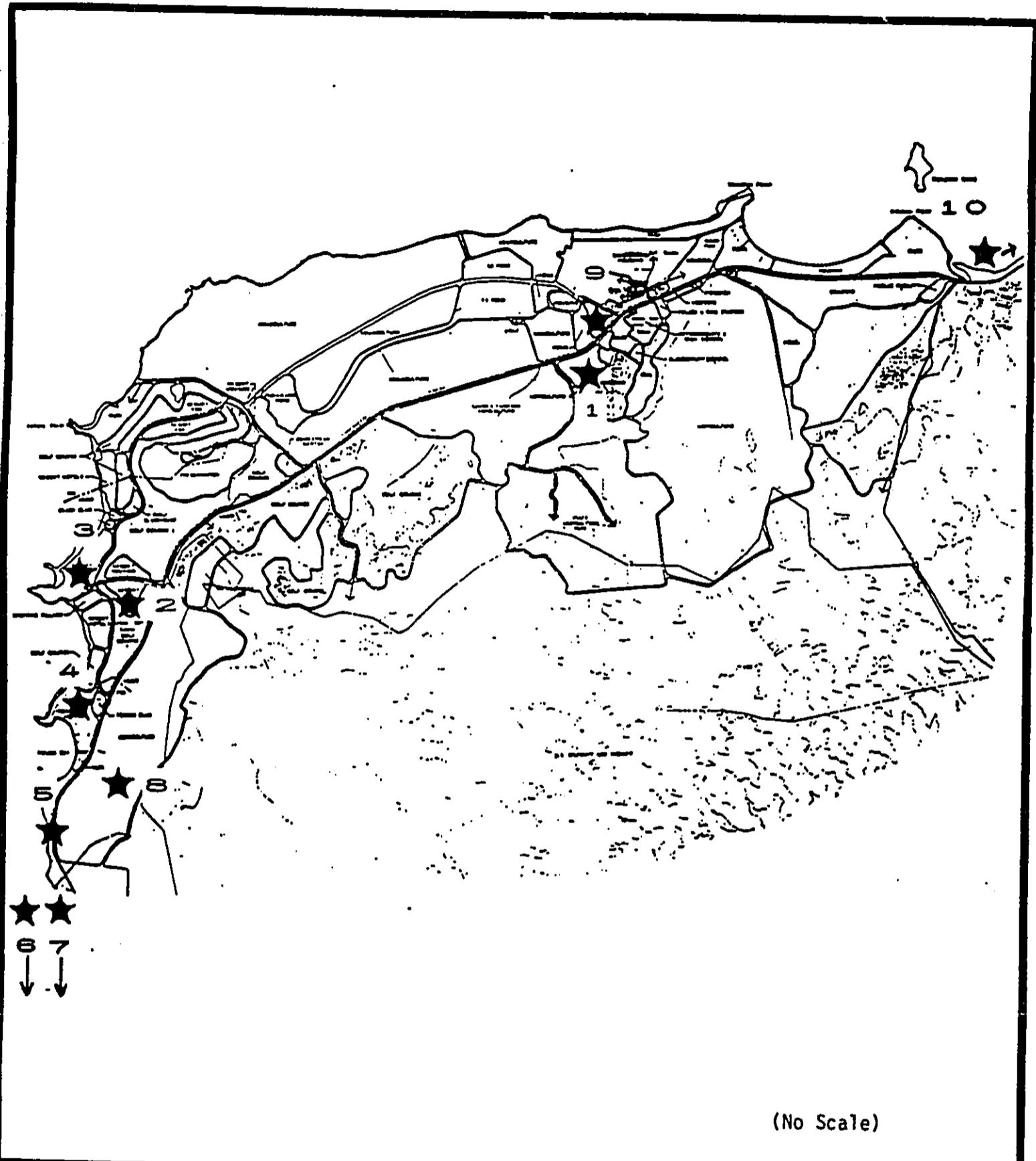
MEASUREMENT RESULTS

Leq: 61.3 dB(A)	NO. OF PASSENGER AUTO COUNTED: 81
	NO. OF PASSENGER AUTO / HOUR: 486
Lmax: 75.3	NO. OF MEDIUM TRUCKS COUNTED: 1
	NO. OF MEDIUM TRUCKS / HOUR: 6
POSTED	NO. OF HEAVY TRUCKS COUNTED: 1
SPEED: 35 MPH	NO. OF HEAVY TRUCKS / HOUR: 6
ESTIMATED	TOTAL NO. OF VEHICLES COUNTED: 83
AVERAGE	TOTAL NO. OF VEHICLES / HOUR: 498
SPEED: 35-40 MPH	

MIC. DISTANCE TO THE SOURCE: 119 feet

MIC. HEIGHT RELATIVE TO THE SOURCE: not recorded

RECEIVED AS FOLLOWS



 **DARBY & ASSOCIATES**
ACOUSTICAL CONSULTANTS

FIGURE 11-1. LOCATION OF MEASUREMENT POSITIONS



**DARBY
& ASSOCIATES**
ACOUSTICAL CONSULTANTS

RESUME OF RONALD A. DARBY, P.E.

- EDUCATION:** B.S. in Mechanical Engineering, Pennsylvania State University, 1954. M.S. in Engineering, 1967, and all course work for Doctor of Engineering at Catholic University, Washington, D.C., Graduate courses at University of Maryland and the University of Hawaii.
- PROFESSIONAL ENGINEER:** State of Hawaii, PE 3002-E
State of Maryland, PE 6482-ME
- PROFESSIONAL AFFILIATION:** Member of Acoustical Society of America, National Society of Professional Engineers, Tau Beta Pi, and Pi Tau Sigma.
- 1970 TO PRESENT:** President of Darby & Associates* which specializes in acoustics and noise control engineering. Airport, community and industrial noise exposure measurements, evaluations, and studies have been performed in the Hawaiian Islands, Guam and the mainland U.S.A. Architectural and mechanical equipment noise control efforts have been made for new and existing building projects in the Pacific Basin, mainland U.S.A. and Japan.
- 1967 TO 1970:** Research Scientist, LTV Research Center, Hawaiian Division. Involved in all phases of deep ocean underwater acoustic measurement exercises: planning, data collection, data processing (analog and digital), analysis, and reporting. Typical results were long range sound transmission loss values, ambient noise levels and source levels. Developed unique method to measure radiated noise levels of submarines using aircraft. Served as a member of Tactical Analysis Group for Commander, Anti-submarine Warfare Forces, Pacific at Pearl Harbor.
- 1960 TO 1967:** Research Mechanical Engineer at the Marine Engineering Laboratory Annapolis, Maryland (Now NSRDC). Was technical secretary for the "Submarine Noise Measurement Panel", Committee of Undersea Warfare, National Academy of Science for one and a half years. Developed practical technique for predicting radiated noise from ship's machinery. Developed laboratory techniques and special transducers for measuring structural noise transmission from machines. Created technological forecasts and cost effectiveness studies on machinery noise. Devised practical experiments to evaluate machinery noise quieting devices, i.e., isolation mounts, flexible hoses, sound enclosures, etc.
- 1959 TO 1960:** Engineer at Westinghouse Electric Corp., Defense Center, Baltimore, Maryland. Team member in developing high frequency sonar transducers for Navy Applications.

* Formerly Ronald A. Darby & Associates and Darby-Ebisu & Associates, Inc.

PALI PALMS PLAZA • 970 NO. KALAHEO AVENUE • SUITE A-311
KAILUA, HAWAII 96734 • (808) 254-3318

- 1957 TO 1959: Research Engineer at Chesapeake Instrument Corp., in Shadyside, Maryland. Initiated program in study of dynamic mechanical properties of elastomers. Developed new products, i.e., hydrophones, accelerometers, special microphones, etc.
- 1956 TO 1957: Engineer in Vitro Corporation in Silver Springs, Maryland. Involved in acoustic homing torpedo development.
- 1955 TO 1956: Engineer at ERCO in Riverdale, Maryland. Did original development of novel techniques to simulate missile noise cone heating.
- 1954 TO 1955: University of Maryland, College Park, Maryland. Instructor. Taught full time in C.E. Department: Undergraduate Strength of Materials, Statics and Dynamics and Elementary Surveying.
- PATENTS,
AWARDS, ETC: Four patent grants; one patent pending; George Melville Award "for distinguished scientific and engineering achievement" at MEL in 1963; Severn Technical Society Award for Best Technical Paper at MEL in 1964.
- MAJOR REPORTS
AND
PUBLICATIONS:
1. National Academy of Science Panel, "Measurement of Submarine Radiated Noise," NRC: CUW: 0331, Oct 1966 (Confidential).
 2. R.A. Darby, "A Practical Method for Predicting Acoustic Radiation or Shock Excursions of Navy Machinery," Part 3, 34 Shock and Vibration Bulletin, The Shock and Vibration Information Center, USNRL, Dec. 1964.
 3. H.A. Deferrari, R.A. Darby and F.A. Andrews, "Vibrational Displacement and Mode-Shapes Using a Laser Interferometer." J.A.S.A. Vol 42, No. 5, November 1967.
 4. R.A. Darby, "Noise from Sugar Operations in Hawaii - A Study of the Extent and Effect on the Community," January 1971.
 5. R.A. Darby, "A Study of Noise in the Kalihi-Palama Area and Practical Soundproofing of Housing," March 1971.
 6. R.A. Darby, "Typical Noise Problems and Some Practical Solutions," Hawaiian Sugar Technicians Symposium, November 1972.
 7. R.A. Darby, "Mechanical Impedance Measurements in Foundation Studies," Part 4, 33 Shock and Vibration Bulletin, The Shock and Vibration Information Center, USNRL, March 1964.
 8. R.A. Darby, "The Quantitative Evaluation of Vibration Isolation Devices for Mounted Machinery Installations," MEL Report 82-287E. August 1963.
 9. Film "Fundamental of Mechanical Impedance - Concepts Applicable to Ship Silencing," Navy Training Film MN9960.



RESUME OF JOHN C. SHEARER

- EDUCATION:** B.E. (Hons) in Mechanical Engineering, University of Adelaide, Australia, 1970.
M.Sc. in Engineering Acoustics, University of Southampton, U.K., 1975.
- PROFESSIONAL AFFILIATIONS:** Member of the National Association of Acoustical Consultants. Member of the Australian Acoustical Society. Member of the Institution of Engineers, Australia.
- 1989 to Present:** Senior Consultant, Darby and Associates.
- 1988 to 1989:** Senior Consultant, Richard Heggie Associates Pty. Ltd., Sydney, Australia. Involved in preparing guidelines for residential development in areas affected by aircraft noise; environmental noise impact assessments for proposed hotels, commercial and industrial developments; architectural acoustics and mechanical noise control for high rise office buildings, hotels and television studios; engineering noise control, including design of specialized acoustic enclosures.
- 1985 to 1988:** Senior Consultant, Wilson, Ihrig & Associates, Inc., Oakland, California. Involved in assessing the noise and vibration impact of new rapid transit systems throughout the U.S. Also involved in assessing the community noise impact of helicopter operations; analysis of existing and projected noise levels at proposed residential developments potentially impacted by aircraft noise; prediction of the environmental noise impact of proposed motor sport raceways; analysis of building sound isolation requirements; design of acoustic enclosures for pumps, compressors, etc.; sound and impact isolation measurements in condominium apartments, and preparation of recommendations on means of upgrading performance to code requirements.
- 1977 to 1984:** Director, Shearer-Gardner Pty. Ltd., Adelaide, Australia. Involved in the design and



conformance testing of fan silencers and high performance natural gas blowdown attenuators; design, letting of sub-contracts for and conformance testing of specialized acoustic enclosures; studies of existing ambient noise levels in areas potentially impacted by noise from new transportation systems, assessment of the environmental noise impacts of alternative transportation systems and design of noise control measures to minimize passby noise levels; design of modifications to improve acoustics in existing radio and television studios; design of new television studio facilities, letting of sub-contracts, supervision of installation and final conformance measurements.

1975 to 1977: Branch Manager, Vipac and Partners Pty. Ltd. Adelaide, Australia. General consulting in environmental and industrial noise control and architectural acoustics.



RESUME OF MIKE SANG LEE

**WORK
EXPERIENCE**

- o December 1988 - Present
Senior Acoustical Consultant
Darby & Associates, Kailua, Hawaii

Conducted noise studies for projects in the Hawaiian Islands in the following areas of acoustics: field noise measurements, impact assessment analysis and research, noise and vibration mitigation measures. The studies involved noise sources such as aircraft, traffic, machinery, musical performance, and construction activity.

- o October 1985 - November 1988
Senior, Associate Acoustical Engineer
J.J. Van Houten & Associates, Anaheim, CA

Performed noise studies in the following areas of acoustics: field noise and vibration measurements; impact assessment analysis; mitigation measures for noise sources such as aircraft, arterial, trains, mechanical equipment and industrial plants; noise tests for compliance with standards; noise element studies.

EDUCATION

University of Wisconsin-Madison, Madison, WI
January '83 - May '85
Degree: Master of Arts - may '85
Major: Mathematics with emphasis on
Numerical Analysis

University of Hawaii at Manoa, Honolulu, HI
January '77 - December '82
Degree: Bachelor of Science
Major: Mathematics and Physics

**PROFESSIONAL
AFFILIATION**

Associate member of Acoustical Society of America (ASA); March '87 - present

Affiliate member of Institute of Noise Control Engineering (INCE); Jan. '88 - pres.



**DARBY
& ASSOCIATES**
ACOUSTICAL CONSULTANTS

- REPRESENTATIVE STUDIES**
1. Noise Impact Evaluation for Proposed West Maui Marina, Launiupoko, Maui
 2. Noise Impact Evaluation for Environmental Assessment, Waikoloa Beach Resort, Hawaii
 3. Noise Impact Evaluation for Proposed Kahuku Golf Courses, Kahuku, Oahu
 4. Waikiki Shell Improvement, Honolulu, Oahu
 5. Waikiki Shell Litigation, Honolulu, Oahu
 6. Kona Alii Condominium Equipment Noise, Kailua-Kona, Hawaii
 7. Kamehameha School Hearing Screening Research, Oahu
 8. State of Hawaii Helicopter System Plan Review
 9. Rooftop A/C Unit for a Learning Center, Honolulu, Hawaii
 10. Fire Alarm System, Ritz Carlton Hotel, Kona, Hawaii
 11. Helicopter Noise Contour Calculation, Princeville, Kauai
 12. Chaminade PRU Noise Impact Evaluation, Honolulu, Oahu
 13. HECO 138 kV Transmission Line Construction Noise Study, Honolulu, Oahu
 14. Sound Transmission Class Testing, Four Seasons Hotel, Wailea, Maui
 15. Kohala Helistop Noise Contour Calculation, Kohala, Hawaii
 16. Aircraft Noise Measurement and Impact Evaluation, Kauai Lagoon Golf Course
 17. Diesel Generator, Outrigger Hotel, Honolulu, Oahu

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX F

**VIEW ASSESSMENT, COUNTRY
COURSES AT KAHUKU,
MALAEKAHANA GOLF COURSE**

Michael S. Chu, Land Architect

APPENDIX F

VIEW ASSESSMENT
Country Courses at Kahuku, Malaekahana Golf Course
Koolauloa, Oahu, Hawaii

prepared by: MICHAEL S. CHU, LAND ARCHITECT
prepared for: THE ESTATE OF JAMES CAMPBELL
DEC. 1989

VISUAL ASSESSMENT for the MALAEKAHANA GOLF COURSE

Note: Figures referred to in this assessment are located in Volume I, Country Courses at Kahuku, Malaekahana.

1. Purpose and Context of Assessment

The purpose of this assessment is to evaluate the potential visual impacts of the proposed County Courses at Kahuku, Malaekahana Golf Course. This assessment identifies potential impacts relative to existing open space, scenic and other visual resources in the project area, pertinent policies and objectives, and proposes mitigations measures where applicable.

This assessment is conducted within the context of (a) existing visual conditions and (b) current State and City/County development plans and policies relating to visual quality.

It should be noted that all of the project's site development and building design details have not yet been determined at this early stage of the land planning/permit process. Given the nature of this project, however (golf course, clubhouse and appurtenances), sufficient data exists for the preparation of a meaningful visual impact analysis and mitigative guidelines. Further detailed visual assessments will be considered by the applicant's professional team in locating and designing project features which may affect public views.

2. Project Location and General Setting

The 200 acre amendment area is an irregular shaped property, located at the north end of the windward side of Oahu, in the Koolauloa Development Plan (DP) district (see Figures 1 and 2). The property lies on the mauka side of Kamehameha Highway, between the rural communities of Laie and Kahuku. It is opposite the Malaekahana State Recreational Area.

The amendment area has a "flag shaped" configuration, and is linked to the highway via a narrow strip of land which provides access to the upper portions of the site. This point of connection to the highway borders the urban fringe of the Laie community and is adjacent to a City and County Corporate Yard.

The majority of the site lies approximately 600 to 800 feet mauka of the highway on low rolling foothills at the base of a lateral ridge of the Koolau Mountains. It is surrounded on

its northwest, northeast and southeast sides by the long flat Kahuku Coastal Plain. Diversified agriculture, including the State's Kahuku Agricultural Park, dominates this plain northwest of the site.

The State Land Use map (Figure 2) places the amendment area within the agricultural district. The stem of the property however abuts the urban boundary at the highway.

As illustrated by Figure 3, Koolauloa DP Land Use map, the amendment area is part of a large stretch of agriculture designated land which lies mauka of the highway between Laie and Kahuku. The current zoning along this 1.5 mile stretch is Ag-1 and Ag-2. The amendment area itself is zoned Ag-2. The makai side of the highway is designated residential and park by the DP, and zoned residential and P-2 accordingly. The amendment area lies outside of the Special Management Area (SMA).

The Koolauloa Public Facility map identifies a golf course development (private funding, no time schedule) at the site location (see Figures 3 and 4). This proposed amendment to the Koolauloa DP Land Use Map (Country Courses at Kahuku, Malaekahana Golf Course) is intended to implement the PF designation. A second golf course in the near vicinity is currently proposed by others. This second course is delineated on Figures 3 and 4. No other public facilities are currently identified on the Public Facility map.

ALISH soil classifications indicate most of the site containing "unique agricultural land" with minor pockets of "prime agricultural land" and unclassified lands (see Figure 8).

The 1972 Detailed Land Classification prepared by the Land Study Bureau denotes most of the amendment area containing E115 type soils which are described as being rocky, well-drained and of the lowest overall productivity rating (see Figure 7). Pockets of B24i, B25i and B27i type soils are found where sugar cane crops were once in production.

Based on Federal Insurance Rate Maps, most of the amendment area lies outside the 500 year flood plain (Zone X) or in areas in which flood hazards have not been determined (see Figure 8).

Figures 10- 13 provide graphic information concerning the visual character of the amendment area and its regional context.

3. Visual Description of the Project

The proposed project will consist of the construction and operation of a 200 acre golf course, to include a clubhouse, maintenance building and yard, driving range, sewage treatment plant, and an entry/access road which intersect Kamehameha Highway. The location of the entry/access road is adjacent to the City and County Corporate Yard. The locations of these features are shown on the Preliminary Site Plan (Figure 9). Photos E and F of Figure 12 further illustrates the visual character of the highway at this point of connection. Much of the heavy vegetation is contributed to landscape screening at the City and County Corporate yard.

The maintenance facility would be located approximately 1200 feet from the highway at an elevation of 60 feet. The clubhouse would be located 2000 feet from the highway at an elevation of 80 feet. The highway elevation is approximately 15 feet.

Approximately half of the amendment area would be graded, contoured and landscaped; the balance of the site would remain in its natural state. Included in these project improvements is an entrance off of Kamehameha Highway, which would have a sign and landscaping. Night lighting would be provided at this entry, along the on-site roadway, and at the clubhouse area (but not at the driving range).

The golf course (along with its associated access road, clubhouse, driving range, maintenance facilities, etc.) would be constructed over a time period of 18-24 months.

4. Applicable Policies & Land Use Controls

State and City/County policies regarding public views, open space, scenic resources and overall visual quality are as follows:

Hawaii State Plan (HRS Chapter 226)

The Hawaii State Plan, recognizing the need to "...provide for wise use of Hawaii's resources and to guide the future development of the State," identifies several Goals, Objectives, Policies and Priorities for the State. Those which are relevant to this report are as follows:

SEC.226-4 State Goals

(2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of people.

SEC.226-12 Objective and policies for the physical environment - scenic, natural beauty, and historic resources

(a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historic resources.

(b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:

(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

(5) Encourage the design of developments and activities that complement the natural beauty of the islands.

SEC.226-23 Objective and policies for socio-cultural advancement - leisure

(a) Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

(b) To achieve the leisure objective, it shall be the policy of this State to:

(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historic, geological, or biological values while ensuring that their inherent values are preserved.

SEC.226-104 Population growth and land resources priority guidelines

(b) Priority guidelines for regional growth distribution and land resources utilization:

(10) Identify critical environmental areas in Hawaii to include but not be limited to the following: ...scenic and recreational shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.

(13) Protect and enhance Hawaii's shoreline, open spaces, and scenic resources.

General Plan, City and County of Honolulu

The General Plan for the Island of Oahu contains several "...environmental and design objectives for the general welfare and prosperity of the people of Oahu" and "...broad policies which facilitate the attainment of the objectives of the Plan." The most relevant Objectives and Policies are:

(In the area of Natural Environment)

Objective A: To protect and preserve the natural environment.

Policy 1: Protect Oahu's natural environment, especially the shoreline, valleys, and ridges, from incompatible development.

Policy 9: Protect mature trees on public and private lands and encourage their integration into new developments.

Objective B: To preserve and enhance the natural monuments and scenic views of Oahu for the benefit of both residents and visitors.

Policy 2: Protect Oahu's scenic views, especially those seen from highly developed and heavily travelled areas.

(In the area of Physical Development and Urban Design)

Objective E: To promote and enhance the social and physical character of Oahu's older towns and neighborhoods.

Policy 3: Provide and maintain roads, public facilities, and utilities without damaging the character of older communities.

Development Plans, Common Provisions

The common provisions for all of Oahu's Development Plan Areas include the following relevant general urban design principles and controls (Section 32-1.4):

(1) Public Views

Public views include views along streets and highways, mauka-makai view corridors, panoramic and significant landmark views from public places, views of natural features, heritage resources and other landmarks, and view corridors between significant landmarks.

Such public views shall be protected by appropriate building heights, setbacks, design and siting controls established in the CZC. These controls shall be determined by the particular needs of each view and applied to public streets and to both public and private structures.

The design and siting of all structures shall reflect the need to maintain and enhance available views of significant landmarks. No development shall be permitted that will block important public views.

Whenever possible, overhead utility wires and poles that significantly obstruct public views shall be relocated or placed underground.

(2) Open Space

Open space areas consist of, but are not limited to, the ocean, beaches, parks, plazas, institutional properties with park-like grounds, streams, inland bodies of water, significant land forms, golf courses, cemeteries and agricultural and preservation lands. The functions of open space areas are to provide visual relief and contrast to the built environment, to serve as outdoor space for public use and enjoyment. The preservation and enhancement of areas that are well suited to perform these functions shall be given high priority.

Open spaces that act as physical boundaries distinguishing one community from another shall be preserved.

(3) Vehicular and Pedestrian Routes

Landscaping shall be provided along major vehicular arterials and collector streets as a means to increase the general attractiveness of the community and the enjoyment of vehicular travel for visitors and residents.

(8) Rural Areas

Rural areas are characterized by a preponderance of open and agricultural lands with limited development clustered in small, low density residential areas which have a strong sense of community and a country-like environment. Large-scale agricultural operations or small farms are major economic activities and constitute the predominant land use. Business centers are generally modest in size, low in intensity of use and primarily oriented to meeting the day-to-day shopping and service needs of the surrounding area's residents.

The location and character of new development in rural areas shall be consistent with the above-described characteristics of such areas and be guided by the following principles and controls:

- (A) The visual attractiveness that distinguishes rural from urban and country from city shall be maintained.
- (F) Commercial development shall be characterized by extensive landscaping and designs compatible with the rural character of the area.
- (G) Design standards for streets and other infrastructure improvements shall reflect the reduced demands of lower density developments and be compatible with the desired country-like environment of rural communities.

Koolauloa Development Plan, Special Provisions

The Development Plan for the Koolauloa Area specifies that

The land use pattern shown on the land use map provides for the preservation of the predominantly rural character of Koolauloa by allowing only limited single-family residential development and confining further tourist oriented development to the Kahuku Point-Kawela Bay area.

Further development within the Koolauloa area, particularly in the Kahuku Point-Kawela Bay area, is to be sensitive to the delicate coexistence between the natural scenic, recreational, and agricultural resources of the area. This is to be accomplished by minimizing adverse impacts on and preserving important agricultural lands and public views, maintaining public access to recreational areas, and providing building designs which reflect the rural character of the area.

The Urban Design Principles and Controls for Koolauloa (Section 32-7.2 of the DP) provide the following relevant Specific Urban Design Considerations:

(1) Open Space

The visibility, preservation, enhancement and accessibility of open space areas, as described in Section 32-1.4 of the development plan common provisions, shall be given high priority in the design of adjacent and nearby development in Koolauloa.

(2) Public Views

In order to protect and enhance the rural attractiveness of Koolauloa, views from public places of the lateral Koolau ridges and deep inland valleys of southern Koolauloa shall be protected wherever possible. Panoramic and continuous views from public places of the coast and the sea, as well as views of the expansive Kahuku plain, shall also be protected.

The subordinate role of the built environment with respect to the natural environment and agricultural activities shall be emphasized by the identification and protection of panoramic public views of the shore, streams, mountains and agricultural fields.

Kamehameha Highway provides the traveler with an exceptionally scenic experience, Development adjacent to the highway shall reflect the need to preserve the current panoramic roadway views of the sea, the coastline, the Koolau mountains and lateral ridges, inner valleys, and landmarks.

(3) Height Controls

The general height limits of buildings shall be as follows:

Preservation	25 feet
Agricultural	25 feet
Residential	25 feet
Low-density	30 feet
Apartment	
Medium-density	40 feet
Apartment	
Commercial	40 feet
Resort	70 feet
Industrial	40 feet

Coastal View Study Considerations

The amendment area lies within the Malaekahana Viewshed (Oahu Coastal View Study, 1987). The study characterizes the viewshed as containing intermittent views from the coastal highway (makai direction) and further cites the natural vegetation and surrounding agricultural land uses as important features in retaining the rural character of the area. The Malaekahana Viewshed is classified as a type 2 viewshed, typical of many of the rural areas of Oahu. Management recommendations focus on preserving this rural character by controlling development impacts along the highway to insure the continuation of visual open space. Generous setbacks, clustering of structures, and avoidance of solid walls along the highway are typical recommendations for the type 2 viewshed.

5. Existing Visual Conditions

The area between Laie and Kahuku (Malaekahana Viewshed) is predominantly rural in its visual character. The area consist of a relatively flat terrain with the Koolau Mountains rising as a distant backdrop to the mauka views. Some low and gentle foothills create a mid-ground formation but is of minor visual significance. Random stands of Ironwood

trees, Hale koa and other naturalized vegetation buffer segments of the mauka side of the highway while the makai side of the highway is nearly continuously buffered with a vegetative screen. As a result, the experience of open space and views occurs primarily on the mauka side of the road (see Photos A-D and H-L).

The open space and visual character is fairly consistent. The northwest portion of the viewshed is planted in agriculture, with numerous small rectangular plots of land crops and aquacultural ponds. The mid-section along the highway is in pasture. Both activities are conducive to the visual highway experience.

The community of Laie lies just south of the site, but is visually isolated by intervening terrain and by a shift in highway direction (see Photos D and E).

Malaekahana State Recreation Area lies just east of the site, across the highway. The shoreline and recreational amenities of this public facility are set back and not visible from the highway. As one exits this park, one directly faces the pastoral scene of which the site is a part (see Photo G).

The City and County Corporate Yard and Refuse Convenience Center are located immediately adjacent to the project's south end, at the site's proposed entry (see Photos E and F). These facilities are completely screened from highway view by landscaping.

The site itself lies on low rolling hills which are separated from Kamehameha Highway by approximately 600 to 800 feet. This intervening plain consists of flat pasture and fallow fields (see Photos A-D).

The highway elevation is 15 feet, and the highest point on the subject site is 100 feet. Most of the visible portion of the site lies below the 50-foot level. The proposed golf clubhouse location is sited at an elevation of 75 feet and is approximately 3000 feet from the highway.

The upper (northwesterly) half of the site is not visible from the highway. It consists of rolling hilltops and flat plains (see Photos H-L). The hilltops are covered by dense shrubs and shrub-like trees, which consist of secondary vegetation and remnants of natural vegetation remaining from the time (up to 1971) when this entire area was extensively planted in sugar cane. All of the flatter areas of this upper part of the site (like its lower elevations) are used for light grazing of livestock, mostly horses. The northwest end of

this upper area overlooks diversified agriculture in the Malaekahana Stream-bed area (see Photo J).

Figure 10 indicates the site's visibility from Kamehameha Highway. Tall trees at each highway approach (from the northwest and from the southeast) block or screen potential distant views of the site (see Photos A, D and E). Topography, shifts in highway direction and landscaping around the Corporate Yard also preclude such potential views from the southeast approach. There is quarter-mile long section of highway from which completely unobstructed views of the site are available (Photos C and D).

6. Potential Visual Impacts & Mitigative Measures

Overall Short-Term Visual Impacts

6.1 Construction of the project will require necessary vegetation removal, contour grading and stockpiling of materials. Some dust will be created. Such impact could occur over a time period of 18 to 24 months. These impact are relatively minor, considering its distance and low elevation relative to Kamehameha Highway. Such impact will be limited to the project's entry point.

Mitigative Measures - Although such impacts are unavoidable to some degree, there are numerous mitigative measures which will be imposed to minimize them. The City/County Department of Public Works will specify various construction impact controls (temporary and permanent erosion controls, limits on timing and phasing of construction, temporary and permanent revegetation, etc.) which will keep such impacts within acceptable limits.

Long-Term Visual Impacts

6.2 Considering the low profile of the site and its distance from the highway the open space, roadway views and the rural character of the Malaekahana Viewshed will be retained. However the nature of this open space, in the location of the proposed golf course, will shift from a pastoral-like setting to a park-like landscaped appearance.

6.3 The overall profile of the site will not change significantly. There will probably be more tree plantings (in contrast to the existing dense tree-like shrub masses), but these will blend with existing tree stands at both ends of the site. Thus, the net visual impact will be a change in texture more than in form or pattern.

6.4 Project structures will not have a visual impact, considering (a) their setback distances from Kamehameha Highway, (b) the site's low profile, (c) Development Plan height limits, (d) probable landscape buffering and mitigative design elements (low roof line, use of appropriate colors and materials, etc.), and (e) its proximity to the urban structures of the Laie community. The project's entrance off of the highway will not have a significant adverse impact, as it is will be adjacent to the entry to the existing Corporate Yard and Refuse Convenience Center.

Mitigative Measures - It is assumed that when detailed architectural and landscape plans are prepared for the project, the roof styles, materials, colors and scale of these structures, grounds and appurtenances will be designed to "reflect the rural character of the area" as required by Development Plan urban design principles and controls.

MICHAEL S. CHU
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PROFESSIONAL SERVICES

Land Use Planning
Landscape Architecture
Urban Design

EDUCATION

B.S. California State Polytechnic University, Pomona, 1977
Landscape Architecture
University of Hawaii, Urban and Regional Planning
Iolani School, 1967

PROFESSIONAL PRACTICE

Michael S. Chu, Land Architect, 1982 to present
Phillips Brandt Reddick, Hawaii 1978-82
EDAW Inc., 1977-78
Tongg Assoc. 1973-75

REGISTRATION

State of Hawaii, Board of Registration, Professional Landscape Architect
State of Hawaii, Board of Registration, Realtor Associate

PROFESSIONAL & COMMUNITY AFFILIATIONS

American Planning Association, Member
American Society of Landscape Architects, Member
American Institute of Architects, Professional Affiliate
Hawaii Architect Magazine
The American Land Resource Association, Charter Member
Honolulu Chamber of Commerce, Member
DLU Design Advisory Committee, Member
Honolulu Zoo Hui, Director

Background

Michael S. Chu, Land Architect is a professional consulting firm specializing in land use planning, landscape architecture and urban design. The firm was founded in 1982 and is located in downtown Honolulu.

The firm is often engaged by governmental agencies, private land owners, developers or other consultants to provide technical planning and/or design services. These services include land use analysis, site planning and landscape architectural design, environmental studies and permit processing.

As a sole proprietorship, the firm maintains a wide network of professional colleagues in related fields and often draws upon this network when undertaking multi-disciplinary projects. This flexibility has enabled the firm to successfully engage in larger and complex projects with a team of subconsultants specifically selected to *meet the needs and work* products of a particular project. In other instances, the firm participates as a subconsultant to others and is capable of contributing land use and site planning expertise, technical report writing, design graphics, and landscape architectural design services.

The services of the firm are particularly strengthened with its broad experience and familiarity with governmental objectives as they relate to land use planning and design. Most recently the firm was the prime consultant and author of the Coastal View Study for the City and County of Honolulu and the Statewide Planning for Private Marina Facilities for the State Department of Transportation, Harbors Division.

Since 1985 Michael S. Chu has served been a member of the DLU Design Advisory Committee and has served as a member of the DLU technical review committee for the BMX-4 zoning district of the Land Use Ordinance.

Prior to establishing the firm, Michael S. Chu was a planner and landscape architect with EDAW Inc., PBR Hawaii and Tongg Assoc. While at PBR he held the position of managing director of its Hawaii office and was project manager for several large multi-disciplinary projects to include the Oahu Urban Design and the Housing Location Study.

His professional experience includes planning and design work throughout Hawaii, as well as Guam, Tahiti and Japan.

List of Recent Projects

Waimea Main Street, Kauai

The firm performed planning and design services for the physical improvement and economic revitalization of Waimea Town. The project was the first to be sponsored under the Main Street Program and the Historic Hawaii Foundation. Performed for the West Kauai Professional and Businessmen Association and Spencer Mason Architects.

Old Koloa Town

The firm was responsible for planning and the development of a landscape architectural master plan for the renovation and revitalization of Koloa Town. Prepared for Koloa Town Associates and Spencer Mason Architects.

Russian Fort Elizabeth

The project consisted on preparing an overall master plan and phase I construction documents for the historic restoration of the Russian Fort Elizabeth at Waimea, Kauai. Performed for the State of Hawaii, Department of Land and Natural Resources.

Oahu Coastal View Study

This landmark study was completed in 1987 and consisted of a detailed inventory of coastal scenic resources on Oahu and the formulation of design guidelines applicable to the SMA and Coastal Zone Management program. Performed for the City and County of Honolulu, Department of Land Utilization.

Since the completion of the study, the firm was commissioned to conduct similar Coastal View Studies by the Hawaii County Planning Department (1988) and the Kauai County Planning Department (1989).

Kapolei Villages

Involvement in Kapolei Villages consisted of revising the 830 acre residential master plan and providing further design and design graphics to illustrate the overall development concept. Performed for the State of Hawaii, Housing and Finance Development Corp. and Towill Corp.

Architectural Compatibility Study, Oahu

This urban design project consisted of organizing and structuring a variety of independent projects into an overall and thematic development master plan for Hickam Air Force Base. Performed for the U.S. Air Force.

Servco Commercial Center

The services of the firm was utilized to prepare the owner's development requirements, preparation of a detailed development master plan and to process assorted governmental permits for Servco's newly acquired 14.5 acres of waterfront industrial land at Sand Island. Performed for Servco Pacific, Inc. and Aotani and Assoc.

Hotel Street Transit Mall

The firm participated in the planning and design of the Hotel Street Transit Mall by providing design guidance regarding historic features, street signage, bus shelters, light standards and sidewalks within the Chinatown historic district. Performed for the

Department of Transportation Services, City and County of Honolulu and Parsons Brinkerhoff, Quade and Douglas.

Kalakaua Center

The firm was retained to provide complete landscape architectural design and permit processing services for the renovation of the "Mitsukoshi building" located in the Waikiki Special District. Performed for Mutual of New York (MONY), Graham Murata and Russell, and the CJS Group Architects.

Hawaii State Library

The firm was the project landscape architect for the renovation of the Hawaii State Library locate within the Capital District on Honolulu. Performed for the Department of Accounting and General Services, State of Hawaii and Aotani and Assoc.

Chinatown Gateway

The firm participated as project landscape architect for the planning and design of the Chinatown Gateway Plaza, a mixed use project consisting of a highrise residential tower, lowrise commercial development and a major plaza and park flanking both sides of Hotel Street. Prepared for the City and County of Honolulu and Lacayo Architects.

EWA by Gentry, Soda Creek, Increment 2 & 3

The firm was retained to prepare the cluster development application for increments 2 and 3 of the EWA by Gentry development consisting of over 600 residential units and community support facilities. Services included the landscape design and the preparation of all material for the submittal and application of permits. Other services include participation in the zoning application of the overall 700 acre development. Prepared for the Gentry Companies.

Pentagram Restaurant Projects

The firm provides exclusive landscape architectural services for all development and renovation of Burger King and El Pollo Loco restaurants in Hawaii and Guam . Work has included landscape development and/or renovation of over 12 restaurants since 1985. Performed for the Pentagram Corp.

Statewide Planning for Marina Facilities

The firm was retained as the prime consultant to provide a statewide study and recommendations for expediting the development of recreational marina facilities. Performed for the State of Hawaii, Department of Transportation, Harbors Division.

Honolulu Waterfront Master Plan

The firm served as the landscape architectural subconsultant (to R.M. Towill/ Helber Hastert Kimura, a joint venture) in preparing the overall redevelopment master plan for the 1500 acre Honolulu waterfront area. Performed for the State of Hawaii, Office of State Planning.

Kewalo Basin Park

The firm served as prime landscape architect for the park design at the triangle peninsula located at Kewalo Basin. The park development is the first increment of the "lei of green" concept envisioned by the Honolulu Waterfront Master Plan. Performed for the State of Hawaii, Hawaii Community Development Authority.

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX G

**AIR QUALITY IMPACT REPORT,
THE COUNTRY COURSES AT
KAHUKU**

J.W. Morrow, Environmental Consultant

APPENDIX G

AIR QUALITY IMPACT REPORT
THE COUNTRY COURSES AT KAHUKU:
MALAEKAHANA GOLF COURSE

December 18, 1989

PREPARED FOR

William E. Wanket, Inc.

AND

The Estate of James Campbell

PREPARED BY

J. W. Morrow
Environmental Management Consultant
563 Paulele Street
Kailua, Hawaii 96734

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1. INTRODUCTION

The Estate of James Campbell is proposing to develop an 18-hole golf course between Laie and Kahuku, Oahu (Figure 1). The site is located west of Kamehameha Highway across from the Malaekahana State Park (TMK: 5-6-06: 2 & por. 6). It is part of an integrated golf course complex consisting of four 18-hole courses located in the Kahuku area. This first course is anticipated to be completed by 1994. Existing site conditions are depicted in Figure 2.

The purpose of this report is to assess the air quality impact of the proposed development. The project can be considered an "indirect source" of air pollution as defined in the federal Clean Air Act [1] since it will attract mobile sources of air pollution, i.e., motor vehicles. Thus, much of the focus of this analysis is on the project's ability to generate traffic and the resultant impact on air quality. Air quality impact was evaluated for existing (1989) and future (1994) conditions.

Also, during routine operation of the golf course, various pesticides are used which may result in air pollution contributions. This potential impact has been addressed.

Finally, during construction of the various buildings and facilities air pollutant emissions will be generated due to vehicular movement, grading and general dust-generating construction activities. These impacts have also been addressed.

2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 1 [2,3]. Note that Hawaii's standards are not divided into primary and secondary standards as are the Federal standards.

Primary standards are intended to protect public health with an adequate margin of safety while secondary standards are intended to protect public welfare through the prevention of damage to soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values [4].

Some of Hawaii's standards are clearly more stringent than their Federal counterparts but, like their Federal counterparts, may be exceeded once per year. It should also be noted that in April, 1986, the Governor signed amendments to Chapter 59 (Ambient Air Quality Standards) making the State's standards for particulate matter and sulfur dioxide the same as national standards. In the case of particulate matter, however, this uniformity did not last long. On July 1, 1987, the EPA revised the Federal particulate

standard to apply only to particles 10 microns or less in diameter (PM-10) [5], leaving the State once again with standards different than the Federal ones.

In the case of the automotive pollutants [carbon monoxide (CO), oxides of nitrogen (NOx), and photochemical oxidants (Ox)], there are only primary standards. Until 1983, there was also a hydrocarbons standard which was based on the precursor role hydrocarbons play in the formation of photochemical oxidants rather than any unique toxicological effect they had at ambient levels. The hydrocarbons standard was formally eliminated in January, 1983 [6].

The U.S. Environmental Protection Agency (EPA) is mandated by Congress to periodically review and re-evaluate the Federal standards in light of new research findings [7]. The last review resulted in the relaxation of the oxidant standard from 160 to 235 micrograms/cubic meter (ug/m³) [8]. The carbon monoxide (CO), particulate matter, sulfur dioxide (SO₂), and nitrogen dioxide (NO₂) standards are currently under review, but no new standards have been proposed [9].

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [10]. There simply can be no visible emissions from fugitive dust sources.

3. EXISTING AIR QUALITY

3.1 General. The State Department of Health maintains a network of air monitoring stations around the state to gather data on the following regulated pollutants:

- o total suspended particulates (TSP)
- o particulate matter <10 microns (PM-10)
- o sulfur dioxide (SO₂)
- o carbon monoxide (CO)
- o ozone (O₃)
- o lead (Pb)

In the case of TSP, PM-10, and SO₂, measurements are made on a 24-hour basis to correspond with the averaging period specified in the standards. Samples are collected once every six days in accordance with U.S. Environmental Protection Agency (EPA) guidelines. Carbon monoxide and ozone, however, are measured on

a continuous basis due to their short-term (1-hour) standards. Lead concentrations are determined from the TSP samples which are sent to an EPA laboratory for analysis. Note that the lead standard is a quarterly average.

There is no Department of Health (DOH) air monitoring station in the immediate vicinity of the project site. The nearest site on the windward side of Oahu is at Waimanalo, some 28 miles southeast of Kahuku. The DOH also monitors air quality at its downtown Honolulu building some 26 miles south-southeast of the golf course project. It seems safe to assume that present air quality is good most of the time since there are no large stationary sources in the vicinity, and the immediate area is not densely populated. The primary source of air pollution is the motor vehicle traffic along Kamehameha Highway.

3.2 Department of Health Monitoring Sites. Recent data from the Waimanalo and Honolulu stations are summarized in Tables 2 - 5. The data indicate that total suspended particulate (TSP) and sulfur dioxide (SO₂) standards are being met. In fact, much of the time sulfur dioxide concentrations are below the detectable limit of the measurement method being employed. Carbon monoxide (CO) levels are also below State standards most of the time with only occasional exceedances.

Photochemical oxidants are secondary pollutants formed in the atmosphere largely as a result of anthropogenic emissions of hydrocarbons and oxides of nitrogen. Since there are no ambient standards for hydrocarbons, there is no monitoring. In the case of NO₂, the State ceased routine monitoring in 1976. As indicated by federal and state standards, ozone is monitored at Sand Island as a surrogate for photochemical oxidants. Recent monitoring data from that station indicate that the state's 1-hour standard is being met over 99% of the time.

As noted above, the State also has been having particulate samples analyzed for lead content, and Table 5 summarizes ambient lead levels in recent years. Generally, airborne lead levels have declined as expected due to the federal program for gradual phaseout of leaded gasoline. Particulate lead accumulated over the years in roadside soils and plants, however, will remain indefinitely in the area and provide inhalation exposure whenever dust is re-entrained in the air as a result of scouring winds or mechanical disturbance due to vehicular motion.

3.3 Onsite Carbon Monoxide Sampling. In conjunction with this study, air sampling was conducted at two sites along Kamehameha Highway in the project area during December, 1989. One site was located across from the Malaekahana State Park entrance while the other one was located adjacent to the access road to the proposed golf course.

Both sites were approximately 5 meters from the road edge on the southwest (mauka) side due to the winds prevailing at the time. A continuous carbon monoxide (CO) instrument was set up and operated during weekend late afternoon traffic hours. An anemometer and vane were installed to record onsite surface winds. A simultaneous manual count of traffic along Kamehameha Highway was also made. The variability of each of the parameters measured during the peak hour is clearly seen in Figures 3 and 4.

Onsite surface winds were generally northwesterly and thus at an acute angle with Kamehameha Highway. Wind speeds were quite low during the sampling period, i.e., generally less than 1.0 meter per second (m/sec). Atmospheric stability was neutral to slightly unstable. Total 2-way traffic counts of 813 and 857 vehicles at the proposed access road and near the Malaekahana Park entrance, respectively, were slightly lower than the peak-hour volumes reported by the traffic consultant [12]. CO concentrations compared quite closely with the computer-predicted concentrations discussed in Section 6.

4. CLIMATE & METEOROLOGY

4.1 Temperature & Rainfall. The National Climatic Data Center in its 1982 annual summary for Honolulu notes that:

"Hawaii's equable temperatures are associated with the small seasonal variation in the amount of energy received from the sun and the tempering effect of the surrounding ocean. The range of temperature averages only 7 degrees between the warmest months (August and September) and the coolest months (January and February) and about 12 degrees between day and night. Daily maximums run from the high 70's in winter to the mid-80's in summer, and daily minimums from the mid-60's to the low 70's. However, the Honolulu Airport area has recorded as high as 93 degrees and as low as 53" [13].

Based on historical records from the State Weather Station No. 907.00 at the Kuilima Resort north of the project site, median annual rainfall is 39.4 inches. In accordance with Thornwaite's scheme for climatic classification, the area is considered a subhumid grassland [14].

4.2 Surface Winds. Kaneohe Marine Corps Air Station (KMCAS) is the nearest long-term meteorological data collection station to the project. Records from KMCAS were therefore reviewed with particular attention to the p.m. peak traffic hours. This examination revealed seasonal and diurnal differences both in direction and velocity. Figures 5 and 6 depict directional wind

roses for the 3:00 - 5:00 p.m. period during the months of January and August. The predominance of northeast tradewinds during the summer in contrast to the more variable nature of the winter months is quite clear.

The winter months also are characterized by generally lower wind velocities as evidenced again by the January-August comparison, this time presented in tabular form (Tables 6 and 7). Light, variable winds are much more prevalent during January than in August, and not surprisingly, it is during the winter months that most of the high carbon monoxide levels are recorded by the Department of Health in Honolulu.

5. HIGHWAYS AND TRAFFIC

As noted above, the principal access road to the project area is Kamehameha Highway. It is a typical 2-lane rural roadway as can be seen in Figure 7. Because of the generally recreational nature of the area, the peak traffic volumes tend to occur during weekend afternoons. Based on the traffic consultant's review of State DOT records, the peak period was between 1:30 and 3:30 p.m.; thus, both traffic and air quality impact analyses focused on this period.

Existing traffic volumes as well as projections for future volumes used in this impact analysis were obtained from the traffic consultant [12].

6. MOBILE SOURCE IMPACT

6.1 Emission Factors. Automotive emission factors for carbon monoxide (CO) were generated for calendar years 1989 and 1994 using the Mobile Source Emissions Model (MOBILE-3) [15]. To localize emission factors as much as possible, the August, 1988 age distribution for the City & County of Honolulu [16] was input in lieu of the national statistics normally used.

6.2 Microscale Analysis. Analyses such as this generally involve estimation of concentrations of non-reactive pollutants. This is due to the complexity of modeling pollutants which undergo chemical reactions in the atmosphere and are subject to the effects of numerous physical and chemical factors which affect reaction rates and products. For projects involving motor vehicles as the principal air pollution source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere (about 1 month) [17], and it comprises the largest fraction of automotive emissions.

In this instance, a microscale screening analysis was performed for the proposed Malaekahana Golf Course Access Road intersection with Kamehameha Highway because this is where the proposed golf

course access road will also intersect Kamehameha Highway. The updated version of an EPA guideline model CALINE-4 [18,19] was employed with an array of receptors spaced at distances of 10 - 30 meters from the road edge. Because of the growing level of urbanization and traffic in the area, a background CO concentration of 1.0 milligram per cubic meter (mg/m³) was assumed.

Worst case meteorological conditions were selected for the p.m. peak traffic hours. A wind speed of 1 meter per second, an acute wind/road angle, and neutral stability (Pasquill-Gifford Class "D") [20], were all selected to maximize concentration estimates in the vicinity of the intersections. Review of the traffic data and preliminary modeling indicated that southwesterly winds were most likely to produce the maximum CO concentrations near the intersections under study; thus, this wind direction was input for the modeling.

Maximum one- and eight-hour carbon monoxide (CO) concentrations were then computed for the peak traffic hours. The latter were obtained by multiplying the maximum 1-hour values by a "persistence" factor of 0.6 as recommended in an EPA publication on indirect source analysis [21]. The analyses were performed for existing conditions (1989) and future conditions (1994) both with and without the proposed project. The results are summarized in Figures 8 and 9.

7. PESTICIDE USE

The use of pesticides is routinely required at golf courses in order to maintain fairways and greens. Typical pesticide use at an 18-hole golf course is shown in Table 8 [22].

The herbicides MSMA, glyphosate, metribuzin, and pendimethalin all have relatively low mammalian toxicities with LD₅₀ values on the order of hundreds or thousands of milligrams active agent per kilogram body weight (mg/kg) [23, 24]. They do, however, have WARNING and CAUTION labels because of their irritative effects on the eyes and skin. The OSHA 8-hour time-weighted average standard for metribuzin in the air is 5 mg/m³ [24].

The insecticide Sevin is a relatively low toxicity carbamate which can affect the normal functioning of mammalian nervous systems through its inhibition of the enzyme cholinesterase. It also has a relatively high LD₅₀ value of about 500 - 850 mg/kg and therefore only has a CAUTION label on its containers. The OSHA standard for airborne concentrations of carbaryl (the active ingredient in Sevin) is 5 mg/m³ as an 8-hour average [24].

The fungicides Dithane M45, Kocide 101, and Subdue are also low toxicity chemical mixtures with LD₅₀ values in the hundreds and

thousands of mg/kg [23, 24]. Subdue has a WARNING label because of its potential for eye injury.

If properly used in accordance with label instructions, all of the aforementioned chemicals should present no hazard to the properties or owners of properties adjoining the proposed golf course. In fact, the greatest risk in using such chemicals is generally to the users themselves if they do not strictly follow label instructions. This is because the user may come in contact with the concentrated product while nearby properties and people may only be exposed to the greatly diluted and dispersed application solution.

The potential for significant airborne concentrations of these chemicals is relatively slight when one considers the dilution factor in application solutions plus the coarse spray that is normally used to assure adequate coverage in the desired area and avoidance of drift. Should a user improperly apply these chemicals under wind conditions which would contribute to drift, then there would be an increased possibility of downwind exposure of property and people. In order to assess the possible impact of such an event on people, a dispersion modeling analysis was performed for each of the chemicals. The results of this modeling are summarized in Table 9.

8. CONSTRUCTION IMPACT

The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along the principal access roads as well as in the vicinity of the project site itself. During off-peak hours, the additional construction vehicle traffic should not exceed road capacities although the presence of large trucks can reduce a roadway's capacity as well as lower average travel speeds thereby contributing to additional air pollution emissions.

The site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50 [25].

Since the onsite soils are generally silty clays, in all probability having silt content greater than the 30% cited above [26], and the computed P/E Index for the area is 52, thus comparable to the aforementioned EPA case, it may be assumed that there is a potential for fugitive dust problems.

In addition to the onsite impacts attributable to construction activity, there will also be offsite impacts due to the operation of concrete batching plants needed for construction. Since it is also too early to identify specific facilities that will be providing the concrete, the discussion of air quality impacts is necessarily generic.

Design and operating features of a typical concrete batching plant were obtained for this analysis. This plant (Rex Transit Mix Batch Plant, Model LO GO 5) [27], is a portable unit capable of producing up to 100 cubic yards of concrete per hour.

Assuming 8 hours/day operation and published EPA emission factors [24] for both direct plant emissions and fugitive dust emissions, estimates of worst case ambient impact were derived using the PTPLU screening model [28]. Ninety percent control of particulate emissions from the plant itself and 60% control of fugitive dust emissions from the process were assumed. One-hour concentration estimates were adjusted to 8-hour averages using an EPA-recommended factor [29] and then to 24-hour averages based on a weighted averaging technique. The worst case concentration of total suspended particulates (TSP) was thus estimated to be 105 micrograms/cubic meter ($\mu\text{g}/\text{m}^3$) due to the plant operation.

Since it is not known where exactly the plant(s) will be located and thus what the background concentration of TSP will be, it is somewhat difficult to predict cumulative concentrations for comparison with standards. However, if the batch plant's 105 $\mu\text{g}/\text{m}^3$ were assumed to be all < 10 microns and were added to the second highest 24-hour PM-10 concentration (63 $\mu\text{g}/\text{m}^3$) from the 1988 Waimanalo data, the sum would exceed the federal 24-hour standard of 150 $\mu\text{g}/\text{m}^3$.

9. DISCUSSION AND MITIGATION

9.1 Microscale Analysis. While the project will impact local air quality, the 1-hour and 8-hour "worst case" carbon monoxide concentration estimates for existing as well as future "with project" and "without project" scenarios all indicated compliance with state and federal standards.

9.2 Pesticide Use. The results of the modeling indicated airborne pesticide concentrations several orders of magnitude below the effects and standards levels. More importantly, however, proper use of pesticides in accordance with the legally required label instructions should prevent any significant air quality impact. Use of other non-chemical means of pest control wherever possible would also help reduce or eliminate the potential for air quality impact.

9.3 Short-Term Impact. Since as noted in Section 8, there is a potential for fugitive dust generation during construction, it will be important for adequate dust control measures to be employed during the construction period. Dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. The soonest possible landscaping of completed areas will also help. Use of dust screens may be necessary when excavation and other construction activities occur in close proximity to existing dwellings.

With regard to construction vehicle effects, proper maintenance of vehicle engines will help reduce emissions, while scheduling truck traffic during offpeak hours will reduce the impact on Kamehameha Highway.

Offsite construction related activity such as asphalt and concrete batching will affect air quality in the vicinity of the batch plant site but such plants must demonstrate compliance with state and federal standards before they receive operating permits.

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T A B L E S

TABLE 1
SUMMARY OF STATE OF HAWAII AND FEDERAL
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS		STATE STANDARDS
		PRIMARY	SECONDARY	
1. Total Suspended Particulate Matter (TSP) (micrograms per cubic meter)	Annual Geometric Mean	--	--	60
	Maximum Average in Any 24 Hours	--	--	150
2. PM-10 (micrograms per cubic meter)	Annual	50	50	--
	Maximum Average in Any 24 Hours	150	150	--
3. Sulfur Dioxide (SO ₂) (micrograms per cubic meter)	Annual Arithmetic Mean	80	--	80
	Maximum Average in Any 24 Hours	365	--	365
	Maximum Average in Any 3 Hours		1,300	1,300
4. Nitrogen Dioxide (NO ₂) (micrograms per cubic meter)	Annual Arithmetic Mean		100	70
5. Carbon Monoxide (CO) (milligrams per cubic meter)	Maximum Average in Any 8 Hours		10	5
	Maximum Average in Any 1 Hour		40	10
6. Ozone (micrograms per cubic meter)	Maximum Average in Any 1 Hour		235	100
7. Lead (Pb) (micrograms per cubic meter)	Maximum Average in Any Calendar Quarter		1.5	1.5

TABLE 2

AIR MONITORING DATA
 WAIMANALO, OAHU
 1988

Total Suspended Particulates (TSP)
 24-Hour Concentration (ug/m³)

MONTH	SAMPLES	MIN.	MAX.	MEAN
Jan 88	5	20	63	34
Feb 88	5	27	82	43
Mar 88	5	16	60	36
Apr 88	5	22	41	27
May 88	5	16	30	24
Jun 88	5	19	27	22
Jul 88	5	24	36	29
Aug 88	6	16	37	25
Sep 88	4	20	31	24
Oct 88	5	16	20	18
Nov 88	5	20	34	25
Dec 88	5	21	54	34
ANNUAL	60	16	82	29

SOURCE: Department of Health

TABLE 3

SUMMARY OF AEROMETRIC DATA COLLECTED
AT THE DEPARTMENT OF HEALTH BUILDING

1978 - 1987

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
TOTAL SUSPENDED PARTICULATES (24-hr values, ug/m3)										
Period of sampling (mos.):	12	12	12	8	12	12	12	12	12	12
Number of samples:	60	8	61	35	55	56	60	59	57	53
Range of values:	14-53	22-62	23-103	23-75	11-42	14-58	11-48	10-48	11-61	14-59
Mean of values:	29	32	37	40	29	26	25	24	25	25
Number of times State AQS exceeded:	0	0	1	0	0	0	0	0	0	0
SULFUR DIOXIDE (24-hr values, ug/m3)										
Period of sampling (mos.):	12	12	12	8	12	12	12	12	12	12
Number of samples:	61	57	58	38	50	56	58	53	57	54
Range of values:	<5-44	<5-42	<5-60	<5-44	<5-38	<5-16	<5-45	<5-45	<5-6	<5-11
Mean of values:	18	22	18	19	11	<5	<5	<5	<5	<5
Number of times State AQS exceeded:	0	0	0	0	0	0	0	0	0	0
PHOTOCHEMICAL OXIDANTS (Daily 1-hr maxima, ug/m3)										
Period of sampling (mos.):	10	12	11	12	12	12	12	12	12	12
Number of samples:	284	337	295	314	335	348	296	341	348	342
Range of values:	10-84	10-80	10-84	10-104	0-151	0-123	0-104	8-198	10-88	4-84
Mean of values:	33	39	38	37	32	46	44	43	39	38
Number of times State AQS exceeded:	0	0	0	1	2	2	1	3	0	0

TABLE 4

SUMMARY OF AEROMETRIC DATA COLLECTED
AT THE DEPARTMENT OF HEALTH BUILDING

1971 - 1987

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980-87
NITROGEN DIOXIDE (24-hr values)										
Period of sampling (mos.):	10	12	12	12	12	3	n.d.	n.d.	n.d.	n.d.
Number of samples:	83	113	99	90	91	27				
Range of values:	<20-159	<20-236	<20-95	<20-95	16-70	12-63				
Mean of values:	56	56	46	37	33	35				
Number of times State AQS exceeded:	1	2	0	0	0	0				

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
CARBON MONOXIDE (Daily 1-hr maxima)										
Period of sampling (mos.):	12	8	n.d.	n.d.	n.d.	.6	12	12	12	12
Number of samples:	365	208				169	318	342	348	345
Range of values:	0-20.7	0-17.3				0-8.6	0.6-10.9	0.0-10.4	0.2-13.5	0.3-11.1
Arithmetic mean of daily maximum values:	3.1	3.0				2.4	2.4	1.5	2.2	1.7
Number of days State AQS exceeded:	19	10	10			0	1	1	3	1

TABLE 5
 LEAD MONITORING DATA
 HONOLULU, OAHU
 1970-87

AVERAGE CONCENTRATION
 (micrograms/cubic meter)

YEAR	1st QUARTER	2nd QUARTER	3rd QUARTER	4th QUARTER
1970	0.78	0.81	0.65	0.92
1971	1.65	0.63	0.65	1.05
1972	--	0.75	0.65	0.48
1973	0.52	0.52	0.72	0.55
1974	0.84	0.61	0.70	0.92
1975	0.65	0.81	0.59	1.05
1976	0.91	0.65	0.99	1.00
1977	0.89	0.59	0.48	0.80
1978	--	--	--	0.72
1979	0.39	0.25	0.26	0.42
1980	0.41	0.23	0.21	0.20
1981	0.25	--	--	--
1982	0.21	0.16	0.09	0.21
1983	n/a	n/a	n/a	n/a
1984	0.3	0.2	0.2	0.3
1985	0.1	0.03	0.02	0.1
1986	0.1	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0

Source: Department of Health

RECEIVED AS FOLLOWS

TABLE 8

TYPICAL PESTICIDE USE AT AN 18-HOLE GOLF COURSE

<u>PRODUCT</u>	<u>AREA (acres)</u>	<u>QUANTITY</u>	<u>FREQUENCY</u>	<u>ANNUAL REQUIREMENT</u>
<u>Herbicides (fairways & roughs)</u>				
MSMA	100	33 gal	4/yr	132 gal
Glyphosate				25 gal
Metribuzin	100	25 lb	2/yr	50 lb
Pendimethalin	100	400 lb	2/yr	800 lb
<u>Insecticides (greens & tees)</u>				
Sevin	10	21 gal	12/yr	252 gal
<u>Fungicides (greens & tees)</u>				
Dithane M-45	10	109 lb	25/yr	2,725 lb
Kocide 101	10	217 lb	12/yr	2,604 lb
Subdue	10	6.7 gal	3/yr	20 gal

RECEIVED AS FOLLOWS

TABLE 9

ESTIMATES OF DOWNWIND PESTICIDE CONCENTRATIONS

Product -----	Active Agent Concentration (mg/m ³) -----
Subdue	0.007
Kocide 101	0.057
Dithane M45	0.046
Sevin	0.044
Glyphosate	0.010
Metribuzin	0.001
Pendimethalin	0.013
MSMA	0.011

Conditions: Windspeed: 4.5 m/sec
Stability category: D (neutral)
Downwind distance: 100 m
Exposure duration: 5 - 10 minutes
Treated area: 1 acre
Application height: 0.5 m
Active agent drift: 0.4%

RECEIVED AS FOLLOWS

FIGURES

RECEIVED AS FOLLOWS

FIGURE 1
PROJECT LOCATION

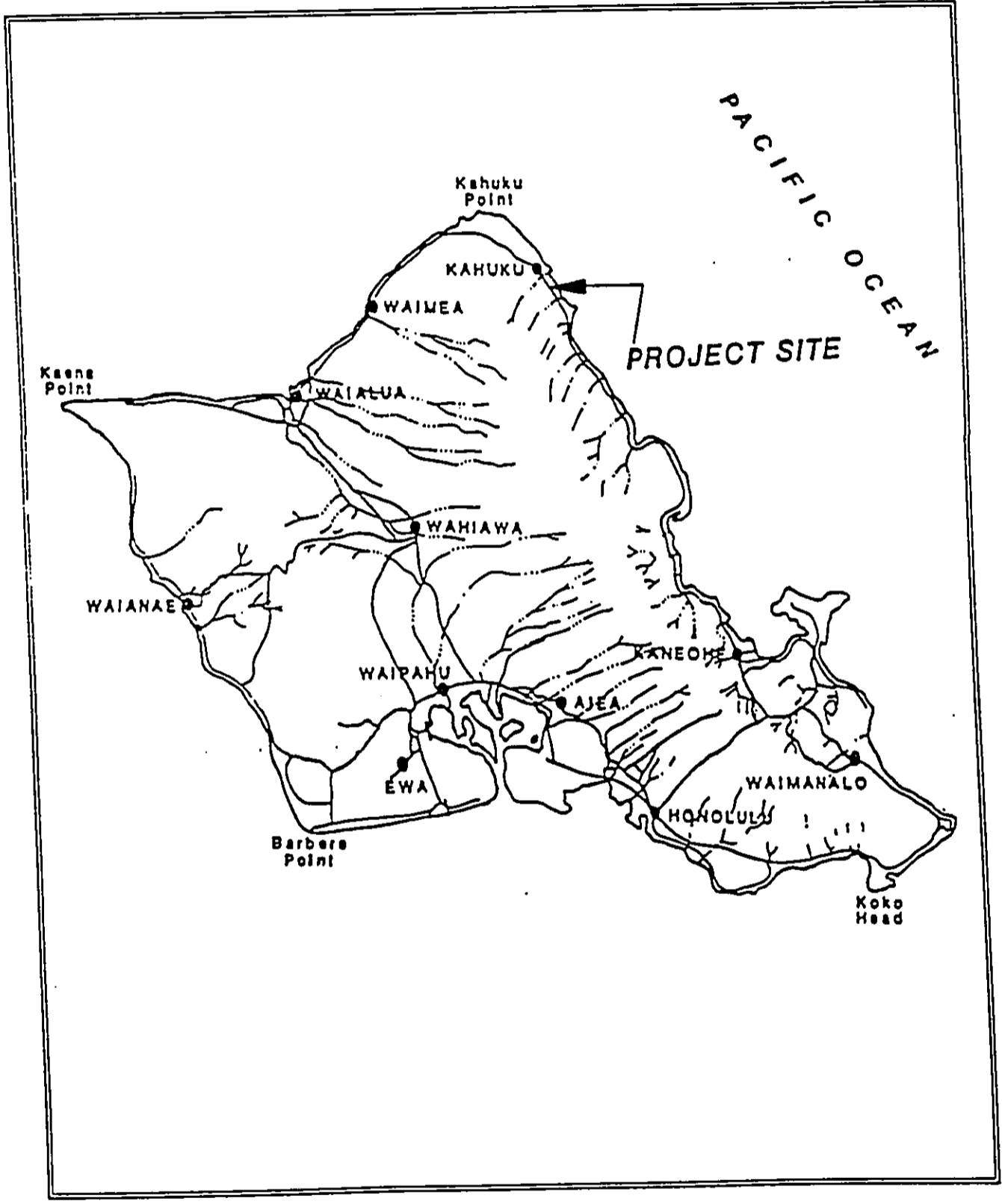


FIGURE 2
EXISTING SITE CONDITIONS

Facing Northwest
from Vicinity of
Access Road



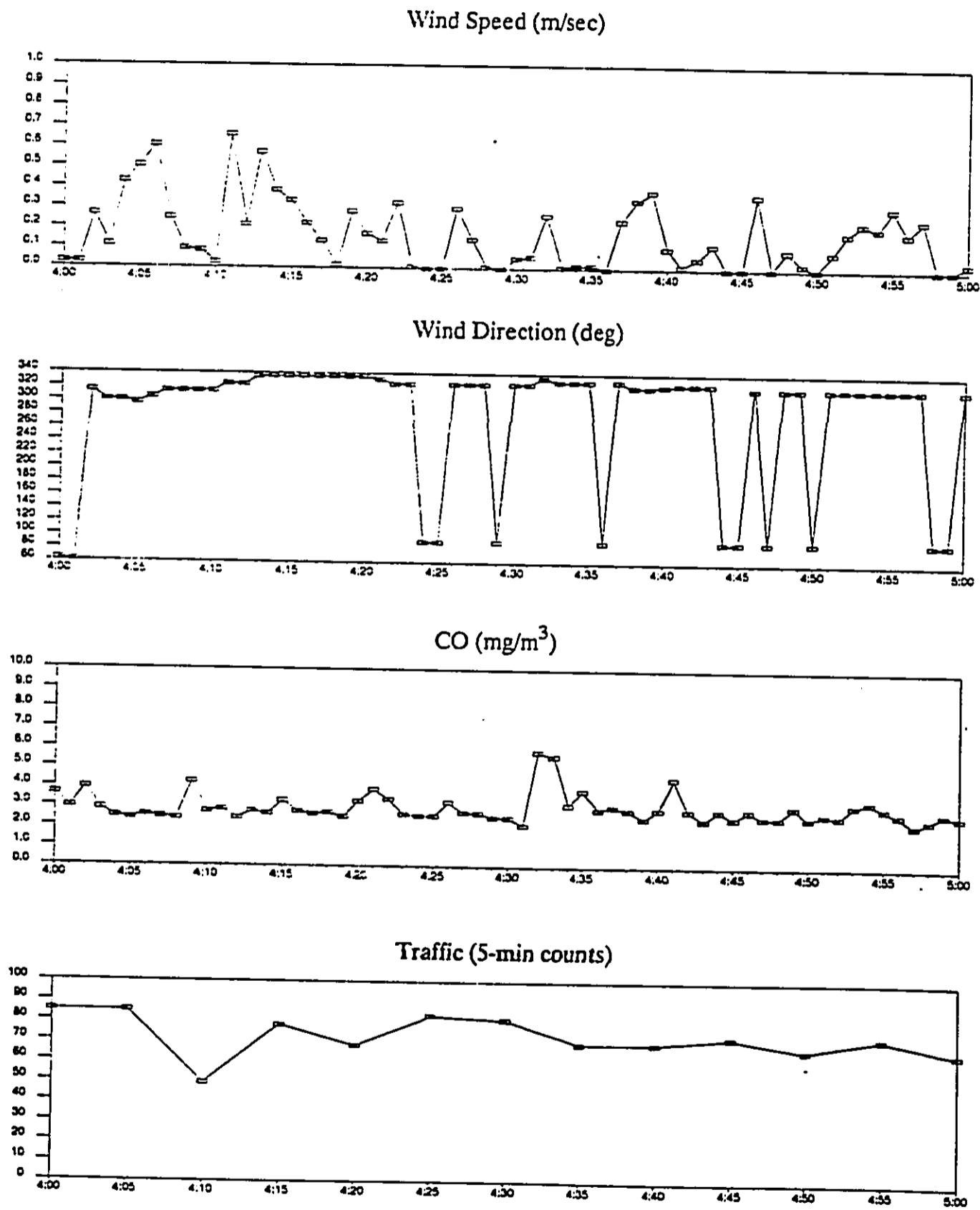
Facing Southwest
From Vicinity of
Malaekahana State
Park Entrance



RECEIVED AS FOLLOWS

FIGURE 3

WEEKEND AFTERNOON CONDITIONS
KAMEHAMEHA HIGHWAY AT MALAEKAHANA STATE PARK ENTRANCE
DECEMBER 2, 1989



RECEIVED AS FOLLOWS

FIGURE 4
WEEKEND AFTERNOON CONDITIONS
KAMEHAMEHA HIGHWAY AT THE PROPOSED GOLF COURSE ACCESS ROAD
DECEMBER 3, 1989

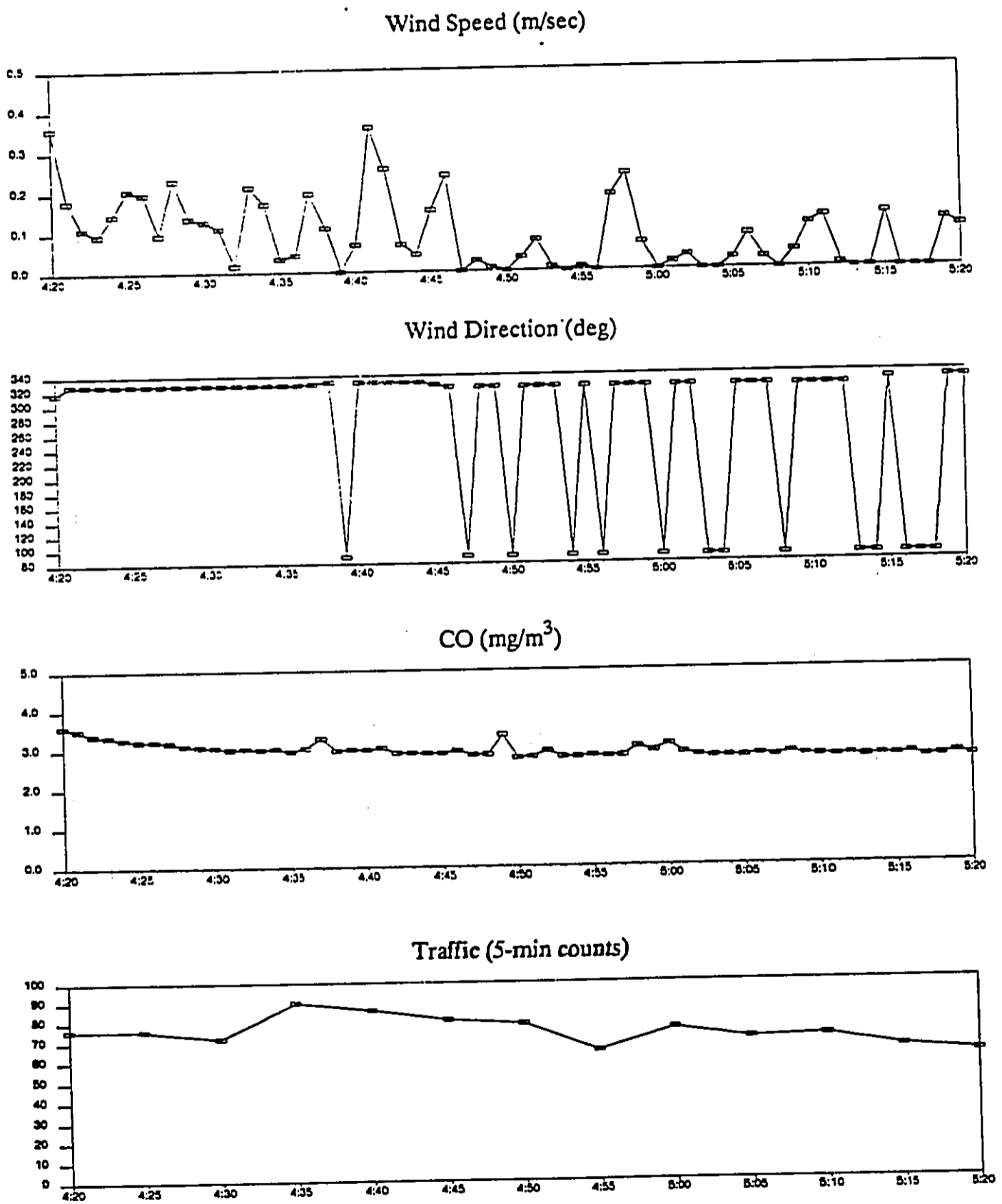
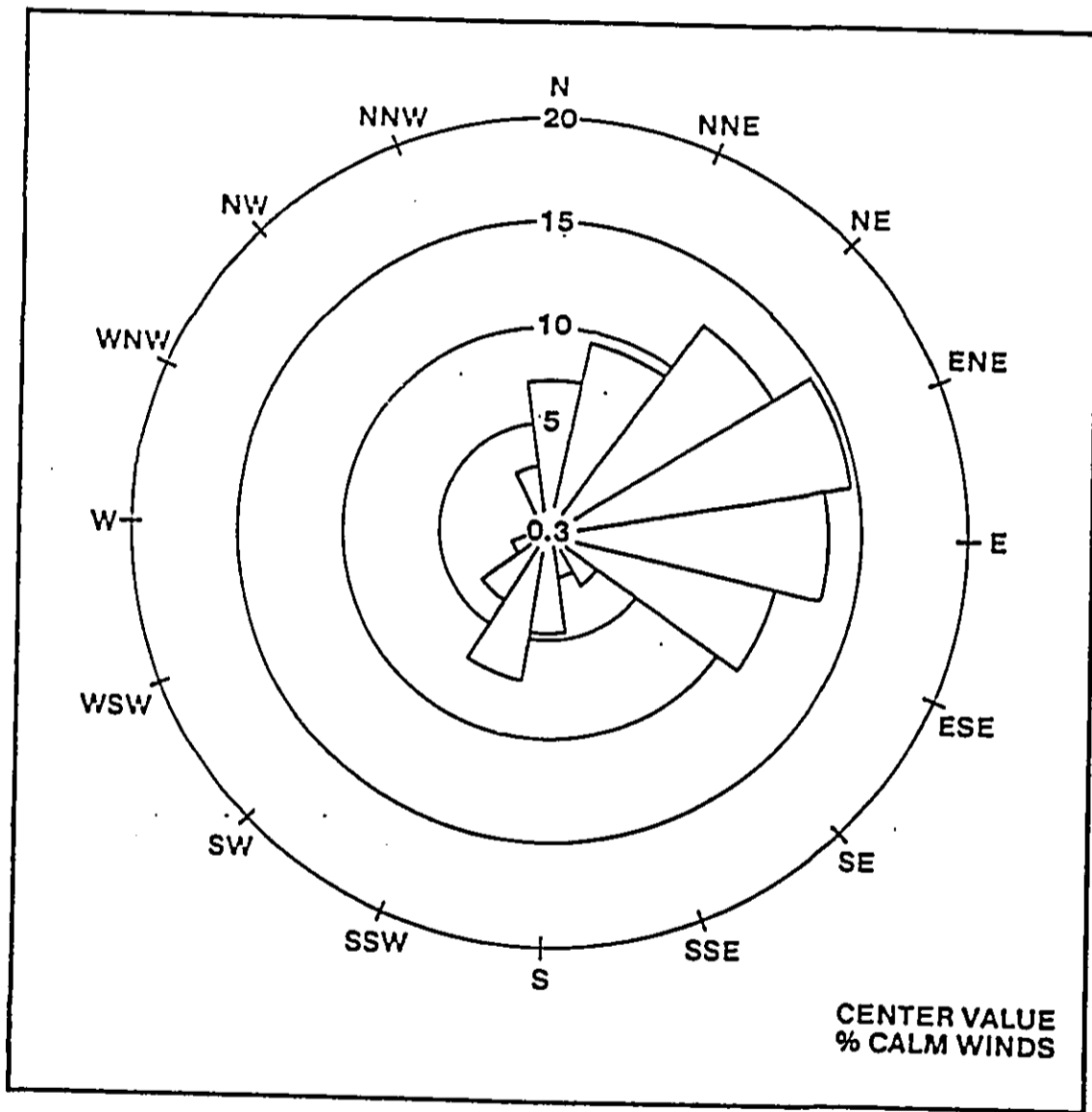
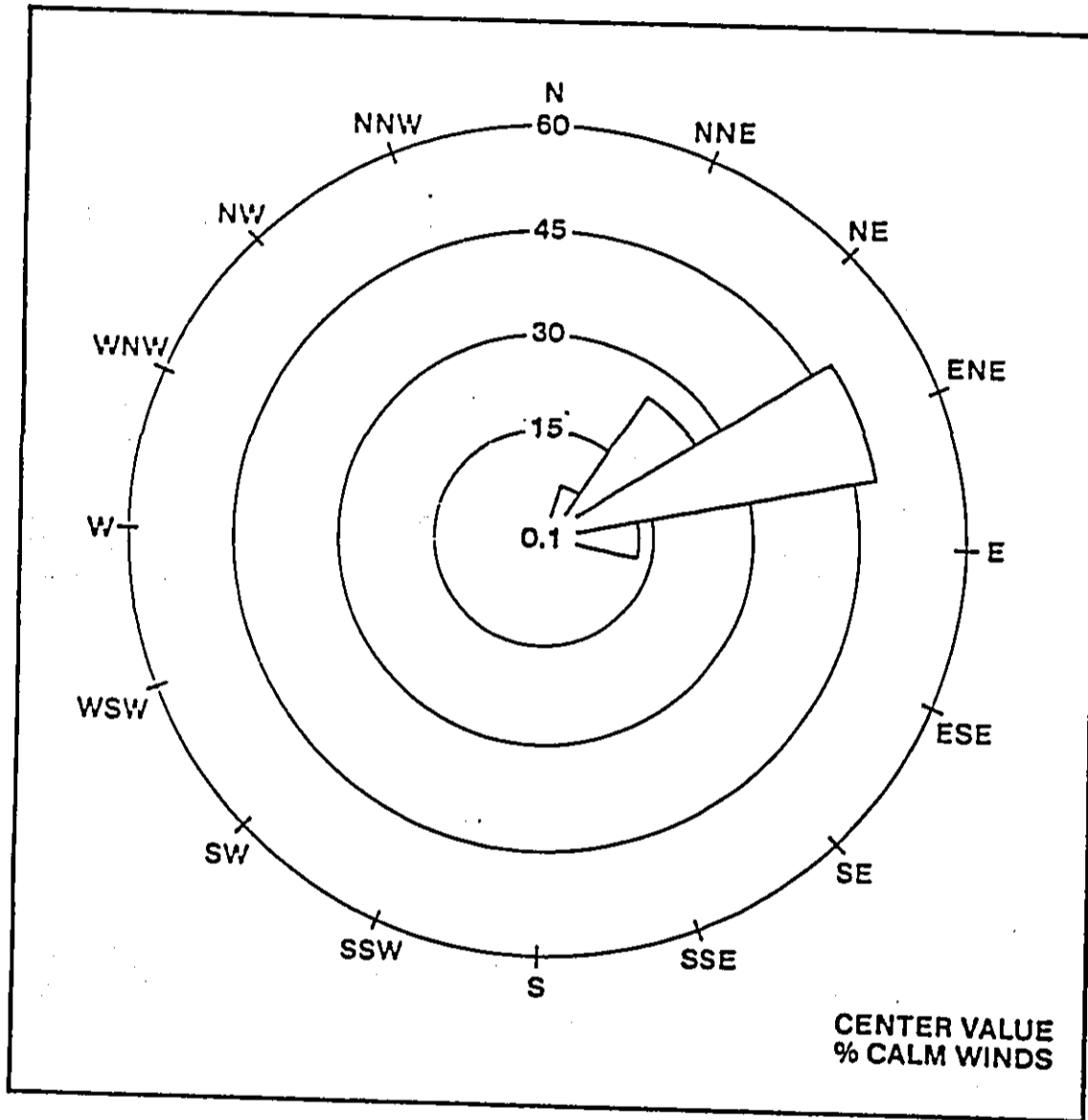


FIGURE 5
JANUARY WIND ROSE
KANEOHE MARINE CORPS AIR STATION
3:00 - 5:00 PM



SOURCE: National Weather Service

FIGURE 6
AUGUST WIND ROSE
KANEHOE MARINE CORPS AIR STATION
3:00 - 5:00 PM

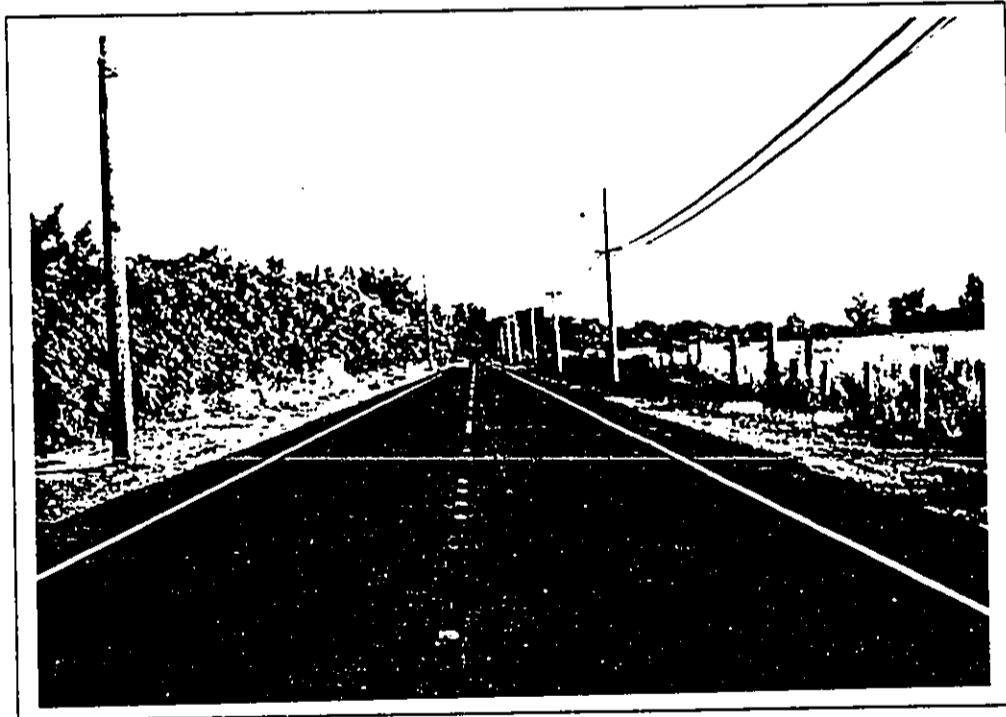
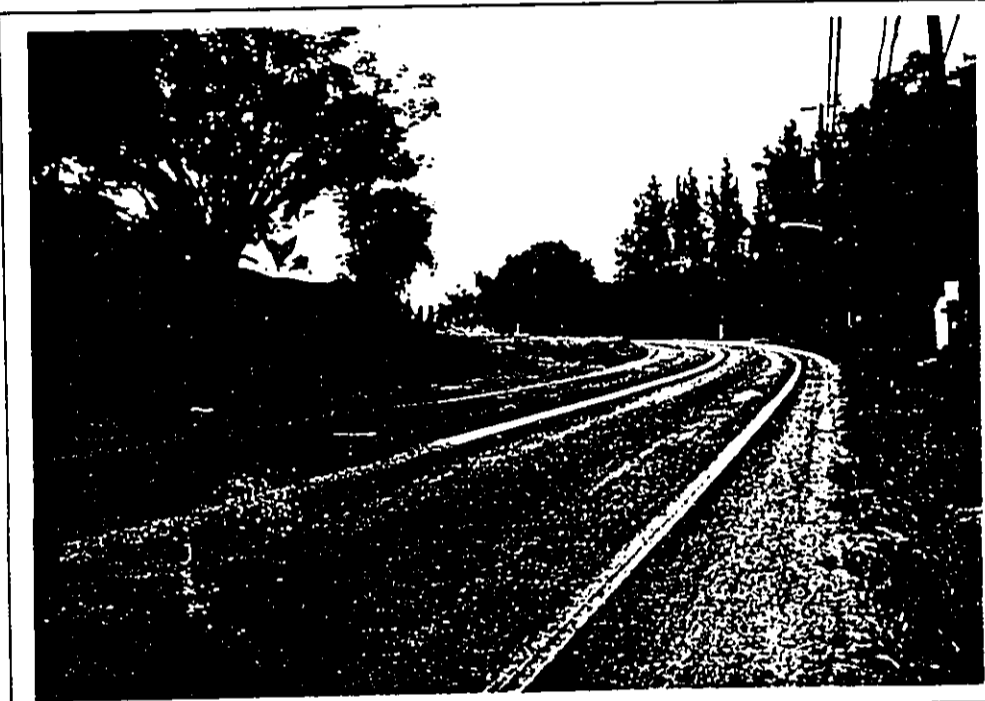


SOURCE: National Weather Service

FIGURE 7

KAMEHAMEHA HIGHWAY IN THE VICINITY OF
THE PROPOSED MALAEKAHANA GOLF COURSE

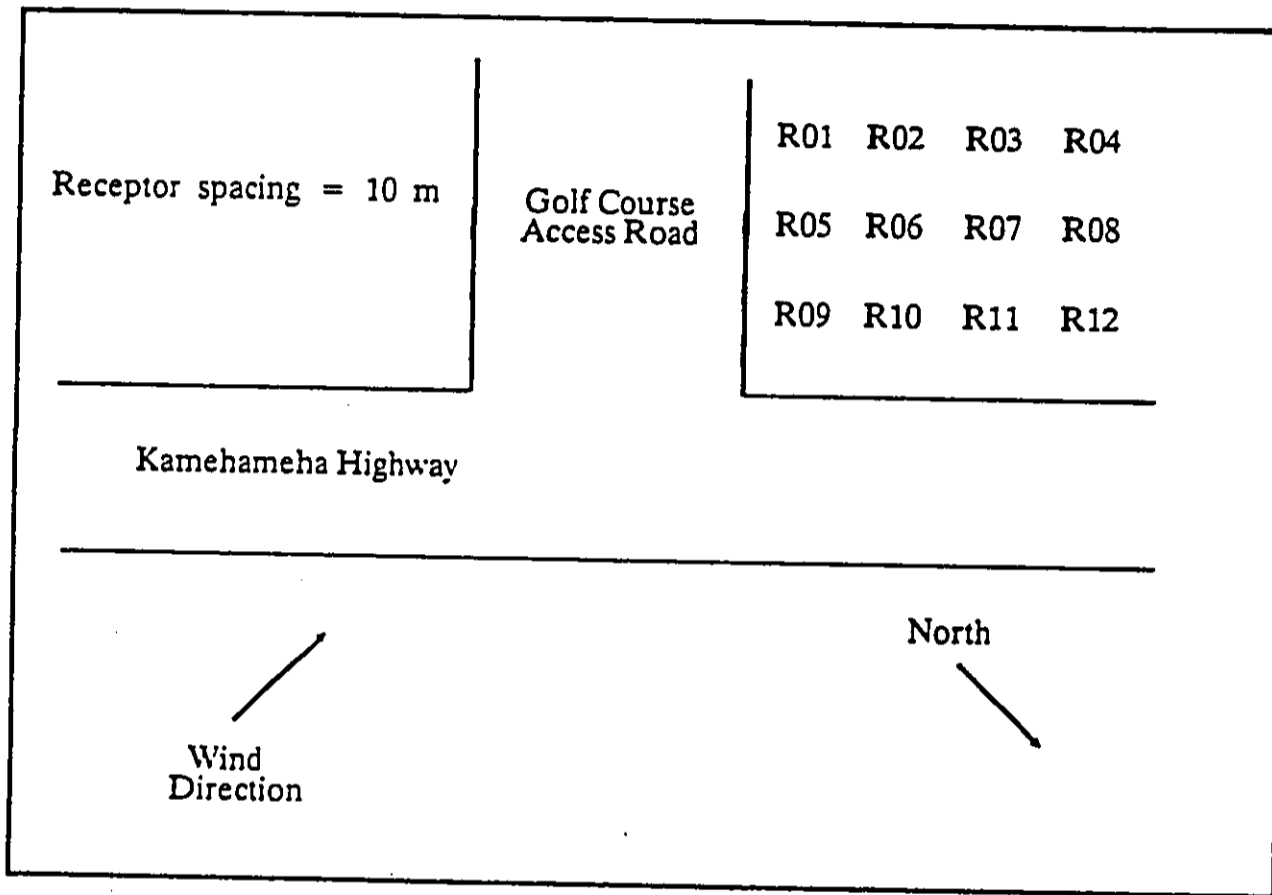
Facing North
in the Vicinity of
the Proposed
Golf Course
Access Road



Facing Southeast
in the Vicinity of
the Malaekahana
State Park Entrance

FIGURE 8

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Kamehameha Highway at the Proposed Golf Course Access Road
P.M. Peak Hour
1989 - 1994

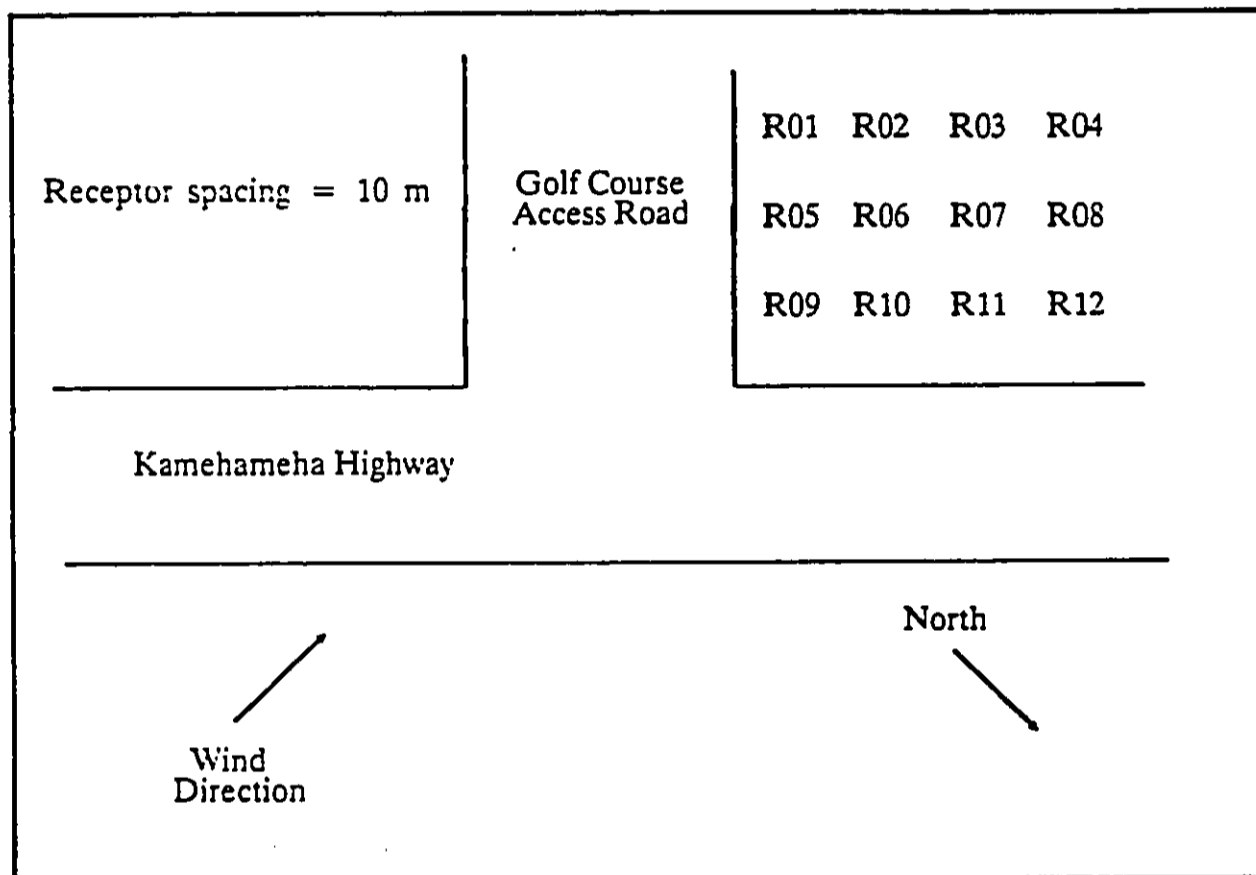


Receptor	Concentration (mg/m ³)		
	1989	1994 w/o proj	1994 w/proj
R01	1.7	1.9	2.2
R02	1.7	1.8	2.1
R03	1.6	1.8	1.9
R04	1.6	1.7	1.8
R05	1.8	2.1	2.3
R06	1.8	1.9	2.2
R07	1.8	1.9	2.1
R08	1.8	1.9	2.1
R09	2.1	2.3	2.5
R10	2.1	2.3	2.4
R11	2.1	2.2	2.3
R12	2.1	2.2	2.3

FIGURE 9

ESTIMATES OF MAXIMUM 8-HOUR
CARBON MONOXIDE CONCENTRATIONS

Kamehameha Highway at the Proposed Golf Course Access Road
1989 - 1994



Receptor	Concentration (mg/m ³)		
	1989	1994 w/o proj	1994 w/proj
R01	1.0	1.2	1.3
R02	1.0	1.1	1.2
R03	1.0	1.1	1.2
R04	1.0	1.0	1.1
R05	1.1	1.2	1.4
R06	1.1	1.2	1.3
R07	1.1	1.2	1.2
R08	1.1	1.2	1.2
R09	1.2	1.4	1.5
R10	1.2	1.4	1.4
R11	1.2	1.3	1.4
R12	1.2	1.3	1.4

PROFESSIONAL QUALIFICATIONS

James W. Morrow, M.S.

Environmental Management Consultant

DATE OF BIRTH: January 25, 1945

EDUCATION:
B.S. (cum laude) University of New Hampshire
Biochemistry Durham, New Hampshire
June, 1966
M.S. University of Hawaii
Public Health Honolulu, Hawaii
August, 1973

LANGUAGE TRAINING:
Vietnamese (3 years) - University of Hawaii
Cambodian (2 years) - University of Hawaii
Thai (2 years) - University of Hawaii
German (1 year) - University of New Hampshire

HONORS, SCHOLARSHIPS:
East-West Center Grantee, 1971-73
National Science Foundation Undergraduate Research
Program, 1964-66
New York State Regents Scholarship, 1962

MILITARY TRAINING:
ROTC Distinguished Military Graduate, 1966
US Army Chemical School Basic Officer's Course, 1967
Chemical Officer's Advanced Course, 1980
Radiological Safety Course, 1985
Command & General Staff College, 1986 (with honors)

MILITARY ASSIGNMENTS:
Assistant Corps Chemical Officer (HQ IX Corps)
Radiological Protection Officer (HQ IX Corps)
Instructor, Nuclear-Biological-Chemical Defense
Current Rank: Lieutenant Colonel

PRESENT POSITION(S):
Environmental Management Consultant
1974 to present
Director, Environmental Health
American Lung Association of Hawaii
August, 1973 to present
Clinical Faculty (currently Associate
Professor of Public Health)
School of Public Health,
University of Hawaii-Manoa
1978 to present

AIR QUALITY CONSULTING SERVICES

PROJECT -----	YEAR(S) -----
Bayview Golf Course	1989
Pu'u honua Subdivision	1989
Pualani Subdivision	1989
Kwajalein Environmental Assessment	1989
Kihei Hotel Project	1989
Honolulu Waterfront Development	1989
Ford Isle Causeway	1988
Pokahea Quarry Relocation	1988
Paluaea Lands Development (Maui)	1988
Waikoloa Resort Expansion	1988
Hawaii Film Studio (Fort Ruger)	1988
Airport Trade Center	1988
West Maui Marina	1988
Kinau Street Offramp	1988
Wahiawa Mixed Use Project	1988
Maui Wailea 670	1988
Honolulu Civic Center and City Hall Annex	1988
Maili Kai Property Affordable Housing	1988
Honolulu Rapid Transit System	1987
Kahului Airport Master Plan	1987
Keahole Airport Master Plan	1987
Kapolei Village	1987
West Loch Estates	1987
Hawaii Film Studio	1987
Honolulu International Airport Master Plan Update	1987
Ewa Town Center	1987
Hawaiian Riviera Resort	1987
AMFAC Entertainment Center	1987
Kwajalein Power Plant Renovation	1987
Kalakaua Sidewalks Widening Project	1986
Kaupulehu Resort	1986
Nitto Kogyo Golf Course	1986
Kipapa Cannery	1985
Hawaii High Technology Park	1985
Kuakini Medical Center Incinerator	1985
Pali Highway Carbon Monoxide Study	1985
Mauna Lani Resort	1985
Ka'u Agribusiness Power Plant	1985
Honolulu Resource Recovery Facility	1985

AIR QUALITY CONSULTING SERVICES (continued)

Ford Island Causeway	1984
North Kohala Residential/Resort	1984
Hapuna Beach Resort	1984
Waikoloa Hyatt Regency Hotel	1984
Hilton Hawaiian Village Renovation	1984
Queens Medical Center Incinerator	1983
Waipahu Incinerator Stack Testing	1983
Tripler Army Medical Center Steam Plant	1982
Honouliuli Wastewater Treatment Facility Sludge Incinerator and Backup Boiler	1982
Kalua Koi Residential/Resort	1982
Ala Moana Center Parking Structure Carbon Monoxide Study	1982
Honolulu Program of Waste Energy Recovery (HPOWER)	1980
Honolulu International Airport Master Plan Study	1980
Ewa Marina Community	1979
Mahukona Residential Resort	1979
Lalamilo Water Supply System	1979
Kailua-Kona Shopping Center & Industrial Park	1979
Mauna Kea Beach Hotel Power Plant	1978
Halekulani Hotel Expansion	1978
Mililani Town - Increment Five	1978
Tapa Tower - Hilton Hawaiian Village	1977
Kunia General Aviation Airport	1977
Dillingham Airfield	1977
Tripler Army Medical Center Modernization	1977
Oahu General Aviation Master Plan Study	1976
Aliamanu Military Housing Project	1974

CONTINUING EDUCATION

<u>Course Title & Sponsoring Institution</u>	<u>Year</u>
"Design & Current Status of Dry Scrubbing Systems" Air Pollution Control Association New York, New York	1987
Lethal Chemical Agent Decontamination Training US Army Chemical School Ft. McClellan, Alabama	1987
MBA1 Automatic Chemical Agent Alarm Certification Course Schofield Barracks, Hawaii	1986
Radiological Safety Course US Army Chemical School Ft. McClellan, Alabama	1984
"Principles & Practice of Air Pollution Control" (EPA Course No. 452) Honolulu, Hawaii	1982
"EPA Dispersion Models" Air Pollution Control Association New Orleans, Louisiana	1982
"Dispersion Modeling of Complex Sources" Air Pollution Control Association Philadelphia, Pennsylvania	1981
"Control Equipment for Particulate Emissions Industrial Ventilation Systems" "Airborne Radioactive Emissions" "Thermal Processing of Hazardous Organic Wastes" Air Pollution Control Association Montreal, Canada	1980
"Coastal Zone Meteorology and Air Quality Problems" Air Pollution Control Association Cincinnati, Ohio	1979
"Pesticide Protection for Health Personnel" EPA and University of Miami Medical School Honolulu, Hawaii	1977
"Principles of Industrial Toxicology" Wayne State University Detroit, Michigan	1977

RESEARCH

American Lung Association of Hawaii, 1973-74. Study of the unique short term air pollution episode occurring annually in Honolulu due to extreme use of fireworks at New Years.

University of Hawaii, School of Public Health, 1972-73. Study of the character, problems and solutions of wastewater treatment at a ready mix concrete plant.

University of New Hampshire, Department of Biochemistry, 1965-66. Study of cell wall constituents of selected Lactobacilli and means of separating and identifying those constituents.

University of New Hampshire, Department of Chemistry, 1964. Development of gas chromatographic method for separating and identifying polyamines from biological samples.

MEMBERSHIP IN HONORARY/PROFESSIONAL SOCIETIES

Air Pollution Control Association
American Public Health Association
National Association of Environmental Professionals
American Industrial Hygiene Association (Hawaii Section)
Hawaii Public Health Association
Alpha Chi Sigma (professional chemistry)
Sigma Xi
Phi Sigma (honorary biological sciences)
Phi Kappa Phi (academic honors)
Alpha Epsilon Delta (honorary pre-medical)
Alpha Zeta (honorary agricultural science)

PUBLICATIONS

Morrow, J. W., D. Thomas and H. Burkard. "H₂S Monitoring in the Vicinity of Hawaii's First Geothermal Well," Paper No. 95-105B, Air Pollution Control Association Annual Meeting (1988)

Flachsbart, P. G. and J. W. Morrow. "Development of Hawaii's H₂S Standards and Geothermal Regulations," Paper No. 87-104.5, Air Pollution Control Association Annual Meeting (1987)

Bach, W., A. Daniels, L. Dickinson, F. Hertlein, J. Morrow, S. Margolis, and V. Dinh. "Fireworks Pollution and Health," Intern. J. Environmental Studies, 7: 183-192 (1975)

Burbank, N. C. and J. W. Morrow. "Wastewater and Wastewater Treatment at a Ready Mix Concrete Plant," Proceedings, 28th Annual Purdue Industrial Waste Conference (1973)

Ikawa, M., J. Morrow and S. Harney. "Paper Chromatographic System for the Identification of Glycerol in Bacterial Cell Walls," J. Bact., 92: 812-814 (1966)

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX H

**THE COUNTRY COURSES AT
KAHUKU, IMPACT ON
AGRICULTURE**

Decision Analysts Hawaii, Inc.

APPENDIX H

**THE COUNTRY COURSES AT KAHUKU:
*IMPACT ON AGRICULTURE***

PREPARED FOR:

The Estate of James Campbell

PREPARED BY:

Decision Analysts Hawaii, Inc.

December 1989

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EXECUTIVE SUMMARY

The Country Courses at Kahuku, a proposed complex of four golf courses, would result in the development of approximately 200 acres of agricultural land at *Malaekahana* and 605 acres at *Punamano*, for a total of 805 acres.

AGRONOMICAL CONDITIONS

Based on various soil surveys, a little over half of the *Malaekahana* site and about two-thirds of the *Punamano* site are comprised of good soils. However, the good soils at *Punamano* are scattered throughout the properties, with gulches and steep slopes intersecting the more gently sloping terrain. It should also be noted that some of the soil ratings are quite old (1972) and, based on the agricultural experiences of the current lessee, may be inaccurate in that much of the topsoil may since have eroded.

Elevation ranges from 20 to 100 feet at *Malaekahana* and 10 to 300 feet at *Punamano*. Rainfall averages 40 to 50 inches a year, and groundwater is available in the area. Heavy winds limit the choice of crops and/or require windbreaks.

PAST AND CURRENT AGRICULTURAL USES OF THE PROPERTIES

Until 1971, most of the *Malaekahana* and *Punamano* properties were cultivated in sugarcane as part of Kahuku Plantation Company.

Currently, most of the *Malaekahana* property is being used by the Gunstock Ranch for grazing 100 head of cattle and 40 horses, and for boarding about a dozen horses. The operation supports one employee. Development of the *Malaekahana* golf course project would cause Gunstock Ranch to either (1) close because insufficient land would remain for a viable operation, or (2) relocate to other lands. Campbell Estate owns other nearby lands that are of similar quality and could be made available to Gunstock Ranch. Another possibility would be to relocate grazing operations around the fringes of the golf course.

Since 1973, the *Punamano* property has been leased to Amoriant Aquaculture International ("Amoriant"), a local firm. However, after over a decade of analyzing the economic feasibility

EXECUTIVE SUMMARY

v

of numerous crops, including field testing of the more promising ones, the company has not identified a profitable agricultural use for the property, and the lands now lie fallow. Amoriont concluded that the Punamano lands are completely unsuited for crop production, and has expressed a desire to be released from its lease obligation to Campbell Estate. The principal difficulties cited were the cost of pumping water to irrigate mauka fields; soils that are poor and thin, and subject to erosion on the steeper slopes and very rocky at the lower elevations; difficult terrain, with the area chopped up by gullies and ravines; and excessive winds which damage plants.

AVAILABILITY OF ADDITIONAL AGRICULTURAL LAND IN KAHUKU

Additional agricultural lands will become available soon in the Kahuku area with the completion of the State's Kahuku Agricultural Park, which is now under development. This Park, which will be under a 30-year lease from Campbell Estate, will have 220 usable acres of land divided into 24 lots. Land will be available for nursery products, truck crops, and orchards. Other Campbell Estate lands in the Kahuku area could be made available for diversified agriculture operations if justified by the economics; this justification would include lease rents that are sufficient to cover the cost of any improvements that might be required.

DEMAND FOR AND SUPPLY OF LAND FOR DIVERSIFIED AGRICULTURE—STATEWIDE

The development of The Country Courses at Kahuku would eliminate the possibility of using the affected lands for diversified agriculture. However, it is extremely doubtful that the project would adversely affect the growth of diversified agriculture in Hawaii. There are four reasons for this assessment: (1) a vast amount of agricultural land and water in the State has been freed from sugar and pineapple production due to past plantation closings and reductions in operations—over 100,000 acres since 1968, including announced reduction plans—and most of this land has favorable soil ratings and remains available for diversified-agriculture activities; (2) it is very possible that additional sugarcane acreage and water will be freed, given the existence of unprofitable sugar operations; (3) some, if not most, of the sugar companies would make their lands available for profitable replacement crops to the extent that such crops exist; and, in contrast, (4) land requirements to accommodate the growth of diversified agriculture are surprisingly modest. In other words, the limiting factor is not the *land supply*, but rather the *market demand* for those crops that can be grown profitably in Hawaii. The proposed Country Courses at Kahuku involve too little land to affect this conclusion, and would therefore not affect adversely the Statewide growth of diversified agriculture.

However, small-scale farmers do have difficulty obtaining land because of *expensive subdivision requirements*. To help overcome this problem in the Kahuku area, the State is developing the Kahuku Agricultural Park.

RETRIEVABLE COMMITMENT OF RESOURCES

Even though the development of The Country Courses at Kahuku constitutes a commitment of prime agricultural land to recreational use, this would not constitute an irretrievable loss of these agricultural lands. If, at some time in the future, farming this land would contribute more economically than the Kahuku golf operations contribute, then the land could be planted in crops relatively easily. Although such a conversion is possible, it is extremely improbable in that Hawaii's economy would have to undergo a dramatic change through one or both of two highly improbable events: (1) the collapse of Hawaii's very healthy and robust visitor industry, followed by the collapse in the demand for golfing by visitors and residents; and/or (2) the discovery of some high-value land-intensive export crop that is unique to Hawaii, and for which the demand would be so large as to virtually absorb all of Hawaii's agronomically suitable land for that crop. Such a crop has been sought for over a century without success.

IMPACT ON AGRICULTURAL LAND VALUES AND LEASE RENTS

To the extent that The Country Courses at Kahuku are perceived to increase the long-term development potential of nearby agricultural lands, the proposed golf courses will also increase the current market value of the nearby lands. The resulting higher land values represent a market signal that, at some time in the future, greater benefits can be derived from the nearby lands than were previously anticipated. Until such development occurs—assuming that it in fact does occur—the land may be put to some temporary use, and this can include an agricultural activity which can last for decades. In the meanwhile, lease rents will be unaffected.

CONTRIBUTION OF THE COUNTRY COURSES TO THE GROWTH OF DIVERSIFIED AGRICULTURE

To an undetermined extent, The Country Courses at Kahuku would contribute to the growth of diversified agriculture in that nursery sales would increase, since a large number of plants and trees would be required to landscape four golf courses.

Also, The Country Courses at Kahuku would allow a significant number of people who possess agricultural skills to work in an activity that is closely related to farming, since about 80 of the jobs involve cultivating grasses and plants, applying fertilizers and chemicals, maintaining irrigation systems, etc. This represents a significant number of agricultural-type jobs inasmuch as Statewide agricultural field employment has exhibited a declining trend for the sugar and pineapple industries, and even for diversified agriculture. After increasing their agricultural skills even further, some of these people may eventually move on to start their own commercial farm operations, thereby contributing to the growth of diversified agriculture

CONSISTENCY WITH STATE AND COUNTY PLANS

The Country Courses at Kahuku (1) would not adversely affect plantation agriculture, since none exists on the properties; (2) would not adversely affect existing diversified-agriculture crop production, since none exists on the properties; (3) involves lands which, for the *Punamano* site, have been found to be poorly suited for crop production; (4) would not limit the Statewide growth of diversified agriculture since the supply of land available to diversified agriculture far exceeds projected demand, with additional agricultural lands to be made available in the area at the State's Kahuku Agricultural Park; (5) would not represent an irretrievable commitment of resources, although a dramatic economic change sufficient to justify converting the golf courses to crop production is regarded as extremely improbable; (6) would not increase agricultural lease rents in the area, although some land values may increase; and (7) would enhance the growth of diversified agriculture to an undetermined extent by increasing nursery sales, and by maintaining and increasing the pool of workers having skills applicable to farming. However, grazing operations on the *Malaekahana* property would have to be relocated; otherwise, one job would be lost.

In view of these findings, The Country Courses at Kahuku is consistent with the major thrust of the *Hawaii State Plan*, the *State Agriculture Functional Plan*, and the *General Plan of the City and County of Honolulu*. The thrust in all three plans calls for preserving the economic viability of plantation agriculture, and maintaining and promoting the growth of diversified agriculture. To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured. Nevertheless, a portion of the development—a little over half of the *Malaekahana* site and about two-thirds of the *Punamano* site—is inconsistent with the lower-level State agricultural guidelines which call for Agricultural Lands of Importance to be protected from development. However, this guideline does not apply if an overriding public interest exists to provide such lands for other objectives of the Hawaii State Plan.

Finally, The Country Courses at Kahuku would conform with those State and County objectives and policies which favor increased recreation and employment. The four golf courses would accommodate over 600 resident and visitor golfers per day; would contribute to the economic health of the visitor industry; and would provide an estimated 200 jobs, of which about 80 would be outdoor jobs similar to certain jobs in the agriculture industry.

THE COUNTRY COURSES AT KAHUKU: IMPACT ON AGRICULTURE

The Country Courses at Kahuku, a proposed complex of four golf courses, would result in the development of approximately 605 acres for three golf courses at Punamano and 200 acres for one course at Malaekahana, for a total of 805 acres.^[1] The impact of this development on existing agricultural operations and on the potential growth of diversified agriculture in Hawaii is summarized in this report.

AGRONOMICAL CONDITIONS

Soil Types and Agricultural Uses

The affected acreage consists of six soil types at Malaekahana, and 19 soil types at Punamano.^[2] At *Malaekahana*, the soil types are:

CR	Coral outcrop;
JaC	Jaucas sand, 0 to 12 percent slope;
KmA	Keaau clay, 0 to 2 percent slope;
KIA	Kawaihapai clay loam, 0 to 2 percent slope;
LaB	Lahaina silty clay, 3 to 7 percent slope;
LaC	Lahaina silty clay, 7 to 15 percent slope;

At *Punamano*, the soil types are:

CR	Coral outcrop;
KaB	Kaena clay, 2 to 6 percent slope;
KaC	Kaena clay, 6 to 12 percent slope;
KaeC	Kaena stony clay, 6 to 12 percent slope;
KanE	Kaena very strong clay, 10 to 35 percent slope;
Kfa	Kaloko clay;
KpB	Kemoo silty clay, 2 to 6 percent slope;
KpC	Kemoo silty clay, 6 to 12 percent slope;
KpD	Kemoo silty clay, 12 to 20 percent slope;

KPZ	Kemoo-Badland complex;
LaB	Lahaina silty clay, 3 to 7 percent slope;
LaC	Lahaina silty clay, 7 to 15 percent slope;
PeB	Paumalu silty clay, 3 to 8 percent slope;
PeC	Paumalu silty clay, 8 to 15 percent slope;
PeD	Paumalu silty clay, 15 to 25 percent slope;
PeF	Paumalu silty clay, 40 to 70 percent slope;
rRK	Rock land; 0 to 70 percent slope;
WkA	Waialua silty clay, 0 to 3 percent slope;
WkB	Waialua silty clay, 3 to 8 percent slope.

For each soil type, Table 1 (for Malaekahana) and Table 2 (for Punamano) show the approximate land area in acres and by percentage of total land area, possible agricultural uses, and two soil ratings (explained below).

The predominate soil types at *Malaekahana*—CR, LaB, and LaC—comprise about 82 percent of the project area. Of the total area, 66 percent can be used for sugar, pineapple, truck, or orchard crops; the remaining land is unsuited for agriculture.

The predominate soil types at *Punamano*—Cr, LaB, LaC and PeC—comprise about 52 percent of the project area, while the remaining land contains 15 different soil types. Of the total area, 74 percent can be used for sugar, pineapple or truck crops; the remaining land can be used for pasture or is unsuited for agriculture.

Soil Ratings

The soils within the petition area have been rated in terms of four classification systems commonly used in Hawaii: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawaii, (3) Overall Productivity Rating, and (4) Proposed Land Evaluation and Site Assessment. These classification systems are discussed below.

(1) *Land Capability Grouping by the United States Department of Agriculture Soil Conservation Service (SCS).*

This classification system rates soils into eight levels, ranging from the highest classification level, "I," to the lowest level, "VIII." The ratings for the two sites, which are made under the assumption that the land is irrigated, are shown in Tables 1 and 2.

At *Malaekahana*, approximately 4 percent of the area has a land capability rating of I, which indicates that the soils have few limitations that restrict their use. About 13 percent of the land has a rating of IIe, which indicates that the soils have

moderate limitations that reduce the options on plants that can be grown successfully, or indicates that moderate conservation practices are required. The subclassification "e" indicates that the limitation is due to the risk of erosion, and therefore the soils require protection when cultivated. About 35 percent of the land is rated IIIe, and 9 percent is rated IIIw. Class III soils have severe limitations that reduce options on plants that can be grown successfully, require special conservation practices, or both. Subclassification "e" indicates risk of erosion as described above, while subclassification "w" indicates that the limitation results from excess water because the soils are poorly drained and subject to seepage. About 5 percent of the land is rated IVs, which indicates that the soils have very severe limitations that reduce the options on plants that can be grown successfully, require very careful management, or both. The subclassification "s" indicates that the soils limitation is because of stoniness, unfavorable texture, shallowness, or low water-holding capacity.

Table 1.— PROPOSED GOLF COURSE AT MALAEKAHANA:
SOIL TYPES, AGRICULTURAL USES, AND LESA AND SCS RATINGS

Soil Type	Approximate Acreage	Percentage of Total	Agricultural Uses	SCS Rating ¹	LESA Rating
CR	68	34	None	VIII _s	—
JaC	10	5	Sugar, Pasture, Truck Crops	IV _s	41
KmA	18	9	Sugar, Pasture	III _w	45
KIA	8	4	Sugar, Truck Crops, Pasture, Orchards	I	94
LaB	27	13	Sugar, Pineapple, Truck Crops	II _e	90
LaC	70	35	Sugar, Pineapple, Pasture	III _e	82

1. Assuming that the soils are irrigated.

Source: Dames & Moore, Honolulu, Hawaii; and U.S. Department of Agriculture, Soil Conservation Service in cooperation with The University of Hawaii Agricultural Experiment Station, *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai*, State of Hawaii, Washington, D.C., August 1972.

Table 2.— PROPOSED GOLF COURSES AT PUNAMANO:
SOIL TYPES, AGRICULTURAL USES, AND LESA AND SCS RATINGS

Soil Type	Approximate Acreage	Percentage of Total	Agricultural Uses	SCS Rating ¹	LESA Rating
CR	87	14	None	VIII _s	—
KaB	37	6	Sugar, Truck Crops, Pasture	III _w	79
KaC	37	6	Sugar, Pasture	III _w	70
KaeC	20	3	Sugar, Pasture	III _w	62
KanE	33	6	Pasture	VI _s	41
Kfa	3	1	Sugar, Pasture	III _w	81
KpB	18	3	Sugar, Pasture	II _e	87
KpC	7	1	Sugar, Pasture	III _e	85
KpD	5	1	Pasture, Sugar	IV _e	69
KPZ	6	1	Pasture	VII _e	23
LaB	97	16	Sugar, Pineapple, Truck Crops, Pasture	II _e	90
LaC	70	12	Sugar, Pineapple	III _e	82
PeB	26	4	Sugar, Pasture	II _e	85
PeC	60	10	Sugar, Pasture	III _e	76
PeD	15	2	Pasture, Sugar	IV _e	57
PeF	26	4	Pasture	VII _e	20
rRK	2	1	Pasture	VII _s	—
WkA	11	2	Sugar, Truck Crops, Pasture	I	93
WkB	45	7	Sugar, Truck Crops, Pasture	II _e	91

1. Assuming that the soils are irrigated.

Source: Dames & Moore, Honolulu, Hawaii; and U.S. Department of Agriculture, Soil Conservation Service in cooperation with The University of Hawaii Agricultural Experiment Station, *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai*, State of Hawaii, Washington, D.C., August 1972.

The remaining 34 percent of the land is coral outcrop rated VIII_s, which indicates that the soils and landforms have limitations that preclude their use for commercial plant production.

At *Punamano*, about 2 percent of the proposed project has a land capability rating of I, 30 percent is rated II_e, 39 percent is rated III_e or III_w, and 3 percent is rated IV_e or IV_w. These ratings are described above. The remaining lands—about 26 percent of the total area—have a land capability rating of VI or higher, which indicates that severe limitations make them generally unsuitable for cultivation—either because of erosion or stoniness.

- (2) *Agricultural Lands of Importance in the State of Hawaii (ALISH)*, by the SCS, University of Hawaii (UH) College of Tropical Agriculture and Human Resources, and the State of Hawaii, Department of Agriculture.^[3,4]

This system classifies lands into three categories: (a) "Prime" agricultural land which is land that is best-suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment; (b) "Unique" agricultural land which is non-prime agricultural land that is currently used for the production of specific high-value crops; and (c) "Other" agricultural land which is non-prime and non-unique agricultural land that is of importance to the production of crops.

At *Malaekahana*, about 23 percent of the lands proposed for the golf course are rated as "Prime" agricultural lands, 38 percent as "Other," and the remaining 39 percent is not rated.

At *Punamano*, 57 percent of the lands are rated as "Prime" agricultural lands, 17 percent as "Other," and the remaining 26 percent is not rated.

- (3) *Overall Productivity Rating*, by the UH Land Study Bureau (LSB).^[5]

This classification rates soils according to five levels, where "A" represents the class of highest productivity and "E" the lowest.

At *Malaekahana*, none of the lands are rated "A," while 55 percent are B; 5 percent are C; and 34 percent are E.

At *Punamano*, 7 percent of the lands are rated A; 52 percent are rated B; 11 percent are C; 3 percent are D; and 27 percent are E. A quarry and a reservoir take up less than 1 percent of the area, and are not rated.

- (4) *Proposed Land Evaluation and Site Assessment (LESA) System, by the State of Hawaii Land Evaluation and Site Assessment Commission.*^[6]

Based on soil quality, locational attributes, improvements, nearby activities, and land-use plans, this proposed classification system attempts to designate a sufficient amount of the better agricultural lands to meet projected agricultural goals. If the LESA classification approach were applied to the *Malaekahana* site, 52 percent of the lands would be termed "important agricultural lands" (IAL), which would include all lands having a rating of 66 or higher, out of a possible total of 100. At the *Punamano* site, about 69 percent of the lands would be termed IAL. Again, the ratings for each soil type are shown in Tables 1 and 2. However, the designations would be subject to change based on a change in nearby activities and a change in County land-use plans. Also, the designation could be changed if an overriding public benefit were demonstrated.

Based on the various soil surveys, a little over half of the *Malaekahana* site and about two-thirds of the *Punamano* site are comprised of goods soils. However, for the *Punamano* site, these good soils are scattered throughout the property, with gulches and steep slopes intersecting the more gently sloping terrain. It should also be noted that some of the soil ratings are quite old (1972) and, based on the agricultural experiences of the current lessee (see below), may be inaccurate in that much of the topsoil may since have eroded.

Other Agricultural Conditions^[7,8]

At the *Malaekahana* site, most of the terrain is comprised of rolling hills with some broad areas of gently sloping grasslands; elevations range from 20 feet to 100 feet above sea level. For most of the land area, rainfall averages between 40 and 50 inches per year.

At *Punamano*, where the elevation ranges from 10 feet to 300 feet above sea level, the terrain is comprised of broad open areas and gentle slopes including some hills, and some steep slopes and cliffs. Three intermittent stream gulches cross the site. For most of the land area, rainfall averages between 40 and 45 inches per year.

Groundwater is available in the area; however, since these are mauka lands the water must be pumped up to the surface and the cost of the water is correspondingly high.

Heavy winds in the area limit the choice of crops and/or require windbreaks.

POSSIBLE CROPS

Studies for the nearby Kahuku Agricultural Park, which is located on similar terrain between the *Malaekahana* and *Punamano* sites, indicates that vegetables, fruits and melons, and

flowers and nursery products can be grown in the Kahuku foothills.^[8] Vegetables could include snap beans, green peppers, cucumbers, eggplant, ginger root, mustard cabbage, green onions, Italian squash, sweet potatoes, sweet corn, and tomatoes. Vegetables unsuited for the Kahuku area include carrots, broccoli, celery, lettuce, and dry onions. Fruits and melons which can be cultivated include avocados, bananas, guava, papaya, tangerines, passion fruit, and various kinds of melons. Flower and nursery products include ornamental potted plants and dendrobiums.

PAST AND CURRENT AGRICULTURAL USES OF THE PROPERTIES

Malaekahana^[9]

Until 1971, most of the Malaekahana property was cultivated in sugarcane as part of Kahuku Plantation Company. This plantation closed primarily because of the poor agronomical conditions in the Kahuku area, and because of its small size and lack of economies of scale.

Most of the Malaekahana property is now being used by the Gunstock Ranch under a short-term lease from Campbell Estate. Including some adjoining property, the Gunstock Ranch covers about 250 acres of land that is used for grazing about 100 head of cattle and 40 horses, and for boarding about a dozen horses. The operation is marginally profitable to profitable, depending upon beef prices and the amount of rainfall—plentiful rainfall increases the amount of grass for grazing and reduces feed costs. Revenues of about \$60,000 per year support one job, and cover feed, rent, water, taxes and other operating costs. By comparison, revenues from the proposed Malaekahana golf course alone are projected to be about \$2.7 million per year, while employment is projected to be about 50 jobs, including about 20 jobs which would require agricultural skills to maintain healthy plants and greens.

Development of the Malaekahana golf course project would cause Gunstock Ranch to either (1) close because insufficient land would remain for a viable operation, or (2) relocate to other lands. Campbell Estate owns other nearby lands that are of similar quality and could be made available to Gunstock Ranch. Another possibility would be to relocate grazing operations around the fringes of the golf course.

Punamano^[10]

Until 1971, most of the Punamano property was cultivated in sugarcane as part of Kahuku Plantation Company. Since 1973, the property has been leased to Amorient Aquaculture International ("Amorient"), a local firm. However, to date, the company has not identified a profitable agricultural use for the property, and the lands now lie fallow. Amorient has investigated the economic feasibility of numerous candidate crops on this land, including test cultivation of Christmas trees, pineapple, hale koa seed for export, and other crops. They also analyzed the economics of feed corn, sorghum, sudex, hay and other fodder crops.

After over a decade of effort, Amorient concluded that in today's economic environment the lands are unsuitable for commercial agricultural crop production, with the principal difficulties being the cost of pumping water to irrigate mauka fields, poor soils, difficult terrain, and excessive wind. Because Amorient has considerable experience with wind power, it had hoped that windmills might reduce pumping costs. The firm concluded, however, that the initial cost of wind turbines, coupled with the very poor reliability of commercially available units and the consequent high cost of maintenance, made this option economically unfeasible.

Amorient also concluded that the soils over most of the lands are poor and thin—a condition which was made worse by nearly 50 years of sugarcane production and the consequent severe loss of topsoil that resulted from the standard farming practices for sugar. In many areas, relatively steep slopes make it difficult to conserve soil and, furthermore, crop cultivation would cause an unacceptable increase in erosion rates. Also, lands at the lower elevations are rocky and therefore difficult to plow. Furthermore, the whole area is chopped up by gullies and ravines. In the opinion of Amorient, these conditions severely limit the available options for suitable crops. Their experience with the property strongly suggests that some of the soil surveys—most of which are based on conditions when the land was cultivated in sugarcane—overstate the quality of the soils.

The winds in the area, which are high and virtually constant, severely restrict options on crops that can be grown successfully. This is evidenced by the number of candidate species that are either stunted or experience extensive lodging under these wind conditions.

Amorient ultimately concluded that the *Punamano* lands are completely unsuitable for crop production, and have expressed a desire to be released from their lease obligation to Campbell Estate because of their inability to find a profitable crop to cultivate on the site.

AVAILABILITY OF ADDITIONAL AGRICULTURAL LAND IN KAHUKU

Additional agricultural lands will become available in the Kahuku area with the completion of the State's Kahuku Agricultural Park, which is now under development. This Park, which will be under a 30-year lease from Campbell Estate, will have 220 usable acres of land divided into 24 lots. Land will be available for nursery products, truck crops, and orchards^[8] By the end of 1989, the number of applicants for lots at the Park exceeded the supply; however, these applicants have not yet been screened by the Department of Agriculture for their farming abilities.^[11]

Other Campbell Estate lands in the Kahuku area could be made available for diversified agriculture operations if justified by the economics; this justification would include lease rents that are sufficient to cover the cost of any improvements that might be required.

DEMAND FOR AND SUPPLY OF LAND FOR DIVERSIFIED AGRICULTURE—STATEWIDE AND OAHU

The development of The Country Courses at Kahuku constitutes a commitment of prime agricultural land to recreational use. For the purposes of this discussion, prime agricultural land is loosely defined to mean any high-quality agricultural land that can produce high yields for a variety of crops. Based on soil quality, between 100 and 130 acres at *Malaekahana* and between 340 and 430 acres at *Punamano* could be considered prime agricultural land. This commitment raises the question of whether The Country Courses at Kahuku would affect adversely the development of diversified agriculture in Hawaii—either immediately or over the long term. To address this issue, the demand for and the supply of prime agricultural land for diversified agriculture are clarified below.

Demand for Prime Agricultural Land

The highest projections known to the consultant for the amount of land required to accommodate the growth of diversified agriculture in Hawaii are those prepared by the Land Evaluation and Site Assessment (LESA) Commission. These projections—which are shown in Tables 3 and 4 for the State and Oahu, respectively—were prepared in 1985. The projections represent an attempt to quantify the amount of agricultural land that will be required to (1) accommodate resident-plus-visitor population growth, (2) increase food and animal-feed self-sufficiency, and (3) increase crop exports.

As indicated, the LESA Commission projected in 1985 that an estimated 52,684 additional acres of land would be required Statewide to accommodate the increase in production from 1983 to 1995. The corresponding figure for Oahu is 7,979 acres. The crops and acreage requirements are categorized according to those which generally do not require prime agricultural land (although some crops may be grown profitably on prime agricultural land), those which generally do require prime agricultural land, plus a contingency of 10 percent of all acreage used for purposes other than beef and cattle production.

The relevant figures from Tables 3 and 4 are not the total figures, but rather the increase in the amount of *prime* agricultural land that is projected to be required to accommodate diversified agriculture: the increase is 8,858 acres for the State, and 2,314 acres for Oahu. These increased requirements for prime agricultural land are surprisingly small. Nevertheless, the projected land requirements, as small as they are, are high in that diversified agriculture is growing more slowly than the LESA Commission projections. A more realistic estimate of the amount of prime agricultural land required to accommodate Statewide growth of diversified agriculture over the next decade to the year 2000 is probably closer to 2,000 acres.^[12] Furthermore, land is being freed from plantation agriculture faster than it can be absorbed by other crops (see discussion below).

Table 3.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
STATE OF HAWAII: 1983 AND 1995

Crop or Activity	1983	1995	Increase
Crops and Activities which Generally Do Not Require Prime Agricultural Lands			
Beef/cattle ^{1,2}	765,450	365,090	--
Livestock:			
Dairy	1,000	1,182	182
Eggs/Poultry	281	515	234
Swine	600	1,050	450
Subtotal for Livestock	1,881	2,747	866
Unique Crops:			
Aquaculture	500	4,500	4,000
Coffee	2,000	5,700	3,700
Flowers/Nursery	1,786	3,040	1,254
Papaya	2,120	11,850	9,730
Taro/Watercress	400	527	127
Subtotal for Unique Crops	6,806	25,617	18,811
Macadamia Nuts	15,800	27,000	11,200
Crops and Activities which Generally Do Require Prime Agricultural Lands			
Plantation:			
Sugarcane ^{2,3}	194,300	177,700	-16,600
Pineapple	36,000	36,049	49
Subtotal for Plantation	230,300	213,749	-16,551
Other:			
Guava	965	1,400	435
Seed Corn	730	1,060	330
Bananas	1,100	2,200	1,100
Feed/Forage ^{2,4}	8,705	12,495	3,790
Fruits	635	1,156	521
Vegetables/Melons ⁵	4,340	7,022	2,682
Subtotal for Other Crops	16,475	25,333	8,858
Contingency ⁶	--	29,500	29,500
TOTAL	1,036,712	689,036	--
TOTAL, Excluding Beef/Cattle	271,262	323,946	52,684

Table 3.—LESA AGRICULTURAL ACREAGE REQUIREMENTS,
STATE OF HAWAII: 1983 AND 1995
(continued)

Source: Derived from State of Hawaii Land Evaluation and Site Assessment Commission, *A Report on the State of Hawaii Land Evaluation and Site Assessment System*, Legislative Reference Bureau, Honolulu, Hawaii, February 1984.

1. Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
2. Often includes land in a holding operation awaiting discovery of profitable uses.
3. The decline in acreage primarily reflects the loss of Puna Sugar Co.
4. Includes some pastureland and 8,000 acres of guinea grass on Molokai.
5. Overstated in that the acreage figures are for harvested acres, rather than for the amount of land required (i.e., the acreage requirements for a crop harvested twice a year should be halved).
6. Based on 10% of all acreage other than that for beef/cattle. This contingency amounts to double counting in that the LESA projections are already high. Also, the contingency figure allows for an additional 17,770 acres for expansion of sugarcane, even though the sugar industry is expected to decline, not expand.

Table 4.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
CITY AND COUNTY OF HONOLULU: 1983 AND 1995

Crop or Activity	1983	1995	Increase
Crops and Activities which Generally Do Not Require Prime Agricultural Lands			
Beef/cattle ^{1,2}	18,200	10,090	--
Livestock:			
Dairy	340	40	62
Eggs/Poultry	250	390	140
Swine	<u>144</u>	<u>200</u>	<u>56</u>
Subtotal for Livestock	734	992	258
Unique Crops:			
Aquaculture	300	2,400	2,100
Flowers/Nursery	495	850	355
Papaya	70	170	100
Taro/Watercress	<u>60</u>	<u>85</u>	<u>25</u>
Subtotal for Unique Crops	925	3,505	2,580
Crops and Activities which Generally Do Require Prime Agricultural Lands			
Plantation:			
Sugarcane ²	27,200	25,300	-1,900
Pineapple	<u>11,829</u>	<u>11,800</u>	<u>-29</u>
Subtotal for Plantation	39,029	37,100	-1,929
Other:			
Guava	--	242	242
Seed Corn	125	180	55
Bananas	540	836	296
Feed/Forage ^{2,3}	1,741	2,912	1,171
Fruits	90	200	110
Vegetables/Melons ⁴	<u>1,155</u>	<u>1,595</u>	<u>440</u>
Subtotal for Other Crops	3,651	5,965	2,314
Contingency ⁵	--	<u>4,756</u>	<u>4,756</u>
TOTAL	62,539	62,408	--
TOTAL, Excluding Beef/Cattle	44,339	52,318	7,979

Table 4.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
CITY AND COUNTY OF HONOLULU: 1983 AND 1995
(continued)

Source: Derived from State of Hawaii Land Evaluation and Site Assessment Commission, *A Report on the State of Hawaii Land Evaluation and Site Assessment System*, Legislative Reference Bureau, Honolulu, Hawaii, February 1984.

1. Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
2. Often includes land in a holding operation awaiting discovery of profitable uses.
3. Includes some pasture.
4. Overstated in that the acreage figures are for harvested acres, rather than for the amount of land required (i.e., the acreage requirements for a crop harvested twice a year should be halved).
5. Based on 10% of all acreage other than that for beef/cattle. This contingency amounts to double counting in that the LESA projections are already high. Also, the contingency figure allows for an additional 17,770 acres for expansion of sugarcane, even though the sugar industry is expected to decline, not expand.

If diversified agriculture is to require a large amount of prime agricultural land, then additional crops will have to be grown for the export market rather than for the small Hawaii market. However, the extreme difficulty of developing large export markets should be noted. For over a century, numerous and extensive crop searches and experiments have been conducted by many people and organizations, and have led to surprisingly few major long-term successes in Hawaii, thereby confirming the extreme difficulty in identifying new export crops and developing them into new and profitable industries. Furthermore, the difficulty in developing export markets is increasing because of increasing competition from other sugarcane-growing areas. Periodic low sugar prices have led nearly all sugarcane operators throughout the world to search for profitable replacement crops, particularly those crops which can increase the level of earnings from exports. Thus far, few successes have materialized.

Supply of Prime Agricultural Land

Regarding the supply of land in Hawaii, an enormous and growing supply of prime agricultural land is available for diversified agriculture. Since 1968, about 90,000 acres of Hawaii's prime agricultural land have been freed from sugar and pineapple production: about 62,700 acres of land freed from sugar production (about 15,200 acres on Oahu and 47,500 acres on the Neighbor Islands), and about 27,300 acres freed from pineapple production (about 6,600 acres on Oahu and 20,700 acres on the Neighbor Islands).^[13-15]

Some of the land which has been freed from sugar and pineapple production has or will be converted to urban, diversified agriculture, and aquaculture uses. After making allowances for the various conversions, uncommitted acreage which remains available to diversified agriculture and aquaculture amounts to many tens of thousands of acres, with a significant amount of this land in the Kahuku area and other parts of Oahu. Much of this land is fallow, in pasture, or in some other low-value land-holding operation.

The Statewide supply of prime agricultural land probably will increase given the very real possibility of future sugar company closings. A number of Hawaii's sugar plantations are unprofitable but remain in operation today only because they are committed to lease and/or energy contracts which make closing prohibitively expensive. However, these contracts eventually will end.

Furthermore, a portion of the sugarcane land is in holding awaiting the discovery of profitable replacement activities; this land forms part of the supply of prime agricultural land available to profitable diversified agriculture crops.

Many of the lands freed, to be freed, or which can be freed from sugar and pineapple production have excellent agricultural qualities and climatic conditions, and are well-suited for a variety of crops. Also, water is available for most of these lands, particularly those lands which have been freed from sugar production.

Additional lands which have been or will be made available for diversified agriculture are in government-sponsored agricultural parks throughout the State, including the Kahuku Agricultural Park which is being developed. Lands for agricultural activities which do not require prime agricultural land include pasture land, land for livestock operations, and "unique" lands as classified by ALISH (see page 5). Unique lands are not prime agricultural lands, but are important lands for certain crops, the principal examples are the coffee lands in Kona, and certain lava lands in Puna that are particularly well-suited for growing papaya. The supply of unique lands is quite large and is distinct from the supply of prime agricultural lands.

Availability of Land to Small-Scale Farmers

Even though considerable agricultural land exists in the State, small agricultural parcels are seldom available to small-scale farmers under long-term leases because land-use regulations and the political environment make it unprofitable and too risky to the landowner to lease out small farm parcels. Agricultural use constitutes a low-value use of the land and, correspondingly, farmers pay relatively low lease rents. At the same time, in order to rent land to small-scale farmers, landowners are required to subdivide the property. Applicable County subdivision regulations (designed for rural estates) require expensive electrical power, paved rather than gravel roads, and buried rather than surface water lines. Thus the combination of low rents and expensive subdivision requirements makes it unprofitable for the landowner to subdivide land for small farms. For example, rather than developing the State agricultural park in Kahuku, it would have been—as surprising as it may seem—less expensive for the State to give each farmer in the park \$100,000.¹

In addition, there is the risk that when the leases expire, small-scale farmers will turn to the Legislature in an attempt to prevent landowners from raising lease rents, or to prevent landowners from evicting them in favor of a higher and more profitable use of the landowner's land—this often occurs in long-term leases for land on which small-scale farmers have built homes (e.g., Waihole-Waikane, Kona, Waianae, Kalama Valley). Such an economic environment favors leases to large-scale operators (including cooperatives consisting of many small-scale farmers), short-term and illegal leases of unsubdivided land, subdivision of the land into rural estates for sale to buyers who can afford the costs of the subdivision requirements, or leaving the land fallow.

1. This is based on 220 usable acres divided into 24 lots, a land cost to the State of \$50 per acre per year; improvement costs for developing the farm plots (electric power, roads, etc.) of \$3.4 million; rents received from farmers of \$300 per acre per year; an 8-percent discount rate based on State bonds; and a 30-year term for the bond and the lease. Improvements are not to County standards.

In summary, the shortage of small parcels of land for farmers is a serious problem. Nevertheless, a vast supply of prime agricultural land does exist and is available for those profitable diversified agriculture operations that are large in scale, or for which the subdivision requirements are somehow circumvented.

Availability of Land for Diversified Agriculture

Based on the above assessment, ample prime agricultural land will be available to easily accommodate the Statewide requirements of diversified agriculture. This conclusion derives from the following: (1) a vast amount of prime agricultural land and water is available Statewide having been freed from sugar and pineapple production in recent years; (2) it is very possible that additional sugarcane acreage and water will be freed, given the existence of unprofitable sugar operations; (3) some, if not most, of the sugar operations would make their lands available for profitable replacement crops to the extent that such crops exist; and, in contrast, (4) land requirements to accommodate the growth of diversified agriculture are surprisingly modest. In other words, the limiting factor is not the *land supply*, but rather the *market demand* for those crops that can be grown profitably in Hawaii and, for small farms, *expensive subdivision requirements*. The proposed Country Courses at Kahuku involve too little land to affect this conclusion, and would therefore not affect adversely the Statewide growth of diversified agriculture.

Consistency with Overseas Long-Term Trends

The increased availability of prime agricultural land in Hawaii compared to that of prior decades results from some very long-term and accelerating trends that are occurring throughout the United States, Europe, and many developed and developing market economies.^[16] For example, U.S. farmers are paid by the government not to farm their land. This has resulted in 30 million acres of agricultural land lying fallow in 1984.^[17] In Europe, quotas are used to limit production. The principal agricultural problem has been overproduction, which has occurred as a result of the tremendous success of increasing yields, coupled with a slowing of the population growth rate. Because yields increase faster than population growth, resources must be freed from agriculture in order to restore balanced markets, and to increase income to the farmers who remain. Otherwise agricultural products glut the market; this is followed by low prices, a decline in farmers' income, and bankruptcies.

Furthermore, the export market has not been able to absorb the excess production, partly due to the agricultural successes achieved in many developing countries. For example, India once suffered from severe food problems. With the introduction of modern agriculture, however, its farm industry has been transformed, making India self-sufficient and even an exporter of

many foods it once had to import. Similar gains have been achieved throughout Asia and Central and South America.

Of significance to Hawaii, sugar is clearly part of this trend which, over the long term, shows supply increasing more quickly than demand. In fact, some of the newer sweeteners have the theoretical potential of causing the release of all the land in the world that is now planted in sugarcane and sugarbeets.

The major agricultural problem facing the United States and many other economies, therefore, is how to make the reduction in production an orderly one so as to minimize social problems. This is a problem that arises from the tremendous successes in agriculture production, and contrasts sharply with, and invalidates, the 200-year old prediction of Thomas Malthus that population will increase faster than the food supply.

RETRIEVABLE COMMITMENT OF RESOURCES

Even though the development of The Country Courses at Kahuku constitutes a commitment of prime agricultural land to recreational use, this would not constitute an irretrievable loss of these agricultural lands. If, at some time in the future, farming this land would contribute more economically than the Kahuku golf operations contribute, then the land could be planted in crops relatively easily.

Although such a conversion is possible, it is extremely improbable in that Hawaii's economy would have to undergo a dramatic change through one or both of two highly improbable events: (1) the collapse of Hawaii's very healthy and robust visitor industry, followed by the collapse in the demand for golfing by visitors and residents; and/or (2) the discovery of some high-value land-intensive export crop that is unique to Hawaii, and for which the demand would be so large as to virtually absorb all of Hawaii's agronomically suitable land for that crop. Such a crop has been sought for over a century without success.

IMPACT ON AGRICULTURAL LAND VALUES AND LEASE RENTS

Regarding land values, if it is anticipated that homes or some other high-value development will be constructed on agricultural land in the next 25 years, then the current market value of this land will be significantly higher than the "agricultural" value of the land.

To the extent that The Country Courses at Kahuku are perceived to increase the long-term development potential of nearby agricultural lands, the proposed golf courses will also increase the current market value of the nearby lands. The resulting higher land values represent a market signal that, at some time in the future, greater benefits can be derived from the nearby land than were previously anticipated.

Until such development occurs—assuming that it in fact does occur—the land may be put to some temporary use, and this can include an agricultural activity which can last for decades.

In the meanwhile, lease rents will be unaffected. If the highest and best permitted use of the land (i.e., the most profitable use) is agriculture, then the lease rents will reflect the ability to pay for an agricultural use of the land. Lease rents will not be increased so as to drive agriculture off the land if this results in less income for the landowner. In fact, there are recent examples on Oahu where the land has become more expensive, but lease rents have been reduced because the most profitable agricultural activity has become less profitable, with a reduced ability to pay lease rents.^[18]

In summary, The Country Courses at Kahuku may increase the values of some agricultural lands, but lease rents on the lands and the agricultural uses of the lands are unlikely to be affected until such time as the lands are in fact developed.

CONTRIBUTION OF THE COUNTRY COURSES TO THE GROWTH OF DIVERSIFIED AGRICULTURE

To an undetermined extent, The Country Courses at Kahuku would contribute to the growth of diversified agriculture in that nursery sales would increase, since a large number of plants and trees would be required to landscape four golf courses.

Also, the four golf courses may enhance the growth of diversified agriculture by helping to retain and increase the pool of people who have farming-type skills, while also increasing their knowledge of plant cultivation. About 80 of the estimated 200 jobs provided by The Country Courses at Kahuku would be outdoor jobs involved with cultivating grasses and plants, applying fertilizers and chemicals, maintaining irrigation systems, etc. Most of these outdoor jobs are similar to certain jobs in the agriculture industry, and require similar skills and training. This represents a significant number of agricultural-type jobs inasmuch as Statewide agricultural field employment declined by an average of 260 jobs per year between 1978 and 1988; the average annual loss has been 148 field jobs for the sugar industry, 85 field jobs for the pineapple industry, and 28 jobs in diversified agriculture. This *decline* in diversified agriculture employment has occurred despite *increasing sales* in the industry, which reflects a gradual conversion to higher-value crops. Furthermore, few of the 80 or so agriculture graduates each year from the University of Hawaii's College of Tropical Agriculture and Human Resources find employment in farming in Hawaii, and those who do generally receive low salaries.^[19]

The Country Courses at Kahuku would allow a significant number of people who possess agricultural skills to continue working in an activity that is closely related to farming, thereby retaining and increasing their skills and knowledge of plant cultivation. Some of these people may eventually move on to start their own commercial farm operations, thereby contributing to the growth of diversified agriculture.

CONSISTENCY WITH STATE AND COUNTY PLANS

The Country Courses at Kahuku (1) would not adversely affect plantation agriculture, since none exists on the properties; (2) would not adversely affect existing diversified-agriculture crop production, since none exists on the properties; (3) involves lands which, for the *Punamano* site, have been found to be poorly suited for crop production; (4) would not limit the Statewide growth of diversified agriculture since the supply of land available to diversified agriculture far exceeds projected demand, with additional agricultural lands to be made available in the area at the State's Kahuku Agricultural Park; (5) would not represent an irretrievable commitment of resources, although a dramatic economic change sufficient to justify converting the golf courses to crop production is regarded as extremely improbable; (6) would not increase agricultural lease rents in the area, although some land values may increase; and (7) would enhance the growth of diversified agriculture to an undetermined extent by increasing nursery sales, and by maintaining and increasing the pool of workers having skills applicable to farming. However, grazing operations on the *Malaekahana* property would have to be relocated; otherwise, one job would be lost.

In view of these findings, *The Country Courses at Kahuku* is consistent with the major thrust of the *Hawaii State Plan*, the *State Agriculture Functional Plan*, and the *General Plan of the City and County of Honolulu*. The thrust in all three plans calls for preserving the economic viability of plantation agriculture, and maintaining and promoting the growth of diversified agriculture (see Table 5). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured. Nevertheless, a portion of the development—a little over half of the *Malaekahana* site and about two-thirds of the *Punamano* site—is inconsistent with the lower-level State agricultural guidelines which call for Agricultural Lands of Importance to be protected from development. However, this guideline does not apply if an overriding public interest exists to provide such lands for other objectives of the Hawaii State Plan.

Finally, *The Country Courses at Kahuku* would conform with those State and County objectives and policies which favor increased recreation and employment. The four golf courses would accommodate over 600 resident and visitor golfers per day; would contribute to the economic health of the visitor industry; and would provide an estimated 200 jobs, of which about 80 would be outdoor jobs similar to certain jobs in the agriculture industry.

Table 5.-- SELECTED STATE AND COUNTY OBJECTIVES,
POLICIES, AND GUIDELINES RELATED
TO AGRICULTURAL LANDS

HAWAII STATE PLAN (Chapter 226, Hawaii Revised Statutes, as amended):

Section 226-7 Objectives and policies for the economy--agriculture.

- (a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:
 - (1) Continued viability in Hawaii's sugar and pineapple industries.
 - (2) Continued growth and development of diversified agriculture throughout the State.
- (b) To achieve the agricultural objectives, it shall be the policy of the State to:
 - (6) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

Section 226-103 Economic priority guidelines.

- (c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:
 - (1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.
- (d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:
 - (1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.

Section 226-104 Population growth and land resources priority guidelines.

- (b) Priority guidelines for regional growth distribution and land resource utilization:
 - (2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

Table 5.-- SELECTED STATE AND COUNTY OBJECTIVES,
POLICIES, AND GUIDELINES RELATED
TO AGRICULTURAL LANDS
(continued)

STATE AGRICULTURAL FUNCTIONAL PLAN (June 1985)

(Functional plans are guidelines for implementing the State Plan, and are not adopted by the State Legislature.)

- B. Objective: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.
- (5) Policy: Provide greater protection to agricultural lands in accordance with the Hawaii State Constitution.
- (c) Implementing Action: Identify important agricultural lands to promote diversified agriculture, increased agricultural self-sufficiency, and assure the availability of agriculturally suitable lands.
- (d) Implementing Action: Until standards and criteria to conserve and protect important agricultural lands are enacted by the Legislature, important agricultural lands should be classified in the State Agricultural District and zoned for agricultural use, except where, by the preponderance of the evidence presented, injustice or inequity will result or overriding public interest exists to provide such lands for other objectives of the Hawaii State plan.

**CITY AND COUNTY OF HONOLULU
GENERAL PLAN, Objectives and Policies (Resolution No. 82-188)**

Economic Activity

Objective C. To maintain the viability of agriculture on Oahu.

- Policy 4. Provide sufficient agricultural land in Ewa, Central Oahu, and the North Shore to encourage the continuation of sugar and pineapple as viable industries.
- Policy 5. Maintain agricultural land along the Windward, North Shore, and Waianae coasts for truck farming, flower growing, aquaculture, livestock production, and other types of diversified agriculture.

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Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX I

**THE COUNTRY COURSES AT
KAHUKU, IMPACT ON STATE AND
COUNTY FINANCES**

Decision Analysts Hawaii, Inc.

APPENDIX I

**THE COUNTRY COURSES AT KAHUKU:
IMPACT ON STATE AND COUNTY FINANCES**

PREPARED FOR:
The Estate of James Campbell

PREPARED BY:
Decision Analysts Hawaii, Inc.

December 1989

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EXECUTIVE SUMMARY

The proposed Country Courses at Kahuku would be comprised of four 18-hole golf courses, two driving ranges, practice putting greens, three clubhouses, and associated improvements.

After the project is approved, the County would net approximately \$370,000 in rollback taxes which are triggered when land which has been assessed and taxed at its agricultural value is developed. Upon full development of the project, the County would net about \$460,000 per year. This compares with 1989 property taxes of less than \$28,000 per year.

The State would net about \$1.7 million from taxes on construction expenditures and, at full development, would net about \$410,000 per year from taxes on operations.

THE COUNTRY COURSES AT KAHUKU: IMPACT ON STATE AND COUNTY FINANCES

INTRODUCTION⁽¹⁾

The proposed Country Courses at Kahuku would be comprised of four 18-hole golf courses, two driving ranges, practice putting greens, three clubhouses, parking areas, maintenance areas, sewage treatment plants, access and circulation roadways, wastewater collection systems, storm-water runoff control, a potable water supply and fire protection system, a non-potable irrigation water system, and other utilities systems. A golf course, clubhouse, and maintenance area would be located on 200 acres at *Malaekahana* on a site between Laie and Kahuku and mauka of Kamehameha Highway; and the other three golf courses, two clubhouses, and maintenance areas would be located on 605 acres at *Punamano*, mauka of Kamehameha Highway between the Turtle Bay Resort and Kahuku. Each clubhouse would have a starting facility, pro shop, lockers, restaurant/lounge, kitchen, restrooms, administration area, cart storage area, and maintenance facilities for golf carts. The Malaekahana clubhouse and one of the Punamano clubhouses would have an area of 10,000 to 12,000 square feet; the other Punamano clubhouse would have an area of 17,000 to 20,000 square feet. Operations are expected to begin in 1994 for the Malaekahana course, and 1998 for the Punamano courses.

The impact of this project on State of Hawaii and City & County of Honolulu finances is summarized below, with all values expressed in 1989 dollars.

COUNTY REVENUES AND EXPENDITURES

Current Revenues^[2]

Currently, the property tax on the *Malaekahana* site is \$3,824 per year. The tax is low because the property is used for grazing, which qualifies it for a property tax assessment based on the agricultural value of the land, rather than its market value.

For the *Punamano* site, the property tax is \$24,079 per year. In this case, a portion of the land is taxed at its agricultural value, while the remainder is taxed at its estimated market value.

Projected Revenues^[2]

When land assessed and taxed at its agricultural value is developed, the action triggers "rollback" taxes which recover 10 years of back taxes based on the difference between taxes computed on the market assessment and the agricultural assessment, plus a penalty of 10 percent. Development of the golf courses would trigger the rollback tax. For 1989, taxes on the *Malaekahana* property would have been \$17,517 if based on its market, rather than its agricultural, value. The 10-year rollback tax—including the 10-percent penalty—amounts to an estimated \$170,000.^[3]

For the *Punamano* property, 1989 property taxes would have been \$36,245 if based on its market value, rather than its mix of market and agricultural values. When development occurs, the rollback tax is estimated to be \$200,000.

Upon full development, the property assessment would be about \$51 million. This is based on the property assessments for the golf course at \$625,000 per hole (the current County guideline), and \$1.5 million each for two of the clubhouse and associated improvements (maintenance area, parking, roads, water systems, sewers, drainage, etc.), and \$2 million for the third clubhouse and associated improvements.

Property taxes on the four golf courses would be about \$460,000 per year, based on a tax rate of \$9 per \$1,000.^[4]

Additional revenues to the County would be derived from miscellaneous taxes and user fees. In addition, revenues would be derived from County taxes paid by employees of the golf courses. However, these taxes would be offset by corresponding government expenditures on facilities and services provided to these employees.

Projected Expenditures

No significant County expenditures are anticipated for infrastructure development, facilities, or services in support of the golf courses, since these items would be paid by the developer, operator, and/or users.

Projected Net Increase in Revenues

Based on the above, the County would net approximately \$370,000 in rollback taxes after the project is approved. Upon full development, the County would net about \$460,000 per year. This compares to less than \$28,000 currently being paid in property taxes on the land.

STATE REVENUES AND EXPENDITURES

Current Revenues

Current economic activity at the property proposed for development is at a low level: the *Malaekahana* property is used for grazing, and no economic activity takes place on the *Punamano* property. Correspondingly, State revenues are negligible.

Projected Revenues^[1,5]

Construction

The State would derive an estimated \$1.7 million in general excise taxes on construction expenditures for the four golf courses and related facilities. This estimate is based on 4 percent of the construction value, which is estimated at 85 percent of the estimated \$51 million value of the property.

Operations

At full development, revenues from golf operations, the pro-shops, and restaurants are estimated at \$10.2 million per year. This is based on an estimated 140 rounds of golf per day for each of the four golf courses, and an average expenditure of \$50 per golfer. The 4-percent general excise tax on this amount is \$410,000 per year. Additional revenues to the State would derive from corporate income taxes, taxes paid by suppliers, and miscellaneous taxes and user fees.

Further State revenues would be derived from income taxes paid by employees of the golf courses and excise taxes on their expenditures. However, these taxes would be offset by corresponding government expenditures on facilities and services provided to support these employees.

Projected Expenditures

No significant State expenditures are anticipated for infrastructure development, facilities, or services to support the golf course operations since these items would be paid by the developer, operator, and/or users.

Projected Net Increase in Revenues

Based on the above, the State would net about \$1.7 million from taxes on construction expenditures and, at full development, would net about \$410,000 per year from taxes on operations. Currently, the State derives negligible tax revenues from the activities on the property.

COMBINED NET REVENUES TO THE STATE AND COUNTY.

In summary, the County would net approximately \$370,000 in rollback taxes after the project is approved, and the State would net about \$1.7 million from taxes on construction expenditures. Upon full development, the State and County would net about \$870,000 per year from taxes on operations.

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Economic Analysis: Economic development, input-output and other economic models, economic impacts, and evaluation of complex resource allocation problems.

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Market Analysis: Market potential, prices, marketing and price strategies.

Demographic Analysis: Population and housing forecasts and impacts.

Analytical Techniques: Systems analysis, mathematical modeling of complex relationships, decision analysis under uncertainty, analysis of multi-variable/dynamic/probabilistic systems, statistical analysis, simulation, and linear programming and other optimization techniques.

Strategic/Policy Planning: Strategic plan development and implementation, project and research team management, and preparation of planning reports, position papers, and analyses.

Selected Fields of Specialty: Economic development (tourism, agriculture, energy, etc.), feasibility analysis, land and housing economics, valuations, and impact analysis (economic, financial, and demographics).

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EDUCATION

Ph.D. 1971: Stanford University, Engineering-Economic Systems

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1980- President, Decision Analysts Hawaii, Inc.

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Various honors and honor societies; fellowships from the National Science Foundation, Ford Foundation, and Wheeler Foundation; various elected offices.

AFFILIATIONS

Adjunct Professor, University of Hawaii, Department of Regional and Urban Planning (1989 -).

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International Agricultural Development Service of Washington, D.C. (Rockefeller Foundation affiliate), registered consultant (1981 -).

Chamber of Commerce, Land & Water Use Planning Committee (1983 -).

American Bar Association, registered expert witness (1983 -).

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Teaching Activities (graduate level)

Economics; regional and urban planning methods; decision analysis under uncertainty; statistics; regression analysis; and systems analysis and optimization: Information Sciences Program, University of Hawaii, 1970 - 1973.

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Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX J

**ENVIRONMENTAL ASSESSMENT OF
FERTILIZER AND PESTICIDE USE
ON THE PROPOSED COUNTRY
COURSES AT KAHUKU
(MALAEKAHANA AREA)**

**Charles L. Murdoch, Ph.D and
Richard E. Green, Ph.D**

APPENDIX J

ENVIRONMENTAL ASSESSMENT
OF
FERTILIZER AND PESTICIDE USE

ON THE PROPOSED

COUNTRY COURSES AT KAHUKU

(MALAEKAHANA AREA)

A REPORT TO

WILLIAM E. WANKET, Inc.

December 9, 1989

PREPARED BY

Charles L. Murdoch, Ph. D

Richard E. Green, Ph. D.

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EXECUTIVE SUMMARY

Overview and Conclusions

This assessment examines the potential environmental impact of fertilizer and pesticide use on a proposed golf course mauka of Malaekahana State Recreational Area on the north shore of Oahu. Site factors considered are topography, geology, soils, climate, sensitivity of off-site areas and the nature of the groundwater aquifer. Management factors include fertilizer use, pesticide use and irrigation. The principal focus of the report is the possible impact on the quality of ground and surface waters.

A basal, unconfined, flank aquifer underlies the site and is considered irreplaceable and highly vulnerable to contamination. Runoff water from the site is expected to be diluted by runoff from surrounding off-site areas, since the treated area is less than 6% of the entire watershed in which the golf course is located.

The project area is about 200 acres, consisting of both lowland and upland areas. About 25% of the upland area has slopes exceeding 15%; runoff will be relatively high in these areas. Although the surface horizons of the dominant upland soils are relatively shallow at this site, probably as a result of past erosion, the profiles are generally deep. Soil organic carbon contents are about 2% in the surface soil in areas that are not severely eroded. Abundant soil organic matter in surface soils is effective in retarding pesticide leaching. Eroded areas and areas of coral outcrop, if leveled and included in the treated area, will be more subject to pesticide leaching. Most of the year there is a water deficit in the area (evaporation exceeds rainfall by about 29 inches). Irrigation is necessary, therefore, and careful management of water can prevent excessive recharge of the groundwater.

Nitrogen is the only nutrient element in fertilizers applied to golf courses which is a potential contaminant of waters. A total of about 15 tons N would be applied each year to the golf course. Although this site is not prone to groundwater contamination by fertilizer nitrogen due to the low natural water recharge, careful management of both irrigation and fertilization is recommended. Use of a slow-release fertilizer or small amounts of soluble nitrogen applied through the irrigation system (fertigation) are management alternatives that contribute to environmental quality. Water budgeting should be based on actual rainfall and pan evaporation or on a computer controlled irrigation system which programs water application from calculations of water use by means of weather sensing components. These careful management practices will result in reduced loss of nitrogen from the site by both leaching and runoff.

Pesticides applied to golf courses are approved by the EPA for such use and are unlikely to have an adverse impact on the environment. Groundwater contamination is of greatest concern at this site since the aquifer is a source of potable water. The pesticides used in largest quantity (MSMA, bensulide, glyphosate and chlorothalonil) are all highly sorbed on soil organic matter and are, therefore, not mobile. The more mobile pesticides are generally used in small quantities or are seldom used. Metribuzin, a herbicide, is the only mobile pesticide applied at a rate of over 25 pounds per year on the entire area. It is not considered a hazard to either surface or ground water as it is of low mammalian toxicity, has a high health advisory level for drinking water and is relatively non-persistent in the environment. The principal surface water body of concern is the shoreline water of Malaekahana Bay. Several hundred yards of low-lying area provides a buffer between the project and the shoreline. In addition, storm runoff from the project area will be highly diluted by runoff from undeveloped areas in the basin, so there is no anticipated adverse impact of the project on shoreline waters. Thus, with judicious use of pesticides and careful irrigation management, there is no apparent threat of pesticide contamination of either groundwater or surface waters.

The chemicals applied in golf course management pose little hazard for birds or wildlife. Fertilizers are relatively non-toxic unless ingested in large amounts. With the exception of chlorpyrifos, the pesticides are of low toxicity to birds. Chlorpyrifos has a low solubility in water, is highly sorbed, and degrades rapidly; thus its use does not threaten either water quality or birds.

There will be no significant impact on air quality from application of herbicides or pesticides in golf course management provided that appropriate application techniques are used. The spray equipment used in golf course maintenance is ground-operated. Nozzle heights are typically less than 2 feet. Low spray pressures and coarse nozzle openings result in relatively large droplet sizes which are not highly subject to drift.

Recommendations

1. Irrigation management is critical to the conclusions reached above. For this reason we recommend that a U. S. Weather Bureau class A evaporation pan be used to measure evaporation and schedule irrigation application in the management of the proposed golf course. An excellent discussion of irrigation scheduling can be found in the book Golf Course and Grounds Irrigation and Drainage (Jarret, 1985).
2. Where grading is necessary, topsoil should be stockpiled and replaced over the areas to which chemicals will be applied; the high-organic matter content of surface soils will retard pesticide movement. Eroded soil areas and coral outcrop areas that are leveled should be covered with surface soil containing at least 1.5% organic carbon.
3. Judicious use of fertilizers and pesticides, especially in the early establishment of turf, is essential, since pesticides and nitrogen will be more likely to move before an extensive root system and thatch layer are developed. Special care in pesticide application is also necessary during the winter months when runoff-producing storms are likely.
4. Slow-release nitrogen fertilizers should be used during the rainy season (November through February) to reduce the likelihood of nitrate-enriched runoff waters.
5. As our conclusions are based on the assumption that sound management practices will be followed with regard to fertilizer and pesticide application and irrigation, we recommend that a qualified Golf Course Superintendent be given the responsibility of managing the golf course.

I. INTRODUCTION

The development of the proposed 18-hole golf course mauka of Malaekahana State Recreational area will require application of fertilizers to supply essential nutrients to turfgrasses and ornamental plants, and pesticides to control their associated weed, disease, and insect pests. The term pesticide, used in its generic sense in this report, includes herbicides, fungicides and insecticides. The assessment provided in the report focuses principally on the potential for applied chemicals to move in surface runoff and to groundwater. Additionally, the potential for pesticide transport in the air and potential for negative impact on birds in the area are addressed briefly in the appendices. The toxicity and environmental behavior of pesticides which are likely to be used are considered in the analysis, as are soil, topographic and climatic factors which may impact on fertilizer and pesticide movement.

II. APPROACH

Key elements of the analysis are (1) calculation of quantities of applied chemicals (pesticides and fertilizer nutrients) which are likely to be used throughout the year, (2) compilation of soil, geologic and climatic information which will aid in the assessment of chemical movement, (3) estimation of water balance from rainfall, irrigation and evapotranspiration, (4) compilation of pesticide properties which may be of environmental significance, and (5) computation of the Attenuation Factor for pesticides used on golf courses, using properties of the chemicals and soil properties, in order to estimate the likelihood of chemical movement to groundwater.

A site location map was provided by William E. Wanket, Inc. We visited the site on November 24, 1989. Soil maps and associated soil survey publications provided information required for an assessment of infiltration and runoff potentials, as well as soil organic carbon contents. Published rainfall and evaporation data in the area provided an estimate of groundwater recharge with turf cover. Anticipated use of chemicals in golf course management is based on our own recommendations, and pesticide properties were obtained from published reports.

III. ANALYSIS OF FACTORS IMPACTING ON CHEMICAL MOVEMENT

A. Site Factors

1. Soils and topography

The project area is located on the northeast slopes of the Koolau mountains on Oahu, just west of Laie Bay. The east boundary of the area to be developed (not including the entry road) is about one-half mile from the coastline. The soil map (Appendix Figure A-1) which includes the area is on sheet number 47 in Foote et

al. (1972). The proposed area of the development is about 200 acres. The elevation varies from a minimum of about 20 feet at the east and north boundaries to a maximum of 100 feet near the center (Appendix Figure A-2). The topography is undulating throughout. No major streams dissect the parcel itself, but the general area is bounded by Malaekahana Stream to the north and Kahawainui Stream to the south. Both of these streams drain to the coastline, the former into Malaekahana Bay and the latter into Laie Bay. The project area is in the Malaekahana drainage basin.

The soils are formed principally from alluvium and colluvium derived from basic igneous rock of the Koolau volcanic series. The major soil series is Lahaina silty clay which occurs on the upland areas. This soil has an organic carbon content of 2% or higher in the surface horizon. Interspersed between parcels of the Lahaina soil series at elevations up to about 100 feet are fairly extensive areas of "coral outcrop", a sandstone which apparently developed from coral sands deposited during a period when the ocean was at a much higher level. The coral outcrop areas are expected to have low permeability and little potential for vegetation. A low-elevation area at the north end of the area is occupied by Keaau clay, an alluvial soil.

The Lahaina soil is classified as clayey, kaolinitic, isohyperthermic Typic Torrox. This soil is generally well drained and has a good water holding capacity. Although it is deep at many locations, the presence of much coral outcrop at this site suggests that the Lahaina soil may be relatively shallow in some of the area (e.g. one to two feet rather than several feet).

The Keaau soil is a Typic Tropaquept; the classification indicates that the soil is wet much of the year. A shallow water table contributes to the wetness, as does the high content of montmorillinite (swelling clay) which restricts permeability. The surface and subsurface horizons are about 15 and 20 inches deep, respectively; the substratum is reef limestone or consolidated coral sand.

The approximate percentage of the total land area in the project area occupied by each soil mapping unit and the slopes are given in Table 1.

Table 1. Soils of the Malaekahana development area.

Soil Type	Soil mapping unit	Slope (%)	Approximate Percent of area
Lahaina silty clay loam (clayey, kaolinitic, Typic Torrox)*	LaB	3-7	20
	LaC	7-15	40
Keaau clay (very-fine, montmorillonitic, non-acid, isohyperthermic, Typic Trophaquepts)*	KmA	0-2	15
Coral outcrop	CR	>15	25

* Soil Great Group according to U. S. Soil Taxonomy

2. Rainfall and potential recharge

Mean monthly rainfall from data of the nearby Laie Station varies from a low of 1.8 inches in June, to a high of 6.2 in January (Giambelluca et al., 1986). Mean annual total precipitation for the area is approximately 50 inches. Mean annual pan evaporation at the nearest station providing pan evaporation data (Kahuku) is approximately 79 inches and ranges from a high of over 8 inches per month for the period May through August to a low of less than 5 inches/month for December and January (Ekern and Chang, 1985). Thus, without irrigation and neglecting runoff there is a water deficit of approximately 29 inches per year. The data indicate that unirrigated cropped or grassed areas providing a full canopy for ET would not contribute recharge to the groundwater aquifer. Because of the water deficit, vigorous turf could not be sustained without irrigation through the dry months. Mean monthly rainfall and pan evaporation are given in Figure 1. Mean monthly rainfall minus pan evaporation (evaporation deficit) is shown in Figure 2.

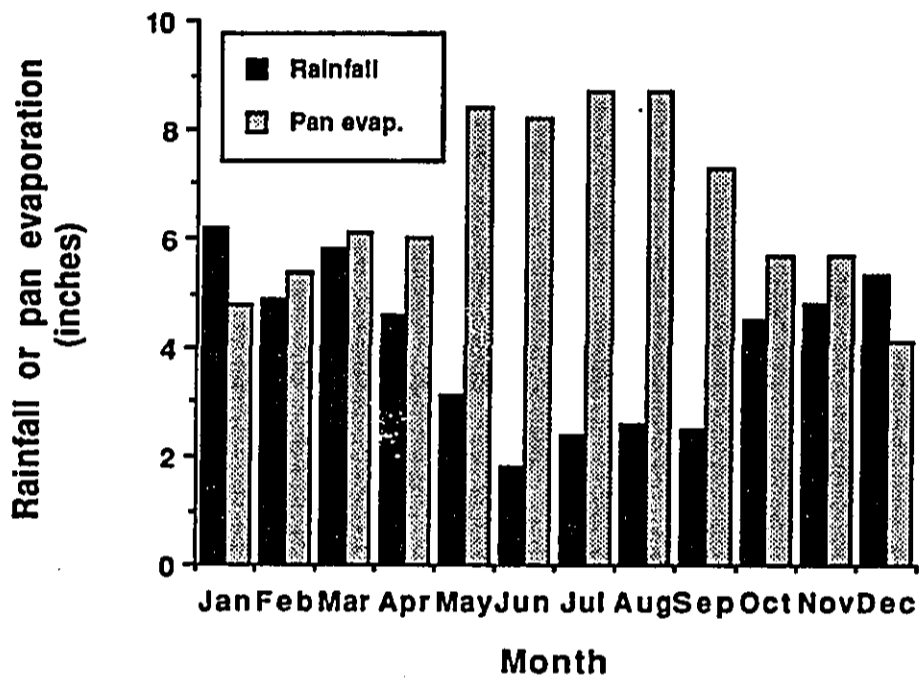


Figure 1. Mean monthly rainfall and pan evaporation for the Malaekahana area.

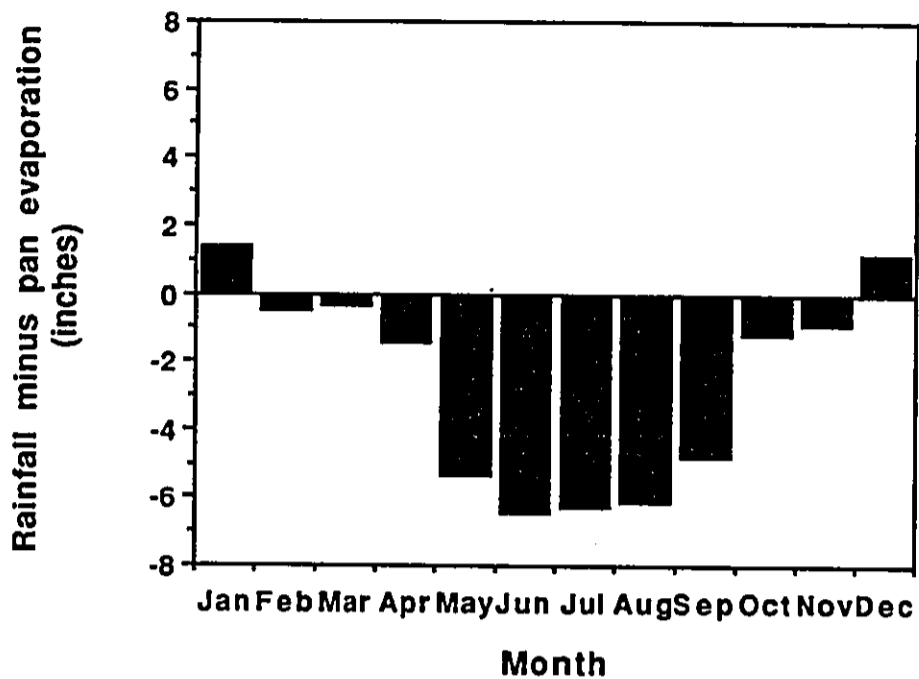


Figure 2. Mean monthly rainfall minus mean monthly pan evaporation for the Malaekahana area.

3. Groundwater

The groundwater aquifers which could be impacted by the proposed development are identified and classified by Mink and Lau (1987). The principal aquifer of concern, which underlies the development area, is in the Koolauloa aquifer system of the Windward sector of Oahu. This basal, unconfined, flank aquifer is currently used for drinking water in the area and is considered irreplaceable and highly vulnerable to contamination. Of secondary relevance are the aquifers located makai of the development; a sedimentary, unconfined aquifer overlies a flank, confined aquifer. Both are unsuitable for drinking water but are considered ecologically important. The upper sedimentary aquifer is vulnerable to contamination, while the deeper flank aquifer is much less so.

B. Management Factors

1. Fertilizers

Fertilizers are applied to golf courses to supply those essential nutrients which are used in large amounts and which are deficient in most soils. In typical soils, the elements which are normally applied in a turfgrass fertilization program are nitrogen (N), phosphorus (P), and potassium (K). Fertilizers are normally ap-

plied to only the greens, tees, fairways, and part of the roughs of a golf course. Typical areas in each of these types of turf are estimated in the discussion below.

Turfgrasses use much more N than other elements. Based on turfgrass clipping composition, it has been shown that the turfgrasses grown in Hawaii use about twice as much N as K and about 4 times as much N as P.

The primary fertilizer elements of concern for contamination of ground and surface waters are nitrogen and phosphorus. Phosphorus is attached very tightly to soil clays and moves little if any from the site of application. Phosphorus, therefore will not cause any problem with contamination of drainage water. Ammonium nitrogen (NH_4) likewise moves little in soils. Nitrogen applied in the ammonium form, however, is rapidly converted to the nitrate form (NO_3) which is not bound to the soil and moves readily with water. Because of high nitrogen use rates by turfgrasses, however, nitrogen will be used rapidly after application. Only under conditions where rainfall occurs soon after application of a soluble nitrogen source would there be excessive loss by surface runoff or by leaching below the root zone. Thus nitrogen movement can be mitigated by applying a slow-release nitrogen fertilizer in which the nitrogen is in an insoluble form when applied (Brown, et al., 1977) or by applying small amounts of soluble N through the irrigation system and irrigating only to replace soil moisture used by evapotranspiration (Snyder, et al., 1984).

Fertilizer use rates for the different golf course areas are shown in Table 2. Complete fertilizers (ones containing N, P, and K) are usually applied. Because nitrogen is applied in larger quantities and also because it is the only fertilizer element likely to cause contamination of ground or surface waters, only nitrogen application rates are given.

Table 2. Approximate fertilizer use for an 18-hole golf course in Hawaii.

Type of turf	Area (acres)	Fertilizer amount (lb. N/1000 sq. ft.)	Application frequency	Total annual application (tons N)
Greens	3	0.5	2 weeks	0.85
Tees	3	1.0	3 weeks	1.15
Fairways	50	1.5	8 weeks	10.00
Roughs	<u>30</u>	1.0	3 months	<u>2.60</u>
Total	86			14.60

2. Pesticides

There are a number of weed, insect and disease pests of turfgrasses in Hawaii which sometimes require application of chemical pesticides. Pesticides are normally applied only in response to outbreaks of pests. There are few instances in which pesticides other than herbicides are applied in a regularly scheduled, preventative

program. A typical pesticide program for golf courses in Hawaii is given in Table 3 below. There are several chemicals which may be substituted for certain ones in this suggested program. Properties of the chemicals listed in Table 3, as well as those of most chemicals used in turf in Hawaii, are given in Appendix Table B-1.

Table 3. A typical pesticide program an 18-hole golf courses in Hawaii.

Turfgrass area	Area (acres)	Chemical	Frequency	Rate/application	Annual total
I. Herbicides					
A. Greens	3	MSMA	6 times/year	2 lb. ai./acre	36 lb. ai
			2 times/year	12 lb ai/acre	72 lb. ai
B. Tees	3	MSMA Trimec® bensulide	6 times/year	2 lb. ai./acre	36 lb. ai
			3 times/year	1 pint/acre	9 pints
			2 times/year	12 lb. ai./acre	72 lb. ai
C. Fairways	50	MSMA Trimec® metribuzin	6 times/year	2 lb. ai./acre	600 lb. ai
			3 times/year	1 pint/acre	19 gallons
			2 times/year	0.75 lb. ai./acre	75 lb. ai.
D. Perimeter areas	20	glyphosate	3 times/year	1.5 lb ai./acre	90 lb. ai.
II. Insecticides					
A. Greens	3	chlorpyrifos	As needed	1 lb. ai./acre	Approx. 18 lb. ai.
B. Tees	3	chlorpyrifos	As needed	1 lb. ai. acre	Approx. 18 lb. ai.
C. Fairways	Spot treatments	chlorpyrifos	As needed	1 lb. ai./acre	Approx. 50 lb. ai.
III. Fungicides					
A. Greens	3	metalaxyl chlorothalonil	As needed	1.3 lb. ai./acre	Approx. 25 lb. ai.
			As needed	8 lb. ai./acre	Approx. 72 lb. ai.
B. Tees	3	metalaxyl chlorothalonil	As needed	1.3 lb. ai./acre	Approx. 25 lb. ai.
			As needed	8 lb. ai./acre	Approx. 72 lb. ai.
C. Fairways	Spot treatments	chlorothalonil	As needed	8 lb. ai./acre	Approx. 250 lb.ai.

3. Irrigation

Because rainfall is not uniformly distributed throughout the year, all golf courses are irrigated to supplement rainfall. Golf courses usually have permanent sprinkler irrigation systems with sophisticated control systems. Many are computer

controlled, so that each sprinkler head on the golf course can be adjusted to apply a selected amount of water on each cycle.

Because golf greens are constructed of sand (or primarily sand), the water holding capacity is less than for other areas containing soil. For this reason, golf greens must be watered more frequently than other areas.

Typical evapotranspiration rates for well-watered turf in Hawaii range from 0.1 to 0.3 inches per day, depending on temperature, the amount of sunlight, relative humidity, wind speed, the amount of available water in the soil, etc. Soils store approximately 0.5 to 2.5 inches of available water per foot of depth, depending on soil texture. Sands hold less, clays hold more. Irrigation should be applied when about one-half the available water has been used. The effective rooting depth for mown turf is approximately one foot. Therefore, turfgrasses will need to be watered every day to about once a week depending upon the type of soil and the water use rate. Amount of water applied at each irrigation varies greatly for different golf courses. Murabayashi (1989) reported that irrigation amounts for 11 golf courses in the State varied from 0.0023 million gallons per day per acre (mgd/acre) to 0.011 mgd/acre, a 478% difference. Average water use for the 11 golf courses was 0.006 mgd/acre. The Turtle Bay golf course reported using 0.0038 mgd/acre. Using the reported amount from Turtle Bay and assuming 150 acres for the golf course, approximately 0.57 mgd irrigation water would be required on days when irrigation is necessary.

Irrigation practices may have a large influence on the movement of soluble nitrogen fertilizers in soils. If excessive irrigation water is applied soon after application of soluble nitrogen sources, the likelihood of runoff or leaching of nitrogen below the root zone is increased. Because of the high cost of irrigation water, there is little incentive to over-water golf courses.

IV. Potential for Chemical Movement to Groundwater and Surface Waters

A. Issues of concern and the scope of this assessment

The principal issue addressed in this report is the potential for movement of fertilizers and pesticides to groundwater and surface waters.

The presence of agricultural chemicals in groundwaters at many locations in the State (Honolulu Star Bulletin, Aug. 13, 1989) is reason for caution in the use of chemicals in recreational areas such as parks and golf courses as well as in agriculture. It is important to recognize, however, that detection of a chemical in water bodies, even in potable water, does not necessarily constitute a health hazard as defined by the U. S. Environmental Protection Agency (EPA). In an effort to assist federal, state and local officials in responding to drinking water contamination, the EPA has set "Lifetime Health Advisory" levels (concentrations in drinking water) for many chemicals. EPA estimates these levels after reviewing available human

data and experimental animal studies to evaluate potential human health effects. The Health Advisories are considered tentative and are updated as new information becomes available. Some agricultural chemicals which have reached groundwater in Hawaii, for example nitrate from fertilizers and the herbicide atrazine, have been detected at many locations in the State, but seldom are at a concentration considered a threat to human health. Also, Health Advisory Levels (HAL) vary widely for different chemicals: for nitrate the level is 10,000 micrograms per liter (10 milligrams/liter) of water while for atrazine it is 3 micrograms per liter. Thus for these two chemicals, the HAL's differ by a factor of 3,333. The relative oral toxicity of a number of pesticides registered for use in golf courses, given in Appendix Table B-1, reflect the wide range of toxicities obtained in animal feeding studies.

In the assessment which follows, we attempt to evaluate the potential for groundwater and surface water contamination by chemicals which might be applied to the proposed Malaekahana Golf Course. Our assessment does not include an estimate of the chemical concentration in waters or of human exposure or risk. Useful estimates of health risk are not possible when concentrations of chemicals in water are not known. However, when the evidence indicates the likelihood of no contamination or of concentrations well below the Health Advisory Level, further analysis of health risk is neither possible nor appropriate.

B. Potential impact on groundwater quality

Because the area treated with pesticides on a golf course is small, the total amount of pesticide applied is relatively small also. Most pesticides used in golf course management are of low toxicity (Appendix Table B-1). Most are either rapidly degraded in soil and/or are sorbed tightly to organic matter or soil colloids and move little from the site of application. The pesticides in Appendix Table 1 which are most likely to move below the root zone are metribuzin, mecoprop, dicamba, simazine, and trichlorfon. The relative mobility of these chemicals can be quantified by computation of the Attenuation Factor (AF) of each chemical for an appropriate set of conditions. Attenuation of chemical movement by the soil includes both retardation of movement due to sorption on soil organic matter and degradation in the soil by both biological and chemical pathways. The AF numerical index (Rao et al., 1985) is presently being evaluated (Khan and Liang, 1989; Loague et al., 1989) for use in an assessment methodology which the State of Hawaii will use in pesticide regulation. The AF index can have numerical values from AF = 0 (total attenuation) to AF = 1 (no attenuation). By definition, AF is the fraction of chemical remaining in the soil after a single application when the recharge is sufficient to carry the chemical to the bottom of a soil layer of a given depth (for example, 50 cm). For soil and water recharge conditions of practical interest in Hawaii, AF values for the five chemicals which are most likely to move beyond a depth of 50 cm are shown in Table 4. AF values range from 2.1×10^{-6} for simazine (lowest contamination potential) to 7.1×10^{-3} for trichlorfon (highest contamination potential). For comparison, DBCP, which was used for 25 years in pineapple and has

contaminated groundwater at many locations, has $AF = 4.6 \times 10^{-1}$, indicating a much higher likelihood for DBCP movement to groundwater than any of the chemicals listed in Table 4. Also, the total amounts of chemicals in Table 4 which are used on golf courses are relatively small. Trichlorfon is not used in Hawaii to our knowledge, although it is labeled. Mecoprop and dicamba are components of the herbicide Trimec®. Total annual mecoprop and dicamba application for the three golf courses will be approximately 9.6 and 2.4 pounds, respectively. The total amount of metribuzin applied will be approximately 75 lb. annually. Simazine is used on few golf courses in Hawaii. If used, simazine application would not exceed 100 lb. annually for the three golf courses.

Table 4. Attenuation factors (AF) for the most mobile pesticides labeled for use on golf courses.[†]

<u>Pesticide</u>	<u>AF</u>
Metribuzin	3.5×10^{-6}
Mecoprop	1.3×10^{-3}
Dicamba	7.1×10^{-5}
Simazine	2.1×10^{-6}
Trichlorfon	7.1×10^{-3}

[†]Based on the following conditions: soil organic carbon content = 1.5%; soil bulk density = 1.2 g/cm^3 ; soil water content = 35% by volume; water recharge = 0.1 cm/day; depth of penetration = 50 cm.

The importance of the Koolauloa groundwater aquifer as a drinking water source is a significant consideration in this assessment. It is unlikely that any of the chemicals used on the golf course would reach the aquifer in sufficient concentration to adversely affect human health. Nitrate and metribuzin are the two chemicals which are applied in sufficient quantities and are sufficiently mobile and persistent to possibly be detected in groundwater. It is unlikely that the small amount of metribuzin used on golf courses would contribute a measurable amount to the groundwater and the contribution of nitrate from fertilizer may be small relative to background nitrate present in the aquifer. If fertilizer nitrate did reach the aquifer, it would not likely increase the level sufficiently to be of concern to human health; the nitrate Health Advisory Level (HAL) is 10 mg/L. The metribuzin HAL is 200 µg /L.; detection at even 1 µg/L in aquifer water is unlikely.

Recharge of groundwater from infiltration of rainfall in the development area will be minimal due to relatively low rainfall much of the year, high evapotranspiration most of the year, and high potential for runoff on steeply sloping areas which comprise over 50% of the land area at this site. The soils which dominate the area contain sufficient organic carbon (1.5 to 2%) in the surface

horizon to retard movement of pesticides through the soil profile. About 25% of the total area is coral outcrop which will require importation of soil to sustain healthy turf and retard pesticide movement. Most of the golf course occupies areas with elevations less than 60 feet above sea level, and about one-third of the area is at elevations less than 40 feet. Groundwater heads in this area are probably a few to several feet above sea level so that vertical travel distances for potential contaminants may be as small as 15 feet and as great as 95 feet. Larger travel distances provide opportunity for non-persistent pesticides to degrade, particularly if they are subject to breakdown by hydrolysis. The lowest elevation area which will be treated with chemicals is the north central region (Figure A-2) where the Keaau soil is located (Fig. A-1). This soil has very low permeability and thus will not contribute much recharge to the underlying aquifer.

All factors considered, we do not expect groundwater contamination from chemical application on the proposed golf course if careful management of irrigation and chemical use is exercised.

C. Potential Impact on Surface Water Quality

The proposed layout of the golf course (Fig. A-2) suggests that the steepest areas will be left undeveloped. The potential for runoff and erosion from high-slope areas is high during winter months while land-shaping operations are in progress. However, fertilizer and pesticide use will be minimal during this period. After establishment of healthy turf, runoff will be no greater than under existing pasture management and probably less, due to the absence of compaction from livestock traffic. Since the project area is a small part (about 6%) of a much larger watershed which will contribute runoff to Malaekahana Stream, the fertilizer and pesticide chemicals which may be carried in runoff from the golf course will be highly diluted by water from surrounding areas, especially undeveloped mauka areas receiving higher rainfall. Such dilution will also reduce potential impact on Malaekahana Bay waters. Additionally, this open bay is subject to good mixing by tides and wave action, so contamination of these waters is not likely. However, it is a good precaution to apply fertilizers and pesticides judiciously during the winter months when high rainfall over brief periods of time may intensify removal of recently applied chemicals in runoff.

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APPENDIX A

Topographic and soils maps

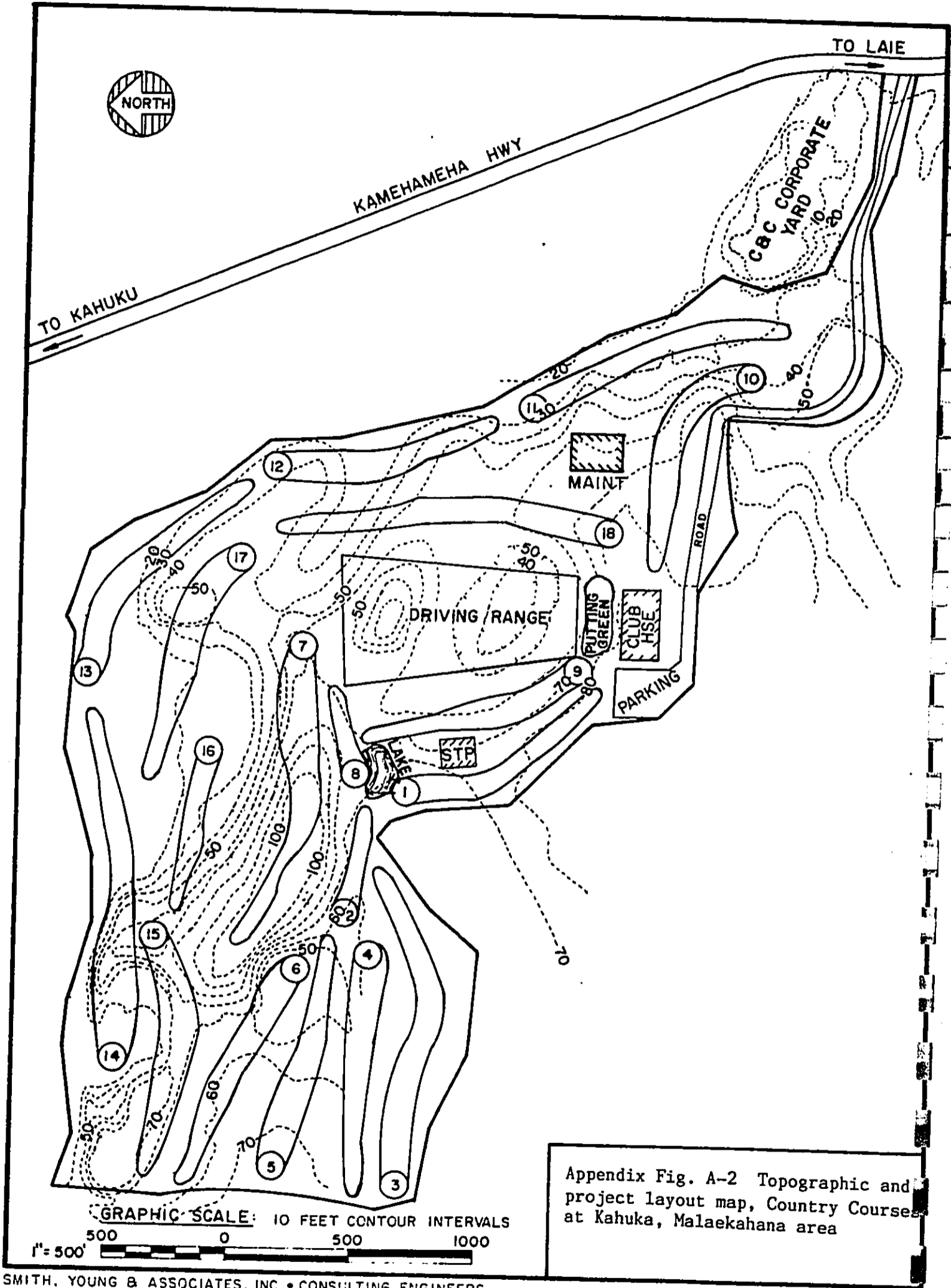
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Appendix Fig. A-1. Soils of the proposed development, Country Courses at Kahuku (Malaekahana)



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Appendix Fig. A-2 Topographic and project layout map, Country Courses at Kahuka, Malaekahana area

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APPENDIX B

Pesticide Data

Appendix Table B-1. Properties of pesticides used on turf in Hawaii.

Pesticide common name	Trade name (s)	Oral LD-50 (mg/kg body wt)*	Toxicity to fish and wildlife*	Soil sorption Index (Koc)**	Water solubility (mg/l)**	Half-life in soil (days)**	Leaching potential**
I. Herbicides							
MSMA	Weed-lee etc.	1800	Low	10000	1000000	100	Small
glyphosate	Roundup, Kleenup	150	Mod. to birds, none to fish	10000	1000000	30	Small
meibuzin	Sencor	2200	Moderate	41	1220	30	Large
2,4-D	part of mixtures	370-700	High to fish	109	300000	10	Medium
meoprop	ditto	700-1500	Low	3	660000	21	Large
dicamba	ditto	1000-2000	Non toxic to fish	2	800000	14	Large
oxyzalin	Surflan	10000	Mod. to birds, toxic to fish	2700	2.5	60	Small
oxadiazon	Ronsiar	8000	Toxic to fish		0.7		
propyzamide	Kerb	5620-8350	Low	990	15	30	Small
simazine	Princep	>5000	Low	138	3.5	75	Large
chlorthal-dimethyl	Dacthal	>3000	Low	5000	0.5	30	Small
bensulfide	Belasan, Betamec	770	Mod. to fish	10000	25	60	Small
paraquat dichloride	Orlho Paraquat CL	150	Mod. to birds, none to fish	100000	1000000	3600	Small
benfluralin	Balan	10000	Low to birds, high to fish	11003	0.1	30	Small
II. Insecticides							
chlorpyrifos	Dursban	135-163	High	6070	2	30	Small
bendocarb	Ficam	40-156	High				
carbaryl	Sevin	400-850	Moderate	229	40	7	Small
trichlorfon	Dylox	450-630	Moderate	2	154000	27	Large
III. Fungicides							
anilazine	Dyrene	<5000	Low	3000	10	1	Small
benomyl	Benlate	9590	Low	2100	2	100	Small
chlorothalonil	Daconil 2787	>10000	Low to birds, mod. to fish	1380	0.6	20	Small
prodione	Chipco 26019 RP	3500	Low	500	13	20	Small
mancozeb	Dithane M-45	>8000	Low	1000	0.5	35	Small
quintozone	PCNB, Terrachlor	12000	Non-toxic	1000	0.44	21	Small
thiram	Tersan	7500	Low	383	30	20	Medium
triadimefon	Bayleton	568	Low	273	260	21	Medium
metlaxyl	Subdue	669	Non-toxic	16	7100	7	Medium
thiophanate-methyl	Cleany 3336	7500	Low	1000	3.5	0	Small

*From: Hartley, Douglas and Hamish Kidd (Eds.) 1983. The Agrochemicals Handbook. Unwin Bros., Ltd. Old Working., Surrey, England.

**From: Wauchope, R. D. 1988. U. S. D. A.-ARS Interim Pesticide Properties Database, Version 1.0. Unpublished

Appendix Table B-2. Toxicity classes of pesticides.

Class	Description	Warning Statement	Oral LD50
1	Highly Toxic Skull & Crossbones	Poison,	1-50
2	Moderately Toxic	Danger	51-500
3	Low Toxicity	Warning	500-5,000
4	Very Low Toxicity	Caution	>5,000

APPENDIX C

IMPACT ON MIGRATORY BIRDS AND ENDANGERED HAWAIIAN WATERBIRDS.

The fertilizers, herbicides, and fungicides used in golf course maintenance pose little or no hazard to birds frequenting the grassed areas or ponds associated with golf courses. Fertilizers are relatively non-toxic unless ingested in large amounts. All herbicides and fungicides used in golf course maintenance in Hawaii are of low to moderate toxicity (Appendix Table 1). The only chemicals used in golf course maintenance in Hawaii which are highly toxic to birds are the organic phosphate insecticides, especially chlorpyrifos.

Although chlorpyrifos is toxic to birds, it is strongly adsorbed on the thatch layer of turf and moves little from the site of application. One reason for its weakness in controlling soil infesting insects is the inability to get the insecticide through the thatch layer to the depth needed to contact these insects. Recent studies (Sears and Chapman, 1980; Tashiro, 1980) have shown that chlorpyrifos applied to turfgrasses does not penetrate more than 2 to 3 centimeters in the soil. In addition to resistance to movement in the soil, it has been shown that it is rapidly degraded in the soil, both by hydrolysis and microbial action (Miles et al. 1979).

Because of the adsorption of organic phosphate insecticides on organic layers in turf and their rapid break down, there is little chance of their movement from grassed areas into the ponds associated with the proposed golf course. Label instructions for application of these pesticides (which turfgrass managers are required by law to follow) specifically prohibit their direct application to streams and ponds.

The likelihood of bird injury by pesticides used in maintenance of the proposed golf course can be reduced by proper application of pesticides with reduced toxicity to birds. Appendix Table 1 shows that carbaryl and trichlorfon are less toxic to birds than chlorpyrifos. In most cases these insecticides may be substituted for chlorpyrifos with little loss of effectiveness.

Golf courses are frequently visited by birds. As far as we are aware, there have been no reported incidents of bird kill in Hawaii from chemicals applied in golf course management. Waterfowl and fish appear to thrive in ponds and water hazards on golf courses in Hawaii. Many golf courses cultivate white amur fish in the ponds to control algae. Mosquito fish are generally stocked to prevent mosquito problems. We are aware of no incidents of fish or waterfowl injury from chemicals applied to golf courses.

The labeling of herbicides and pesticides by EPA for particular uses, enforced by the Hawaii Department of Agriculture, is perhaps the best assurance of protection of humans and wildlife from their hazards. All pesticides must be applied in compliance with federal and state laws regulating their use. Hazards to both humans and wildlife are included in the decision to label a pesticide for specific uses, including use on golf courses, and in developing regulations on allowable application procedures of the pesticide for various uses.

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APPENDIX D

IMPACT ON AIR QUALITY

Most herbicides and pesticides used on golf courses are of relatively low mammalian toxicity, with LD₅₀ values ranging from hundreds to several thousand mg/kg body weight (Appendix Table 1). None of the chemicals listed in Table 2 above are highly volatile. A measure of volatility is the vapor pressure (VP). The compounds used in highest quantity, for which vapor pressure data is readily available, are chlorothalonil (VP=1.3 x 10⁻⁵ atm at 25° C) and chlorpyrifos (VP=2.4 x 10⁻⁸ atm at 25° C). In comparison, DBPC, which is known to be volatile, has a vapor pressure of 1.2 x 10⁻³ atm at 21° C, i.e. at least 100 times the vapor pressure of chlorothalonil and 100,000 times the vapor pressure of chlorpyrifos. In addition, pesticides are applied on golf courses in dilute sprays (50 to 100 gallons of spray solution per acre) to open areas. For these reasons there is little likelihood of volatility once the pesticides are applied.

If properly applied, there is also little potential for drift of spray particles from golf course spray equipment. The greatest danger of significant drift of pesticides is from aerial application. Golf course pesticides are applied with ground spray equipment. Boom height of spray equipment is less than one meter. Low spray pressures (20 to 40 psi) and coarse spray droplets further reduce the hazard of airborne fine droplets. Droplets larger than 100 micrometers diameter are not highly subject to drift.

Most of the spray volume from typical flat-fan nozzles used in agricultural spray equipment is from droplets larger than 100 micrometers. Table 3 below shows a typical distribution of droplet sizes for a flat-fan nozzle (the type used in most golf course spray equipment). At the low concentrations used in pesticide application, this would not result in significant quantities of pesticides being carried downwind. High wind speed would increase the likelihood of drift of fine spray droplets, however, because high wind speed distorts spray patterns and results in poor coverage; spraying in periods of high wind is not common practice. Table 4 below shows the percent of spray application volume deposited at 4 and 8 feet downwind and the distance downwind for the volume to drop to 1% or below for flat-fan nozzles under different conditions. Even under high wind conditions (almost 10 mph) and spraying at 40 psi, the distance downwind at which 1% or less of the total spray volume was deposited was only 17 feet.

Appendix Table D-1 Droplet size range for a typical flat-fan nozzle at 20 and 40 psi. (from Hofman et al., 1986)

Droplet size range (microns)	Percent of spray volume	
	20 psi	40 psi
0-21	0.1	0.4
21-63	3.0	10.4
63-105	10.7	20.1
105-147	16.2	25.4
147-210	36.7	35.3
210-294	27.5	7.7
>294	5.8	0.7

Appendix Table D-2. Percent of spray volume deposited at 4 and 8 feet downwind and the distance in feet for the volume of spray solution to drop to 1% of the total spray volume (from Hofman et al., 1986).

Nozzle ht. (in.)	Pressure (psi)	Wind speed (mph)	Percent deposited		Distance to drop to 1% of volume
			4 ft.	8 ft.	
14	40	3.5	3.1	0.6	7.0
27	40	3.5	5.9	1.5	13.0
18	30	5.3	9.3	2.2	14.0
18	25	9.9	10.3	3.1	15.5
18	40	9.9	9.1	3.6	17.0

To facilitate spray operations and to comply with label instructions of some pesticides, spray applications are only made in late afternoon or early morning hours when golfers are not on the golf course. This reduces the risk of exposure of people to airborne spray particles. Sufficient buffer space with tall vegetation between the golf course and housing sites and facilities (such as the clubhouse) which will be used by people will further reduce the chance of exposure to airborne pesticide particles.

The greatest danger of airborne pesticides is to the applicators of pesticides themselves. Mixing of wettable powder formulations and being in close proximity to airborne spray particles, particularly when operating spray equipment in a downwind position, places spray operators in particularly vulnerable positions. EPA and OSHA have strict standards which specify

that spray operators wear appropriate protective clothing and breathing apparatuses.

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- Murdoch, C. L. 1988. Watering turfgrasses. Hawaii Cooperative Extension Service. College of Tropical Agriculture and Human Resources. University of Hawaii. Turf Management Series No. 4. 3pp.
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BIOGRAPHICAL RESUME

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Pesticides and Other Organics in Soil and Their Potential for Groundwater Contamination (Western Regional Project W-82, CSRS-USDA support, 1983-88)

Evaluation of Fumigants and Non-Volatile Nematicides for Control of Reniform Nematodes (supported by special State legislative action to assist the pineapple industry, 1984-89)

Assessment of the Potential for Groundwater Contamination Due to Proposed Urban Development in the Vicinity of the Navy's Waiawa Shaft (Navy support through WRRRC, 1987-89)

Implementation of a Computerized Procedure for Regulating the Sales and Use of Pesticides in Hawaii (State of Hawaii, Department of Agriculture, 1988-89)

Transformation and Sorption of Pesticides in the Vadose Zone and Impact on Mobility to Groundwater (Calif. Dept. of Food and Agric., 1987-1990)

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University: University Research Council (1986-89)
International Student Office Advisory Comm. (1986-)

Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX K

**BOTANICAL SURVEY, THE
COUNTRY COURSES AT KAHUKU:
MALAEKAHANA, KO'OLAULOA
DISTRICT, OAHU**

Char and Associates

APPENDIX K

BOTANICAL SURVEY
THE COUNTRY COURSES AT KAHUKU: MALAEKAHANA
KO'OLAULOA DISTRICT, O'AHU

by

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Prepared for: WILLIAM E. WANKET, INC.
December 1989

BOTANICAL SURVEY
THE COUNTRY COURSES AT KAHUKU: MALAEKAHANA
KO'OLAULOA DISTRICT, O'AHU

INTRODUCTION

The Malaekahana project site consists of approximately 200 acres located mauka of Kamehameha Highway, opposite Malaekahana State Park. It is bound on the south, in part, by the Asahi golf course and to the north by farmlands and pasturelands.

Elevation on the site ranges from about 20 ft. to 100 ft. Topography consists of small, rolling hills primarily along the property's north and south boundaries with relatively level to moderately sloping areas between the hills. The small hills or knolls support mixed shrublands primarily of koa-haole and Christmas berry; the somewhat level areas or swales support dense pluchea shrublands.

Field studies to inventory the botanical resources on the project site were conducted in December 1989. The objectives of the survey were to (1) describe the major vegetation types; (2) inventory the terrestrial, vascular flora; and (3) search for threatened and endangered plant species.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Topographic maps and aerial photographs were examined to determine

EXECUTIVE SUMMARY

Field studies to inventory the botanical resources on the Malaekahana project site were conducted in December 1989. The primary objectives of the survey were to (1) describe the major vegetation types; (2) inventory the terrestrial, vascular flora; and (3) search for threatened and endangered plant species protected by Federal and/or State laws. Topography on the site consists of small, rolling hills primarily along the property's north and south boundaries with relatively level to moderately sloping areas between the hills. The small hills or knolls support mixed shrublands; the somewhat level areas or swales support dense pluchea shrublands.

Mixed shrublands consist of a mosaic of koa-haole and Christmas berry stands with small groves of ironwood, Java plum, and bingabing trees. Ground cover varies from area to area with sourgrass being the most common component. Pluchea shrublands occur on former sugar cane fields. These shrublands also support a few koa-haole, Christmas berry, and guava shrubs as well as a weedy assortment of herbs and forbs.

Of a total of 85 plant species found on the site, 79 (93%) are introduced or alien; one (1%) is probably of Polynesian introduction; and 5 (6%) are indigenous, i.e., native to the islands and elsewhere. None of the plants occurring on the property are threatened or endangered species.

Because the vegetation is composed almost exclusively of introduced species, there is very little of botanical interest or concern on the site. The proposed golf course development is not expected to have a significant negative impact on the botanical resources. Of concern, however, is soil erosion. Areas removed of vegetation cover should be landscaped as soon as possible to prevent soil loss through wind and runoff.

vegetation patterns, terrain characteristics, access, and boundaries and reference points.

A walk-through survey method was employed. Areas most likely to harbor native species as the knoll or hill areas were more intensively examined. Notes were made on plant associations and distribution, substrate types, topography, exposure, drainage, etc. Plants were identified in the field; plants which could not be positively identified were collected for later determination in the herbarium (U. H., Manoa) and for comparison with the taxonomic literature.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions under which they were conducted. A survey taken at a different season and under varying environmental conditions would no doubt yield slight variations in the species checklist, especially of the weedy, annual taxa.

DESCRIPTION OF THE VEGETATION

Vegetation on the site is composed almost exclusively of introduced or alien species. The small hills are covered by mixed shrublands of koa-haole and Christmas berry, both introduced species. The formerly cultivated fields of sugar cane are now overgrown with pluchea shrubs. These two major vegetation types are described in detail below.

A few native species occur on the site, but nowhere do they form a plant community or vegetation type dominated by native species. The natives, in general, tend to be the more "weedy" types which prefer open, disturbed habitats. Botanical studies conducted on parcels adjacent to the project site (Nagata 1989; Nagata and Char 1981) have also recorded similar vegetation types and findings.

A list of all those plant species inventoried on the project site is presented at the end of this report.

Mixed Shrublands

This vegetation type covers a little more than one-half of the project site, where it is found primarily on the small, rolling hills or knolls. It consists of a mixed pattern, or mosaic, of stands of koa-haole (Leucaena leucocephala) shrubs, Christmas berry (Schinus terebinthifolius) shrubs, and, in places, small groves of ironwood (Casuarina equisetifolia), bingabing (Macaranga tanarius), and Java plum (Syzygium cumini) trees. A few, scattered trees of Chinese banyan (Ficus microcarpa) dot the hillsides covered by the mixed shrublands.

Ground cover varies from area to area depending on the density of the shrubland. Where the stands of koa-haole and Christmas berry are thick, very little light reaches the ground and the understory is poorly developed. Leaf litter and soil typify these areas; a few plants of sourgrass (Digitaria insularis), Guinea grass (Panicum maximum), hairy abutilon (Abutilon grandifolium), and koa-haole seedlings can be found here.

Where the shrubs thin out, along margins of old dirt roads, and other more open areas, ground cover is dense and consists of the species mentioned above as well as white-flowered beggar's tick (Bidens alba var. radiata), California grass or paragrass (Brachiaria mutica), Chinese violet (Asystasia gangetica), and Jamaica vervain (Stachytarpheta jamaicensis). Vines are common in these sunny areas and include pohapoha (Passiflora foetida), and the native huehue (Cocculus trilobus) and koali-'awania (Ipomoea indica).

Pluchea Shrublands

These shrublands are usually found on relatively level to moderately sloping areas of the property. Sugar cane and other

crops were cultivated on these areas at one time, but the majority of the land is now overgrown by dense pluchea shrubs (Pluchea symphytifolia), 6 to 12 ft. tall. Other shrubs encountered in this vegetation type are guava (Psidium guajava), koa-haole, Christmas berry, lantana (Lantana camara), and, very rarely, klu (Acacia farnesiana). A few African tulip trees (Spathodea campanulata) and Java plum can be found in this shrubland.

Again sourgrass is the most abundant ground cover, although, in places, California grass may be locally common. Where cattle have grazed, patches of Bermuda grass (Cynodon dactylon) are abundant. An assortment of herbs and forbs are common in this shrubland and include partridge pea (Chamaecrista nictitans), rattlepod (Crotalaria pallida), swollen finger grass (Chloris inflata), lion's-ear (Leonotis nepetifolia), Cuba jute (Sida rhombifolia), cocklebur (Xanthium strumarium), sensitive plant (Mimosa pudica), and weed verbena (Verbena litoralis).

DISCUSSION AND RECOMMENDATIONS

Vegetation on the Malaekahana project site is dominated by introduced plants which form the two major vegetation types, the mixed shrublands, composed primarily of koa-haole and Christmas berry, and the pluchea shrublands. Of a total of 85 species inventoried on the site, 79 (93%) are introduced or alien species; one (1%) is perhaps of Polynesian introduction; and 5 (6%) are indigenous, i. e., native to the Hawaiian Islands and elsewhere. No plants considered endemic, i. e., native only to the Hawaiian Islands were found on the site. The majority of the native plants, which include 'uhaloa (Waltheria indica), koali-'awania, popolo (Solanum americanum), and ricegrass (Paspalum scrobiculatum), are widespread throughout the islands and prefer open, disturbed habitats. None are considered threatened or endangered species by the State and/or Federal governments; nor are any proposed or

candidate for such status (U. S. Fish and Wildlife Service 1985; Herbst 1987).

There is little of botanical interest or concern on the property and the proposed golf course development is not expected to have a significant negative impact on the total state-wide populations of species involved. Of some concern, however, is soil erosion. It is recommended that areas removed of vegetation cover be landscaped as soon as possible to lessen soil loss through wind and/or water (runoff).

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PLANT SPECIES LIST -- THE COUNTRY COURSES AT KAHUKU: MALAEKAHANA

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of three groups: Ferns, Monocots, and Dicots. Taxonomy and nomenclature of the Ferns follow Lamoureux (1984); the flowering plants, Monocots and Dicots, are in accordance with Wagner et al. (in press). English names follow St. John (1973); Hawaiian names follow Porter (1972), in most cases.

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:
 - I = indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s)
 - P = Polynesian = plants of Polynesian introduction prior to Western contact (1778); not native
 - X = introduced or alien = all those plants brought to the islands intentionally or accidentally after Western contact; not native.

No plants considered endemic, i.e., native only to the islands, were inventoried on the project site.

SCIENTIFIC NAME

COMMON NAME

STATUS

FERNS

NEPHROLEPIDACEAE (Sword Fern Family)
Nephrolepis multiflora (Roxb.) Jarrett
ex Morton

hairy swordfern X

FLOWERING PLANTS -- MONOCOTS

AGAVACEAE (Sisal Family)
Furcraea foetida (L.) Haw.

Mauritius hemp X

COMMELINACEAE (Spiderwort Family)
Commelina benghalensis L.

hairy honohono X

CYPERACEAE (Sedge Family)
Cyperus rotundus L.

nutgrass, nut sedge X

POACEAE (Grass Family)
Brachiaria mutica (Forssk.) Stapf
Cenchrus ciliaris L.
Cenchrus echinatus L.
Chloris barbata (L.) Sw.
Chloris divaricata R. Br.
Cynodon dactylon (L.) Pers.
Digitaria ciliaris (Retz.) Koeler
Digitaria insularis (L.) Mez ex Ekman
Eleusine indica (L.) Gaertn.
Melinis minutiflora P. Beauv.
Panicum maximum Jacq.
Paspalum conjugatum Bergius
Paspalum fimbriatum Kunth
Paspalum scrobiculatum L.
Pennisetum purpureum Schumach.

California grass, paragrass X
buffel grass X
common sandbur, 'ume'alu X
swollen finger grass, mau'ulei X
stargrass X
Bermuda grass, manienie X
hairy crabgrass X
sourgrass X
wiregrass, goose grass X
molasses grass X
Guinea grass X
Hilo grass, mau'u Hilo X
fimbriate paspalum X
ricegrass X
elephant grass, Napier grass I?
X

SCIENTIFIC NAME

Rhynchelytrum repens (Willd.) Hubb.
Setaria verticillata (L.) P. Beauv.
Sporobolus indicus (L.) R. Br.

COMMON NAME

Natal redtop
bristly foxtail
West Indian dropseed

STATUS

X
X
X

FLOWERING PLANTS -- DICOTS

ACANTHACEAE (Acanthus Family)
Asystasia gangetica (L.) T. Anderson
Achyranthes aspera L.

Chinese violet
achyranthes

X
X

AMARANTHACEAE (Amaranth Family)
Amaranthus spinosus L.

spiny amaranth, pakai kuku

X

ANACARDIACEAE (Mango Family)
Schinus terebinthifolius Raddi

Christmas berry, wilelaiki

X

9 ASTERACEAE (Sunflower Family)
Ageratum conyzoides L.
Bidens alba var. radiata (Schultz-Bip.)
Ballard ex Melchert
Calyptocarpus vialis Less.
Conyza bonariensis (L.) Cronq.
Emilia coccinea (Sims) G. Don
Pluchea indica (L.) Less.
Pluchea symphytifolia (Mill.) Gillis
Sonchus oleraceus L.
Verbesina encelioides (Cav.) Benth.
& Hook.

X

maile hohono
white-flowered beggar's tick
hierba del cabello
hairy horseweed, ilioha
emilia
Indian pluchea
pluchea, sourbush
sow thistle, pua-lele

X
X
X
X
X
X
X
X

Vernonia cinerea var. parviflora
(Reinw.) DC.
Xanthium strumarium var. canadense
(Mill.) Torr. & A. Gray

golden crownbeard

X

little ironweed

X

cocklebur

X

BIGNONIACEAE (Bignonia Family)
Spathodea campanulata P. Beauv.

African tulip

X

THE UNIVERSITY OF HAWAII LIBRARY

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
CASUARINACEAE (Ironwood Family) <i>Casuarina equisetifolia</i> L.	ironwood	X
CONVOLVULACEAE (Morning-glory Family) <i>Ipomoea indica</i> (J. Burm.) Merr. <i>Ipomoea obscura</i> (L.) Ker-Gawl.	koali-'awania field bindweed	I X
CUCURBITACEAE (Gourd Family) <i>Coccinea grandis</i> (L.) Voigt <i>Momordica charantia</i> L.	scarlet-fruited gourd wild bittermelon	X X
EUPHORBIACEAE (Spurge Family) <i>Chamaesyce hirta</i> (L.) Millsp. <i>Chamaesyce hypericifolia</i> (L.) Millsp. <i>Chamaesyce prostrata</i> (Aiton) Small <i>Macaranga tanarius</i> (L.) Müll. Arg. <i>Phyllanthus debilis</i> Klein ex Willd. <i>Ricinus communis</i> L.	hairy spurge, garden spurge graceful spurge prostrate spurge bingabing phyllanthus weed castor bean, koli	X X X X X X X
FABACEAE (Pea Family) <i>Acacia farnesiana</i> (L.) Willd. <i>Canavalia cathartica</i> Thouars <i>Chamaecrista nictitans</i> (L.) Moench <i>Crotalaria pallida</i> Aiton <i>Desmanthus virgatus</i> (L.) Willd. <i>Desmodium incanum</i> DC. <i>Desmodium triflorum</i> (L.) DC. <i>Indigofera suffruticosa</i> Mill. <i>Leucaena leucocephala</i> (Lam.) de Wit <i>Medicago lupulina</i> L. <i>Mimosa pudica</i> var. <i>unijuga</i> (Duchass. & Walp.) Griseb.	klu mauna-loa partridge pea, lauki rattlepod slender mimosa Spanish clover, ka'imi three-flowered beggarweed indigo, 'iniko koa-haole black medic sensitive plant, sleeping grass, puahilahila coffee senna, 'auko'i	X X X X X X X X X X X X X X X
<i>Senna occidentalis</i> (L.) Link		
LAMIACEAE (Mint Family) <i>Leonotis nepetifolia</i> (L.) R. Br.	lion's-ear	X

SCIENTIFIC NAME

MALVACEAE (Mallow Family)
Abutilon grandifolium (Willd.) Sweet
Malvastrum coromandelianum (L.) Garcke
Sida rhombifolia L.

MENISPERMACEAE (Moonseed Family)
Cocculus trilobus (Thunb.) DC.

MORACEAE (Mulberry Family)
Ficus microcarpa L. f.

MYRTACEAE (Myrtle Family)
Psidium guajava L.
Syzygium cumini (L.) Skeels

NYCTAGINACEAE (Four-o'clock Family)
Mirabilis jalapa L.

OXALIDACEAE (Wood Sorrel Family)
Oxalis corniculata L.

PASSIFLORACEAE (Passion Flower Family)
Passiflora edulis Sims
Passiflora foetida L.

Passiflora suberosa L.

PHYTOLACCACEAE (Pokeberry Family)
Rivina humilis L.

PORTULACACEAE (Purslane Family)
Portulaca oleracea L.

RUBIACEAE (Coffee Family)
Spermatocoe assurgens Ruiz. & Pav.

COMMON NAME

hairy abutilon
false mallow, hauuoi
Cuba jute

huehue

Chinese banyan

guava, kuawa
Java plum, palama

four-o'clock

yellow wood sorrel, ihi'ai

passion fruit, liliko'i
red-fruited passion flower,
pohapoha
huehue-haole

rouge plant, coral berry

pigweed

buttonweed

STATUS

X
X
X

I

X

X
X

X

P?

X

X
X

X

X

X

U.S. DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
WASHINGTON, D. C.

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
SOLANACEAE (Nightshade Family) Solanum americanum Mill.	popolo	I?
STERCULIACEAE (Cocoa Family) Waltheria indica L.	'uhaloa, hi'aloa	I?
TILIACEAE (Linden Family) Triumfetta semitriloba Jacq.	burbush	X
VERBENACEAE (Verbena Family) Lantana camara L. Stachytarpheta dichotoma (Ruiz & Pav.) Vahl	lantana, lakana	X
Stachytarpheta jamaicensis (L.) Vahl	vervain	X
Stachytarpheta urticifolia (Salisb.) Sims	Jamaica vervain, owi, oi	X
Verbena litoralis Kunth	nettle-leaved vervain weed verbena, oi	X X

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WINONA P. CHAR

EDUCATION

Master of Science (M.S.) degree in the Botanical Sciences, University of Hawaii, Manoa. December 1983. Area of specialization: Plant taxonomy with special emphasis on the native Hawaiian flora. M.S. thesis topic: "A revision of the Hawaiian species of Sesbania (Leguminosae)."

Bachelor of Arts (B.A.) in the Botanical Sciences, University of Hawaii, Manoa. May 1970.

Graduate of Kaimuki High School. June 1965.

EXPERIENCE

Botanical Consultant - 1976 to present; self-employed.

Field investigation, data analysis, and preparation of findings for the biological section in Environmental Impact Statements (EIS). The scope of work involves: (1) a discussion of rare, threatened or endangered plant species found on the study site; (2) a general description of the major vegetation types found on the study site; (3) an inventory of the flora on the study site; (4) the identification of areas of potential environmental problems or concerns; and (5) a summary of the extant botanical knowledge of the study site.

Natural Area Biologist, SR-21 - July 1985 to June 1986. One year funding. Natural Area Reserves System (NARS), State Department of Land and Natural Resources. Major duties: Plan, develop, and direct native and non-native plant and animal surveys within the reserves system. Evaluate existing and potential impact of non-native species within each reserve. Develop site-specific management programs as well as direct on-site management activity. Supervise a lower-level NARS biologist and, when available, part-time and volunteer workers.

Horticulturist, SR-18 - May 1978 to September 1979. Honolulu Botanic Gardens, City and County Department of Parks and Recreation. Major duties: Program director, Exceptional Trees Program. Working with the City Administration and the City Council in establishing a permanent staff organi-

zation and Arborist Advisory Committee necessary to fulfill the Exceptional Trees' Law; documentation and identification of the Exceptional Trees designated by the City and County Ordinance; identification of additional trees to the list. End of contract; left to complete M.S. degree program.

INTERESTS

Hiking, fishing native plants, bonsai, photography, trivia collector.

Member of the following organizations:

- Hawaiian Botanical Society. Life membership. Served as Chairman, Science Fair Committee, 1981, 1983. Secretary 1978, 1979. Director 1977. Native Coastal Plants Committee 1986.
- The Nature Conservancy. Sponsor 1986.

Community service:

- The Nature Conservancy. Resource person. Scientific Advisory Committee.
- State Department of Education (DOE). Resource person and lecturer, native plants and island ecosystems.
- Marine Advisory Program, Sea Grant, University of Hawaii. Resource person, strand vegetation.

PERSONAL BACKGROUND

One-quarter Hawaiian, that's why the active interest in native plants and island ecosystems. Single, 5 ft. 5 in. tall, roughly 128 lbs. Born 16 May 1947 (a baby boomer). References will be furnished on request.

PUBLICATIONS

- Char, W. P. 1976. Field studies of the Sesbania complex on the island of Hawaii. Pacific Tropical Botanical Garden Bulletin 6(2): 41.
- _____. 1977. Strand vegetation of Hawaii. Hawaii Coastal Zone Newsletter 12(1): 4-6.
- _____. 1981. Strand ecosystems in Hawaii. pp. 3-5. In: R. Tabata, ed. Conserving Hawaii's Coastal Ecosystems. Uni. Hawaii Sea Grant Cooperative Report.
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Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX L

**AVIFAUNAL AND FERAL MAMMAL
SURVEY OF PROPERTY PROPOSED
FOR GOLF COURSES TO BE
KNOWN AS THE COUNTRY
COURSES AT KAHUKU, KAHUKU,
OAHU**

Phillip L. Bruner

APPENDIX L

AVIFAUNAL AND FERAL MAMMAL SURVEY OF PROPERTY PROPOSED FOR GOLF
COURSES TO BE KNOWN AS THE COUNTRY COURSES AT KAHUKU, KAHUKU, OAHU

Prepared for

William E. Wanket Inc.

By

Phillip L. Bruner
Assistant Professor of Biology
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15 November 1989

AVIFAUNAL AND FERAL MAMMAL SURVEY OF PROPERTY PROPOSED FOR GOLF
COURSES TO BE KNOWN AS THE COUNTRY COURSES AT KAHUKU, KAHUKU, OAHU

INTRODUCTION

The purpose of this report is to summarize the findings of a two day (9,11 November 1989) faunal field survey of two properties located near Punamano and Malaekahana, Kahuku, Oahu (see Fig.1,2). In addition references to pertinent literature are also provided in order to give a more comprehensive view of the potential wildlife that might occur in the area. The objectives of the faunal survey were to:

- 1- Determine what species of birds and mammals occur or potentially might occur on the property.
- 2- Determine, within the time constraints available, the relative abundance of each species.
- 3- Check for the presence of any endangered species and note their particular use of the site ie. feeding, nesting, loafing.
- 4- Identify any special habitats that may occur on the sites and suggest ways in which they might be protected.

SITE DESCRIPTION AND METHODS OF SURVEY

Both properties are located mauka of Kamehameha Highway near Kahuku (Fig.1,2). Vegetation consists of a variety of introduced

species the most common of which are: Koa Haoli (Leucaena leucocephala), Christmas Berry (Schinus terebinthifolius), Indian Pluchea (Pluchea indica) and an assortment of grass and weed species. The overall appearance of each property is one of parkland with scattered trees and open grassy fields. The topography is generally flat with gentle rolling hills.

The survey was conducted by following the roads and trails through each site. A total of 22 census stations were established at the two sites and eight minute counts of all birds seen and heard at these stations were recorded (Fig.1,2). Tallys of birds observed between these census stations were also kept. From these data relative abundance estimates were calculated (see Table One). Mammals were surveyed by visual means and by noting the presence of scats and tracks. No trapping of mammals was attempted in order to determine their relative abundance.

Scientific names used in this report follow those given in the most recent American Ornithologist's Union Checklist (A.O.U. 1983), Hawaii's Birds (Hawaii Audubon Society 1989), A Field Guide to the Birds of Hawaii and the Tropical Pacific (Pratt et al. 1987), Mammal species of the world (Honacki et al. 1982), Tropical Trees of the Pacific (Hargreaves and Hargreaves 1970) and Hawaiian Coastal Plants (Merlin 1980).

RESULTS AND DISCUSSION

Endemic Species:

The Punamano Unit of the James Campbell National Wildlife Refuge is located makai of the Punamano property (Fig.1). This refuge provides habitat for four endangered species: Common Moorhen (Gallinula chloropus sandvicensis), American Coot (Fulica americana alai), Black-necked Stilt (Himantopus mexicanus knudseni) and Koloa or Hawaiian Duck (Anas wyvilliana). No wetlands exist on the Punamano property proposed for golf course development. One irrigation pond was located on the Malaekahana property. This pond contained a pair of Koioa. Koloa are very opportunistic and will utilize not only ponds but streams and ditches as well.

The Pueo or Short-eared Owl (Asio flammeus sandwichensis) is rare on Oahu but does occur in the Kahuku area. This species of owl forages during the day as well as at night. No Pueo were observed on this survey.

Indigenous Species:

The only resident indigenous species recorded was the Black-crowned Night Heron (Nycticorax nycticorax). Two herons were observed flying over the Malaekahana property. Migratory birds observed on the survey include: Pacific Golden Plover (Pluvialis fulva) and Ruddy Turnstone (Arenaria interpres). A total of two plover were found on the Punamano property and 30 at Malaekahana.

One turnstone was also seen on the Malaekahana site. Plover are known to be site-faithful and territorial which makes it possible to determine their abundance in a particular area with a reasonable degree of accuracy (Johnson et al. 1981, 1989). The only other shorebird that might be found in the area is the Bristle-thighed Curlew (Numenius tahitiensis). This species can be found in upland grasslands and coastal habitats during September as it migrates through Hawaii on its way to the South Pacific (Pratt et al. 1987, Hawaii Audubon Society 1989).

Introduced (Exotic) Species:

A total of 16 species of exotic birds were recorded on the survey. Table One shows the relative abundance of each species based on the data from this two day survey. Two exotic species not recorded but likely present at times on the property are Barn Owl (Tyto alba) and Chestnut Mannikin (Lonchura malacca). Bruner (1989a, 1989b) obtained a similar list of exotic species on lands elsewhere in the Kahuku area.

Feral Mammals:

Mongoose (Herpestes auro punctatus) and cats were seen on both properties. Rats and mice were not recorded but undoubtedly are resident at these sites. This survey found no unusual concentrations of mammals. The endemic and endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus) is known from Oahu (Tomich 1986) but was not recorded on this survey.

CONCLUSIONS AND RECOMMENDATIONS

A two day survey can provide only a brief glimpse of the use of the habitat by wildlife. Species composition and abundance vary depending on the time of year and the availability of resources. Some species are common for a time and then decline or disappear altogether (William 1987). The conclusions that can be drawn from this field survey are:

- 1- The variety of habitats available at these two sites contain the typical array of introduced species of birds one would expect to find at this locality on Oahu. The diversity and abundance of exotic species should decline following the construction of golf courses and the subsequent loss of a more diversified habitat.
- 2- Native birds at these sites are limited due to inappropriate habitat i.e. absence of good wetlands and native vegetation. The most abundant native bird in this area is the migratory Pacific Golden Plover. This species utilizes open grassy habitat such as pastures and lawns. Their numbers should actually increase following the development of the golf courses.
- 3- Feral mammal populations will decline following development due to loss of cover and the construction of a more monotypic environment.

CONCERNS AND RECOMMENDATIONS

- 1- The close proximity of the Punamano Unit of the James Campbell National Wildlife Refuge down slope from the proposed Punamano golf courses is a concern. Ground water from the golf course operations may contain pesticides and herbicides that could potentially contaminate the refuge water supply. A study of the likelihood of this problem and measures that would be needed to protect the refuge should be conducted. Punamano is an important wetland for migratory water fowl as well as for native resident waterbirds. The integrity of this refuge must not be violated. Contamination of its water would quickly reduce the value of this essential wetland.
- 2- The Malaekahana property does not contain any natural wetlands but irrigation ponds do provide habitat for Koloa and Black-crowned Night Heron. If water features are to be a part of the golf course design these "ponds" or water traps could be made attractive to waterbirds as well as to the appearance of the golf course if they were planted with emergent vegetation around the edges of the pond. This vegetation would provide cover for waterbirds and would present a more suitable habitat than the usual open sterile looking ponds seen on most golf courses.

RECEIVED AS FOLLOWS

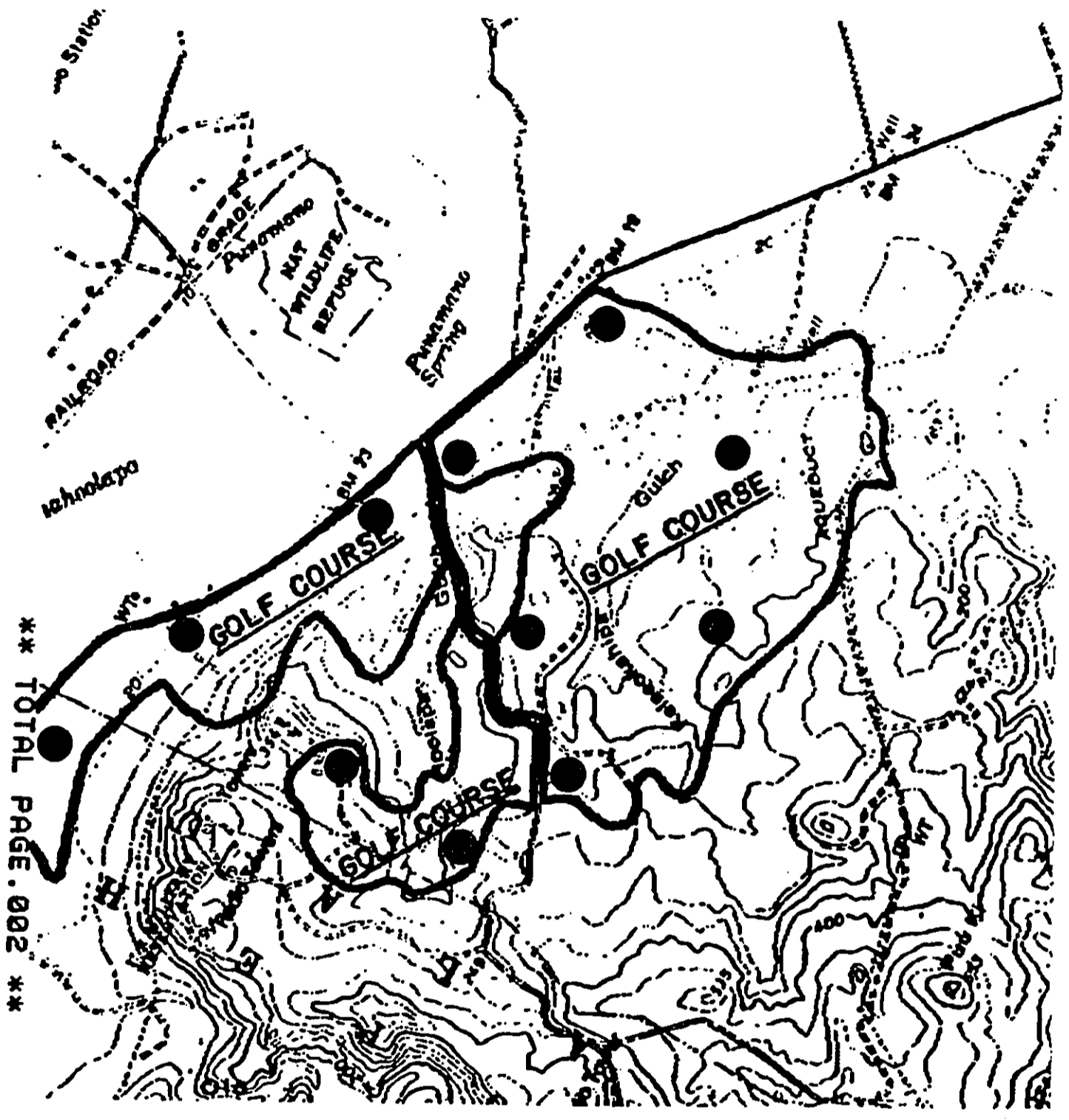


Fig. 1. Proposed golf course sites at Punamano, Kahuku. Census stations marked by solid circles.

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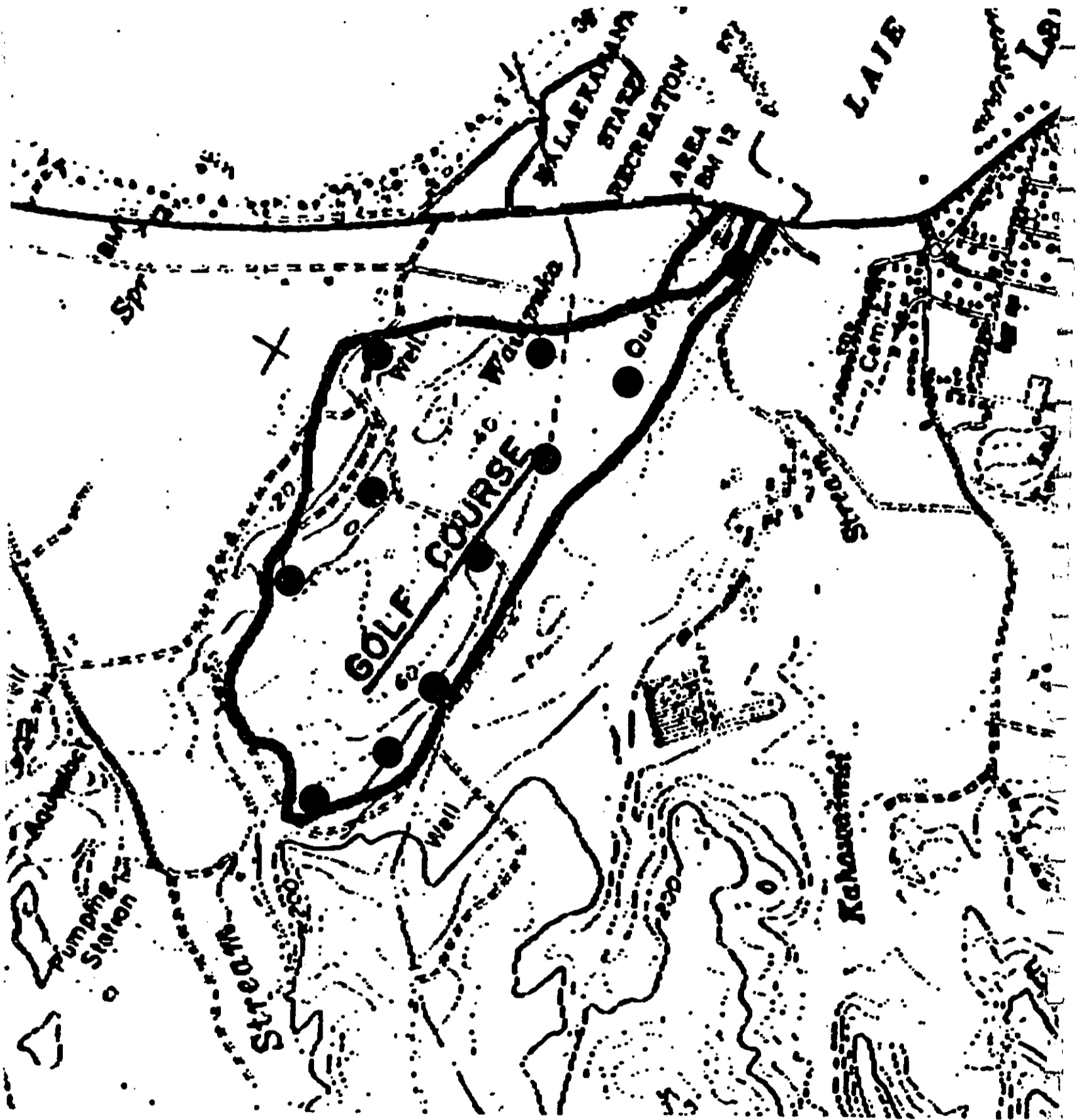


Fig. 2. Proposed golf course site at Malaekahana, Kahuku. Census stations marked by solid circles.

TABLE 1

Relative abundance of exotic birds recorded on proposed golf course sites at Punamano and Malaekahana.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*	
		Punamano	Malaekahana
Cattle Egret	<u>Bulbucus ibis</u>	C = 6	C = 8
Ring-necked Pheasant	<u>Phasianus colchicus</u>	R = 2	R = 5
Spotted Dove	<u>Streptopelia chinensis</u>	U = 3	C = 5
Zebra Dove	<u>Geopelia striata</u>	A = 11	A = 12
Common Myna	<u>Acridotheres tristis</u>	A = 12	C = 9
Japanese White-eye	<u>Zosterops japonicus</u>	A = 14	A = 11
Japanese Bush-warbler	<u>Cettia diphone</u>	U = 2	A = 10
Northern Cardinal	<u>Cardinalis cardinalis</u>	U = 2	U = 3
Red-crested Cardinal	<u>Paroaria coronata</u>	U = 2	C = 6
White-rumped Shama	<u>Copsychus malabaricus</u>	U = 2	U = 4
Red-vented Bulbul	<u>Pycnonotus cafer</u>	A = 16	A = 12
House Sparrow	<u>Passer domesticus</u>	---	R = 4
House Finch	<u>Carpodacus mexicanus</u>	R = 10	C = 8
Java Sparrow	<u>Padda oryzivora</u>	---	R = 2
Nutmeg Mannikin	<u>Lonchura punctulata</u>	R = 18	C = 8
Common Waxbill	<u>Estrilda astrild</u>	C = 9	C = 9

* (see page 10 for key to relative abundance symbols)

KEY TO TABLE 1

Relative abundance = determined by frequency on eight minute counts
in appropriate habitat.

A = abundant (10+)

C = common (5-10)

U = uncommon (1-5)

R = rare or recorded but not on census stations (number which follows
is total recorded during the field survey)

- = species not recorded at that site

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1985, 1987 " " " Southern Marquesas Islands, French
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1986-present Morphometric study of Black-crowned Night Heron in Hawaii.

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Other associated professional experience:

President, Hawaii Audubon Society 1986,1987
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Project: 1- Ornithological survey of Hawaiian Wetlands. 1977.
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Environmental Impact Statement
THE COUNTRY COURSES AT KAHUKU

APPENDIX M

**MARKET ASSESSMENT FOR THE
PROPOSED COUNTRY COURSES AT
KAHUKU**

John Zapotocky

APPENDIX M

Market Assessment for the
Proposed
**COUNTRY COURSES AT
KAHUKU**
Malaekahana Area Containing 18
of a Planned 72 hole Golf
Complex

Prepared For:
The Estate of James Campbell

Prepared By:
John Zapotocky, Consultant

December 1989

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Executive Summary

The Estate of James Campbell proposes to develop a 72 hole golf complex in the Koolauloa Development Plan area to be known as the "Country Courses at Kahuku". Eighteen holes of the complex are located at Malaekahana. The remaining 54 holes are located at Punamano. Because more than a mile separates the two areas proposed in the complex and the different physical attributes of the sites, two separate amendment proposals to the Koolauloa Development Plan have been made. A market assessment for each of the two development plan proposals is being prepared. However, in the case of the market assessment, the entire "Country Courses at Kahuku" complex is being treated as a single entity. All of the proposed courses will serve the same demand and the development of each course within the complex will have an impact on the supply available for the market area. Therefore although two separate reports will be prepared for submittal with the respective amendment package, the interrelationships of the entire complex will be addressed in each report.

The proposed "Country Courses at Kahuku" Malaekahana facilities consist of a single 18 hole championship golf course and support facilities. These facilities are expected to provide a resort golf experience to the golfers using the facilities, i.e., an enjoyable yet challenging round of golf. The golf course is to be unique with characteristics and holes that are memorable yet maintained in a condition which will improve scores, i.e., mowing and maintenance patterns which provide a certain amount of forgiveness of golf shots which tend to be off the mark.

A single clubhouse and will serve the course and a driving range and putting green as well as an appropriate amount of parking will be provided.

Demand for golf nationwide has been increasing for the past thirty years. This growth is expected to continue based on the following: higher incomes; an aging population; early retirement; more leisure time; flex time, and more residential mobility. Two studies undertaken in 1986 projected growth in demand for golf participation from zero to five percent annually, so far empirical evidence indicates that actual growth is taking place closer to the upper end of the projections. These growth projections suggest a

Executive Summary

need to increase the supply of golf facilities significantly on a nationwide basis through the year 2000.

Demand for golf in the State of Hawaii has also exhibited strong growth for the same reasons golf nationwide has grown.

In addition, golf demand in Hawaii has grown due to the development of a resort golf industry. Thus, growth in golf demand in Hawaii is driven by two distinct factors: growth in visitor demand for golf and growth in resident demand for golf. The largest growth in the Hawaiian golf has come from the resort aspect with the number of resort courses increasing from two in 1965 to twenty in 1985.

This growth in the resort golf business is expected to continue due to the following: projected growth in the volume of visitors over time; higher golf participation rates among visitor populations; an upscaling of the resort industry in Hawaii; the trend for an increasing percentage of visitor accommodations to be located in resort destination areas; and an increase in the number of eastbound visitors, particularly the Japanese, who have demonstrated a strong desire to play golf when visiting the Hawaiian islands.

Existing destination resorts have found through experience that golf demand is seasonal. The three months of January, February and March account for over 30% of play on resort courses. Further, the maximum theoretical capacity of a resort course is approximately 73,000 rounds while the maximum practical capacity of a resort course is approximately 50,000 rounds due to the seasonality factor.

Experience has shown that guest units at Hawaiian destination resort generate a wide range of golf demand depending on the resort and availability of golf facilities. A survey of selected resorts found resort hotel units generated from .08 rounds per day at Wailea to .4 rounds per day at Mauna Kea. In addition, resort condominiums generate between .07 and .11 rounds per day.

A survey conducted for this study showed that approximately 1.5 million rounds were played, in 1988, on Oahu's 19 non military golf courses. Of these, approximately 1.24 million or 79% were played by residents and .27 million or 21% were played by visitors. Based on this information the average rounds played in 1988, by Oahu's average resident (non military) and visitor population was 1.81 and 3.58 rounds respectively. Using the 1988 average round information and the projected growth rates for resident and visitor population as estimated by State planners through the year 2000, alternate demand scenarios were generated by incorporating growth rates of 0%, 2%, 5%, and 10%. Use of these assumptions indicated demand for additional golf courses of three (3), eight (8), eighteen (18), and forty four (44) respectively.

A number of factors evident in the Oahu golf industry: Courses operating at maximum capacity; Escalating green fees; Institution of a telephone lottery for municipal course starting times; A comparison with the rates of play on the Island of Maui; the strong interest in the development of new golf facilities by the municipality and by private land owners and developers and, the extrapolation of past trends suggest that there is currently an existing shortfall in the supply of golf facilities. The consultant estimates that this shortfall could range between eight to sixteen golf courses assuming the same average existing number of rounds per course on Oahu. The shortfall would increase dramatically if the average play per course were to be reduced.

There are currently three golf courses under construction on Oahu with an additional forty one sites planned or being discussed a potential golf course sites. However, based

Executive Summary

on a number of considerations including the ability to achieve needed governmental approvals, the physical constraints of the sites under consideration, and the ability of potential developers to obtain financing, the consultant estimates that less than half of these potential courses could be developed by the year 2000.

Thus, a range of demand of excluding the 0% and 10% growth scenarios would indicate that Oahu would need from sixteen (16) to thirty four (34) new courses by the year 2000 against a maximum supply of twenty two (22) new courses.

Demand for the Country Courses at Kahuku is expected to come primarily from increased visitor golf demand. The expansion plans of the Kuilima Resort Company are expected to provide the critical mass of visitor units necessary to support the Country Courses at Kahuku. While there is no local (Hawaii State Model) that demonstrates the feasibility of a conglomeration of golf facilities such as those proposed at the Country Courses at Kahuku, there are Mainland (U.S.) models including Pinehurst, North Carolina, and Pebble Beach, California which demonstrate successful operations. In addition, this success can be achieved through the use of golf demand factors per visitor unit already experienced at Hawaii destination resorts. Further, there are island nations i.e., Bermuda and the Bahamas which offer a high concentration of golf facilities.

Assuming the development of visitor accommodations at the Kuilima Resort takes place as projected by the Kuilima Resort Company, the Country Courses at Kahuku would be totally absorbed by the year 1998. The course at Malaekahana would be absorbed in 1994. These projections include the development of the course planned by the Kuilima Resort Company within the resort proper and at Malaekahana. They also include absorption of additional capacity at the Kahuku Municipal Course.

One factor which is expected to be particularly beneficial to the resident golfing public is that resort oriented golf courses have a significant amount of excess capacity at times other than the traditional peak season (January, February, and March). Given the difference between the theoretical capacity of resort courses of 73,000 rounds and their practical capacity of 50,000 rounds, the single course at the Country Courses at Kahuku - Malaekahana is likely to result in the availability of 20,000 rounds which could be used during the off peak times. Golf course managers are aware of the value of this resource and often promote its use by the resident population.

Development of the Country Courses at Kahuku is expected to be beneficial to the marketing of the Kuilima Resort. The concentration of golf facilities is expected to enhance golf marketing through availability, variety, accessibility and versatility. There are also expected to be operational benefits to the clustering. Existing and planned uses in the area are expected to be compatible with the proposed golf course developments. Employment generated by the Country Course at Kahuku - Malaekahana is expected to be 50 full time equivalent jobs.

The proposed "Country Courses at Kahuku" - Malaekahana has a number of advantages, from a marketing standpoint, over other golf courses proposed in the North Shore and Koolauloa Development Plan areas.

1. By virtue of its location, less than a ten minute drive east of the entrance to the Kuilima resort, the Malaekahana Course has better access to resort guests at the Kuilima Development than any other existing or proposed golf course save the two located within the Kuilima Resort proper and the Punamano Courses at the complex.

Executive Summary

2. The size of the Malaekahana site and its dedication to strictly golf activities, will allow the golf course designer to maximize the recreational golf aspects of the site.
3. The site possesses natural beauty and at various locations within the site excellent views will add to the enjoyment of the basic recreational golf experience.
4. The existing Turtle Bay and Kahuku Courses are already attracting in excess of 100,000 (non-Kuilima Complex) golf rounds annually and the North Shore and Koolauloa areas are already known for their recreational amenities, including: major beach parks; major visitor attractions, i.e., Polynesian Cultural Center and Waimea Falls Park; ocean recreation, including surfing and boating (Haleiwa Harbor); and equestrian activities including polo at Mokuleia and other activities along the entire coast.
5. Will build on the strength of the existing Turtle Bay Resort in attracting golf business while at the same time attracting golfers to the resort.

The proposed Country Courses at Kahuku will help to satisfy the growing demand for golf of Oahu's visitor and resident populations. The development will help to preserve the long term viability of Hawaii's and Oahu's resort industry. At the same time the Country Courses at Kahuku will foster the development of a niche market (golfing visitors) which will be beneficial for the Hawaiian visitor industry as well as for the approved Kuilima Resort Development.

**Market Assessment For
COUNTY COURSES AT KAHUKU
MALAEKAHANA AREA
Containing 18 Of A Planned 72 Hole
Golf Complex**

I. INTRODUCTION

The Estate of James Campbell proposes to develop a 72 hole golf complex in the Koolauloa Development Plan area to be known as the "Country Courses at Kahuku". Eighteen holes of the complex are located at Malaekahana. The other 54 holes are located at Punamano. Because more than a mile separates the two areas proposed in the complex and the different physical attributes of the sites, two separate amendment proposals to the Koolauloa Development Plan have been made. A market assessment for each of the two development plan proposals is being prepared. However, in the case of the market assessment, the entire "Country Courses at Kahuku" complex is being treated as a single entity. All of the proposed courses will serve the same demand and the development of each course within the complex will have an impact on the supply available for the market area. Therefore, although two separate reports will be prepared for submittal with the respective amendment package, the interrelationships of the entire complex will be addressed in each report.

The proposed "Country Courses at Kahuku" - Malaekahana is located in Koolauloa mauka of Kamehameha Highway and Malaekahan State Park. The property is bounded all sides by grazing land. To the east a golf course has been proposed by the Kuilima Resort Company.

Access to the site is from Kamehameha Highway. The site is extremely well located to attract golfers from the Kuilima resort as it is less than a ten minute drive to the entrance of the Kuilima resort. The proposed "Country Courses at Kahuku" are expected to be complementary to and supportive of existing and proposed golf operations within the Kuilima Resort Complex.

The purpose of this report is to assess the demand for the proposed "Country Courses at Kahuku".

*Market Assessment For
Country Courses at Kahuku Malaekahana Area*

II. DESCRIPTION OF PROPOSED MALAEKAHANA GOLF FACILITIES

The proposed "Country Courses at Kahuku" Malaekahana facilities consist of a single 18 hole championship golf course and support facilities. These facilities are expected to provide a resort golf experience to the golfers using the Facilities, i.e., an enjoyable yet challenging round of golf. Each of the golf courses is to be unique with characteristics and holes that are memorable yet maintained in a condition which will improve scores, i.e., mowing and maintenance patterns which provide a certain amount of forgiveness of golf shots which tend to be off the mark.

Golf Course - A single 18 hole championship course is planned. The course is expected to be unique in character due to the varied terrain and topography in the area as well as to the various elevations. The incorporation of golf design features into the various courses is expected to mitigate or make more difficult terrain features where appropriate.

Clubhouse - A single clubhouse will serve the 18 hole golf course. The clubhouse would be approximately 10,000 to 12,000 square feet. Incorporated into the clubhouse would be a starting facility, proshop, lockers, restaurant/lounge, restrooms, and cart storage and maintenance facilities for 90 golf carts. Note: Cart storage is expected to account for approximately 5,000 square feet or approximately one half of the clubhouse area.

Driving Ranges - The clubhouse will be served by a driving range and putting green.

Parking - The clubhouse will be provided with an appropriate number of parking stalls.

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III. GOLF - DEMAND

A. BACKGROUND

According to the State of Hawaii Data Book, 1986, there are fifty-seven golf courses in the State of Hawaii. These courses are further broken down by type; seven municipal; nineteen resort; seventeen public; nine military and five private. During the past ten years almost all of the golf course development has taken place as an integral part of resort or other land development projects. This situation follows closely the national experience.

The City and County of Honolulu which, for all practical purposes, encompasses the Island of Oahu, contains 28 golf courses consisting of: four municipal, three resort, eight public, nine military and four private courses. Thus Oahu, which accounts for approximately 80% of the State's population, contains less than 50% of the State's golf courses. Further, Oahu, which has an average visitor census of approximately 50% to 60% of the State total, contains only 15% of the State's resort golf courses. In addition, the nine military golf courses included in the Oahu total are restricted (for all practical purposes) to active military, retired military, their dependents and selected civil servants that account for less than 20% of Oahu's population.

At the present time, municipal golf courses on Oahu are operating at capacity, the four private country clubs have waiting lists, the military courses are said to be at capacity, and the public daily fee courses are at capacity with continuing fee increases anticipated.

While a number of new courses have been proposed, only three new courses — the Ko Olina (resort/daily fee) Course, Minami Course (private) and the City's West Loch Course (municipal) — are under construction. These three courses are expected to be open in 1990.

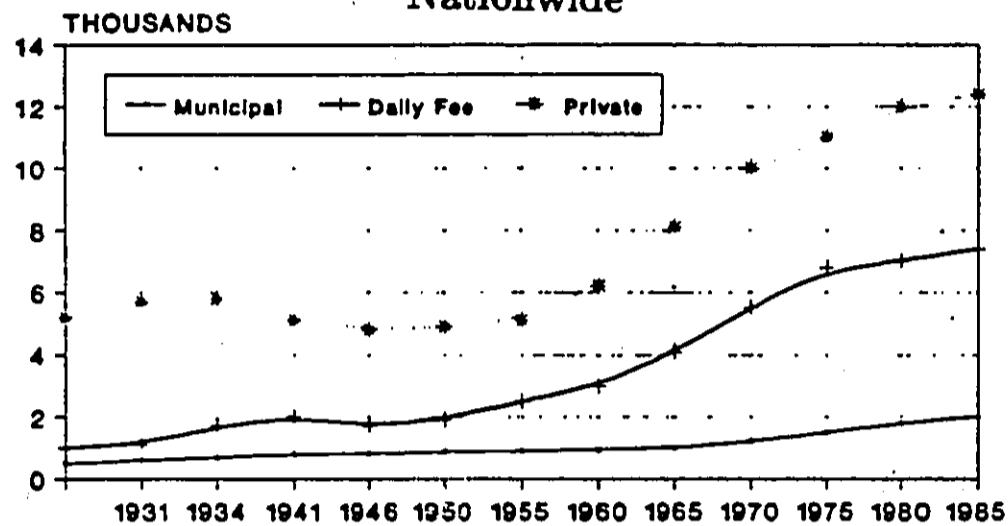
B. NATIONAL GOLF TRENDS

Statistics provided in the National Golf Foundation's publication *Golf Facilities in the United States, 1985* attest to the growth of golf in the United States over the past 30 years. Between 1955 and 1985 the number of golf courses in the country grew from 5,218 to 12,346, a 136% increase. At the same time, population grew from 164 million to 237 million, a gain of only 44%. The number of private facilities has decreased from approximately 54% to 39%, indicating a broadening of the participation in the sport to include a wider spectrum of the American population (See *Exhibit 1*).

At a 1986 symposium sponsored by the National Golf Foundation, a nationally recognized organization of golf related operators, managers, manufacturers and related affiliates, Dr. John F. Rooney of Oklahoma State University presented a paper on the *Demand for Golf in the Year 2000*. The

EXHIBIT 1

Growth In Facilities Number Of Golf Facilities Nationwide



Trends

- Over the past decade, the total number of facilities has grown about nine percent.
- During the past ten years, municipal facilities have increased by 21 percent compared to daily fee facilities which have increased by 11 percent. Private facilities have grown at the slowest rate of seven percent.
- Twenty-five years ago, private courses comprised 50 of the total number of facilities. In 1985, private courses make up 39 percent of the total number.

Source: National Golf Foundation

Golf Facilities in the United States, 1985

Market Assessment For Country Courses at Kahuku Malaekahana Area

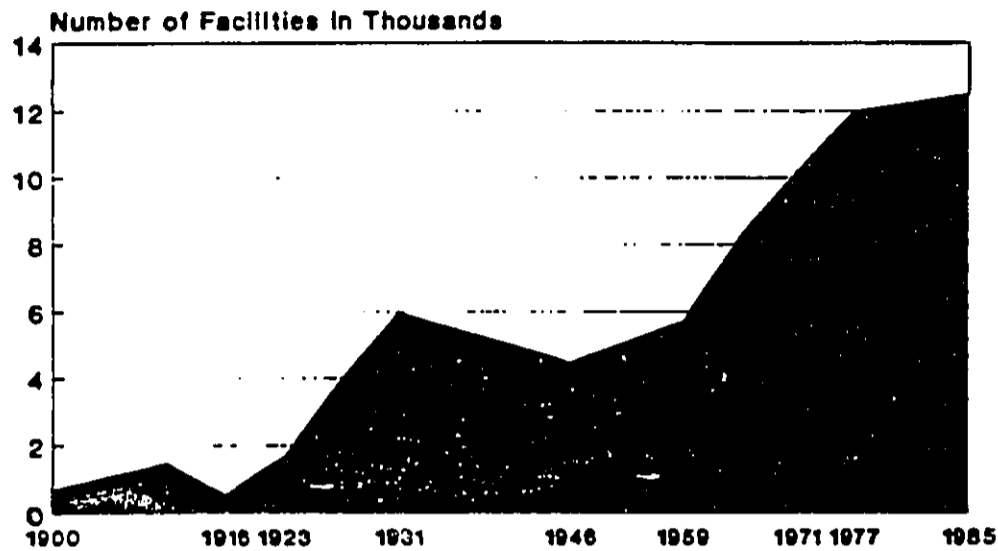
paper presented historical data on the growth of golf in the United States and those factors which would be predictive of future growth. Dr. Rooney estimated that in 1986 there were 17,500,000 golfers being accommodated by 12,500 golf facilities. (See *Exhibit 2*)

Growth generators for the future were projected to be: higher incomes; aging population; early retirement; more leisure time; flex time and residential mobility. Using alternate growth rates ranging from 0% to 5% and including only the known demographic changes in the population results in a range of 19,900,000 to 41,450,000 golfers by the year 2000. (See *Exhibit 3*) Thus in the short time between now and 2000 golf demand nationally would rise between 10% and 100%+.

At the same symposium in a paper titled *The Crisis in Public Golf Course Development*, Dr. Robert Adams of the University of New Hampshire attempted to quantify the demand for new golf facilities. Dr. Adams' research indicated that golf facilities nationwide are in tight supply (thus frustrating the desire for golf among the "wider spectrum" of golfers identified previously) and that the availability of public golf facilities declined in 23 of 50 states, including Hawaii. (See *Exhibit 4*) Dr. Adams, using the same alternate scenarios cited in Dr. Rooney's paper, but eliminating the 5% scenario, developed projected increases in golf facilities to maintain present levels of course availability. The results of his analysis showed the need for a range of 1,400 to 7,900 courses by the year 2000 if growth rates of 0% and 3% were assumed respectively. (See *Exhibit 5*) Annualized, these projections would result in increased golf course inventory of 100 to 560 per year. Need for additional facilities is expected to be the greatest in the south and the west, where population growth has outstripped new golf facilities in the recent past.

According to *Golf Participation in the United State, 1988 Edition* published by the National Golf Foundation in August of 1988, both participation and the number of rounds increased between 1986 and 1987. Participation increased by 9% and rounds by 3%. This report was one of the first opportunities to measure the validity of the initial growth projections contained in the aforementioned studies.

EXHIBIT 2 Growth of U.S. Golf Facilities



Source: G. Cornish and R. Whitten
The Golf Course and NGF

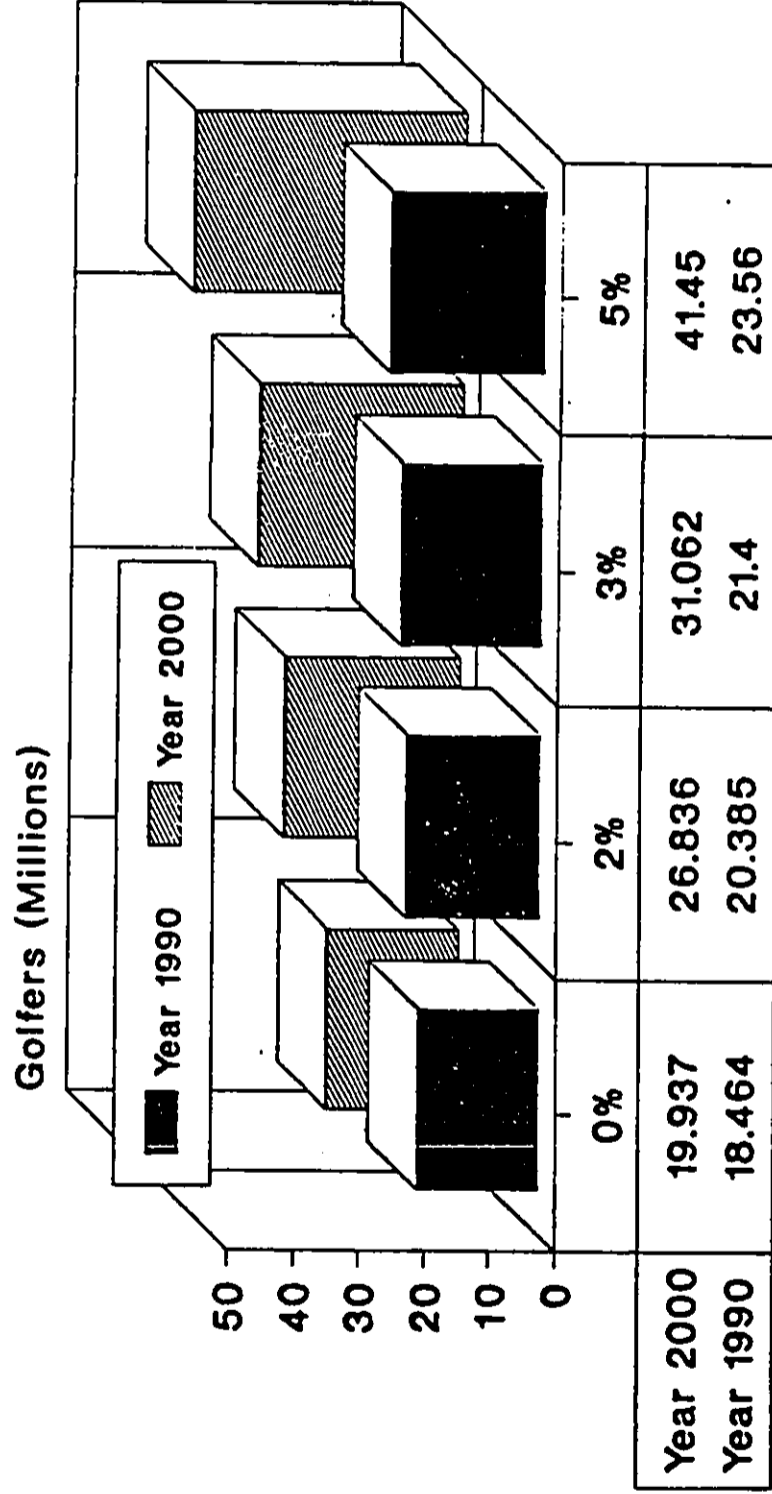
Golf Growth: 1960 - 1986

	<u>1960</u>	<u>1970</u>	<u>1980</u>	<u>1986</u>
Number of Facilities	6,400	10,200	12,000	12,500
Number of Golfers	5.0M	11.2M	15.1M	17.5M
Annual Facility Growth Rate		4.7%	1.5%	0.7%
Annual Golfer Growth Rate		8.5%	2.1%	1.1%

Source: NGF/Market Facts, Inc.

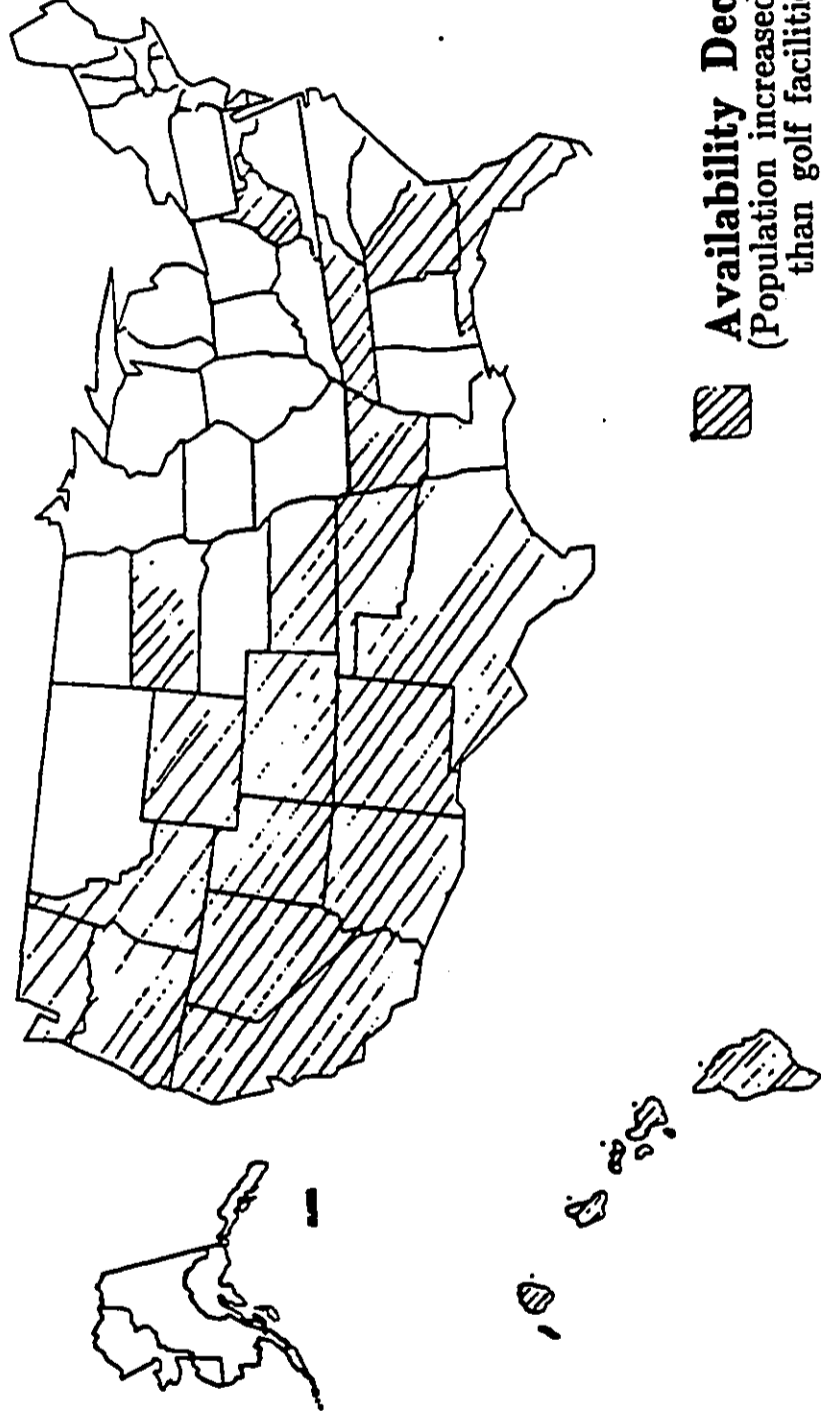
EXHIBIT 3

Potential Growth in Golf Participation



Source: National Golf Foundation
Golf Projections 2000: Golf Summit '86 Research Presentation

EXHIBIT 4
States that Declined in Availability
of Public Golf Facilities: 1975 - 1985



Source: U.S. Bureau of the Census and NGF

COPY OF THE REPORT ON THE AVAILABILITY OF PUBLIC GOLF FACILITIES IN THE UNITED STATES, 1975-1985

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EXHIBIT 5

**COURSE DEVELOPMENT REQUIRED
TO MEET POTENTIAL GROWTH**

Year:	Today	2000	2000	2000
% Growth in Golf Population		@ 0% Growth	@ 2% Growth	@ 3% Growth
Number of Golfers	17,500,000	19,900,000	26,800,000	31,100,000
Number of Courses ¹ That must be added to Maintain Current Availability ²	0	1,399	5,420	7,926
Required Average Yearly Increase in Number of Courses to 2000 ³	--	100/year	387/year	566/year

¹ Course = 18-Hole Equivalents

² Current Availability = 58 Courses/100,000 Golfers

³ Average Yearly Growth 1983-1985 = 116 Courses/Year (Not 18-Hole Equivalents)

SOURCE: Market Facts, Inc. and NGF

Similar projections have been made by others. The following quote from an article in the January 1987 issue of *Urban Land Magazine* illustrates the point.

"Golf will be a major beneficiary of the aging of the population. A disinterested baby boom generation slowed golf play growth considerably in the 1970s. However, as this generation moves into the 35- to 54-year-old age bracket group with the highest golf participation rate—and as growth accelerates in the 65-and-over population—the group exhibiting the highest per capita play—golf will benefit greatly. Today there are approximately 6 million golfers in the 35- to 54-year-old age bracket. By 1990, there will be approximately 7.2 million, and by 2000, golfers in that age group will swell to over 9 million, a 50 percent increase in 15 years. In addition, golf is becoming increasingly popular with women."

Thus, the number of golfers is expected to increase significantly by 1995 (See *Figure 1*). And, because of the aging population, golf demand (number of rounds) will rise at an even faster rate. Moreover, with a growing retirement population, golf demand during mid-week periods should accelerate, a major factor in improving the profitability of golf course operations.

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**FIGURE 1
GROWTH IN GOLF PLAY**

Year	Number (Millions)	Percent Increase	Number of Rounds (Millions)	Percent Increase
1985	18.1	—	440	—
1990	19.1	5.5	466	5.9
1995	19.9	4.2	491	5.4

Source: Economics Research Associates

The awareness of golf has grown, in part, due to its prime time weekend television exposure supported by major sponsors who target their message at the middle income and affluent market. Golf awareness has also grown due to an increase in junior golf programs and the emergence of golfers as sports heroes.

C. GOLF TRENDS IN THE STATE OF HAWAII

Golf in the State of Hawaii has also exhibited strong growth for many of the same reasons identified as golf generators nationally. Hawaii has been identified as one of the states in the nation with high golf intensity. (See *Exhibit 6*) The most explosive growth in golf in Hawaii during the past 20 years has been the development of the resort golf industry. This growth is described more fully later in the text.

Golf growth in Hawaii is expected to come from two distinct factors: growth in the demand by residents and growth in the demand by tourists.

Demand for golf by residents is expected to grow at rates consistent with national trends. Based on the Department of Planning and Economic Development's M-K Series projections, the median age of Hawaii's population is expected to increase from 30.5 in 1985 to 35.3 in the year 2010 with the 35-54 year old population group increasing by 52% and the over 65 population group by 90%. The aging of the population follows national trends. Demand for golf by tourists is expected to continue to increase with the growth of the visitor industry and may accelerate as the mix of Hawaii's visitors shift towards the up-scale market.

1. Resort Golf

The growth in golf as a leisure time activity has translated into the growth of golf as an activity for tourists. In 1955, none of the golf courses in the State of Hawaii could be classified as being resort

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courses; in 1965 only the Mauna Kea and the Kaanapali Golf Facilities could be classified as resort courses; by 1985 there were 20 golf courses in the state classified as resort golf courses.

An examination of golf courses by island (See *Exhibit 7*) indicated that resort courses have developed on the neighbor islands to a greater degree than on Oahu when measured against average visitor census or visitor expenditures by county (*Exhibits 8 and 9*). This can probably be explained by the fact that growth of the neighbor island visitor industry has taken place more recently and, to a large degree has focused around destination resorts. Proposed additions to Oahu's visitor plant such as West Beach and the Kuilima Expansion include golf facilities as prominent features of the proposed resort development plans. A recent study¹ commissioned by the State Legislature stated that Hawaii attracted approximately 200,000 golfers in 1985 and that they expended \$30,000,000 at the state's resort golf courses.

The development of destination resorts in Hawaii, starting with the development of Kaanapali on Maui over 20 years ago, have followed a more or less standard formula for success. In general, resorts have been sited in coastal areas with prevailing good weather and provided a variety of self-contained recreational amenities, including ocean activities, golf course(s), tennis facilities, shopping and various other amenities. In the early years golf and other recreational facilities were considered to be necessary cost centers for the resort development. Costs for these amenities were generally allocated to parcels for sale or lease and were recovered by sales of developable land within the resort. The basic reason for this assumption was that golf course fees and demand was relatively low in comparison to golf course operating and capital costs. During the past five years there has been an increase in the level of demand, and fees have been increased to allocate scarce playing times on an economic basis. Golf course operations have become self-supporting and, in a number of cases, profitable. This change in demand at Hawaiian resort courses is the result of maturation of the Hawaiian destination resort industry.

As destination resorts have matured, the number of resort units providing potential golf users has increased, occupancy rates have improved and generally planned densities for developments have been reduced with a consequent upscaling of accommodations. These factors have encouraged the growth of the golf playing visitors.

Another factor encouraging the expansion of the golf playing visitor market has been the expansion, availability and marketing of resort golf facilities. The islands of Maui and Hawaii have led the state in the expansion of golf facilities. Twenty years ago on Maui, there was a single golf facility at the "infant" Kaanapali Resort. Today there are

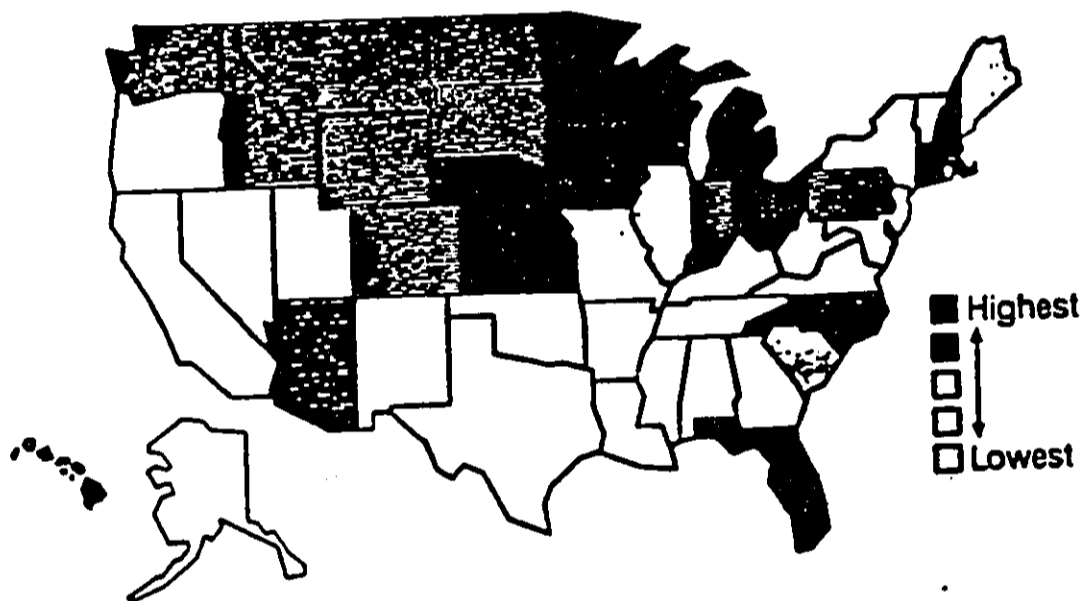
¹ Coopers & Lybrand, *A Master Plan for the Continued Development of Hawaii as a Sports Center*, February 1987.

**EXHIBIT 6
GOLF INTENSITY**

RECEIVED AS FOLLOWS



Golf Intensity



Source: Rooney, Adams Golf Involvement Index

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EXHIBIT 7

GOLF COURSES, BY ISLANDS: 1984

Island and type of operation	Number of courses				Number of holes
	Total	9-hole	18-hole	27-hole	
State total ..	57	12	44	1	927
Hawaii	11	2	9	-	180
Public 1/	4	2	2	-	54
Municipal	1	-	1	-	18
Resort	6	-	6	-	108
Mauī	10	2	8	-	162
Private	1	1	-	-	9
Public 1/	1	1	-	-	9
Municipal	1	-	1	-	18
Resort	7	-	7	-	126
Lanai	1	1	-	-	9
Public 1/	1	1	-	-	9
Molokai	2	1	1	-	27
Public 1/	1	1	-	-	9
Resort	1	-	1	-	18
Oahu	28	5	23	-	459
Private	4	-	4	-	72
Public 1/	8	1	7	-	135
Municipal	4	1	3	-	63
Military	9	3	6	-	135
Resort	3	-	3	-	54
Kauai	5	1	3	1	90
Public 1/	1	1	-	-	9
Municipal	1	-	1	-	18
Resort	3	-	2	1	63

1/ Privately owned courses open to the public on daily-fee basis.

Source: Bill Gee, 1984 Hawaiian Golf Almanac (Hawaii Junior Golf Association), pp. 3 and 8.

RECEIVED AS FOLLOWS

EXHIBIT 8

WESTBOUND VISITOR ARRIVALS, BY COUNTIES VISITED:
1982 TO 1987

[Covers westbound visitors staying overnight or longer anywhere in the State, and any overnight or non-overnight interisland trips reported by these visitors. Based on a 20-percent sample through 1983 and a 10-percent sample thereafter]

Year	State total ^{1/}	City and Co. of Honolulu	Hawaii County	Kauai County	Maui County
1982 ...	3,278,525	2,589,190	678,170	733,295	1,550,080
1983 ...	3,396,115	2,591,635	712,380	691,940	1,644,605
1984 ...	3,721,380	2,901,320	760,940	814,590	1,854,690
1985 ...	3,708,610	2,828,640	697,380	832,580	1,831,110
1986 ...	4,256,390	3,146,030	786,930	1,014,650	2,001,870
1987 ...	4,204,010	3,078,500	782,550	1,032,840	1,908,780

^{1/} Because many visitors visited more than one county, county data sum to totals greater than the State totals shown here.
Source follows next table.

AVERAGE VISITOR CENSUS, BY COUNTIES: 1982 TO 1987

[Unlike the preceding table, this table includes eastbound and northbound visitors (all of whom have been included with the City and County of Honolulu) as well as westbound visitors. Based on a 20-percent sample through 1983 and a 10-percent sample thereafter]

Year	State total	City and Co. of Honolulu	Hawaii County	Kauai County	Maui County
1982 ...	105,310	73,445	6,725	7,050	18,090
1983 ...	108,045	66,695	8,690	7,990	24,670
1984 ...	118,660	67,370	7,570	10,930	32,790
1985 ...	116,700	65,280	8,040	11,470	31,910
1986 ...	132,910	73,870	9,870	14,840	34,330
1987 ...	134,270	74,660	10,210	15,510	33,890

Source: Hawaii Visitors Bureau, release dated March 1988 and records.

EXHIBIT 9

ESTIMATED EXPENDITURES BY VISITORS TO HAWAII, BY COUNTIES: 1970 TO 1987

[Millions of dollars. Interisland air fares have been distributed on a prorata basis. Expenditures by eastbound visitors have been included with the City and County of Honolulu. Excludes expenditures by Hawaii residents]

Year	State total	City and County of Honolulu	Other counties			
			Total	Hawaii	Kauai	Maui
1970	595	442	153.0	53.4	45.1	54.5
1971	705	507	198.0	67.7	56.1	74.2
1972	840	609	231.0	77.0	61.9	92.1
1973	1,020	777	243.0	81.9	63.2	97.9
1974	1,225	928	297.5	99.3	73.9	124.3
1975	1,360	1,004	355.9	114.6	87.2	154.1
1976	1,640	1,213	427.2	126.8	101.8	198.6
1977	1,845	1,377	468.5	131.2	109.9	227.4
1978	2,146	1,569	577.0	152.9	137.9	286.9
1979	2,537	1,867	669.8	162.0	159.1	348.7
1980	2,875	2,097	777.5	187.6	189.3	400.6
1981	3,200	2,394	805.9	179.2	197.3	429.4
1982	3,700	2,748	951.8	200.9	210.6	540.3
1983	3,974	2,653	1,320.9	277.2	250.8	792.9
1984 1/ ...	4,582	2,895	1,686.6	248.9	359.4	1,078.3
1985 1/ ...	4,884	3,084	1,799.5	285.9	407.9	1,105.7
1986 1/ ...	5,500	3,444	2,056.2	343.8	516.9	1,195.5
1987 1/ ...	6,600	4,370	2,229.6	381.8	580.1	1,267.7

1/ Preliminary estimate.

Source: Hawaii Visitors Bureau, "Neighbor Island Statistics," tabular release dated March 1988.

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seven resort golf courses with a number of new facilities in the planning stages. Unlike a tennis court, each golf course is unique. Avid golfers seek opportunities for experiencing a number of championship facilities, thus encouraging them to return year-after year. This has also resulted in word of mouth advertising upon their return home. Maui has marketed its golf on a national (U.S.) basis under the heading "Maui Golf Coast".

a. Future Prospects

Future prospects for growth in demand for Hawaiian resort golf look extremely bright for the following reasons: a) Continued maturation of the Hawaii destination resort industry; b) Favorable demographic trends in the United States (primary source of the Hawaiian visitor market); and, c) Growth of eastbound tourist business (primarily Japanese) who also exhibit a high propensity for golf.

i. Maturing Industry

While golf course play at selected resorts shown in *Exhibit 10* shows a matching of play with resources, it does not take into account that, with the exception of Kaanapali, the resort developments shown have reached less than 50% of their ultimate size in terms of total units.

Further, Wailea and Kaanapali benefit from the availability of neighboring courses such as Makena and Kapalua, respectively, where development of visitor accommodations (hotels and condos) is, at a very early stage, comprising only 20 to 30% of ultimate development. It should be noted that all of the resort facilities shown in *Exhibit 10* are planning additional golf courses.

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EXHIBIT 10

<u>RESORT AND NUMBER OF GOLF COURSES</u>	<u>ACTUAL ROUNDS FY 1989</u>	<u>DESIRED MAXIMUM ROUNDS¹</u>	<u>TWO TIERED PRICING²</u>	<u>ROUNDS RESERVED FOR HOTELS³</u>	<u>% ROUNDS FROM RESORT COMPLEX</u>	<u>COMMENTS</u>
Princeville 1 Course	70,000 ⁴	50,000	\$85/\$75	100	over 50%	Additional course is under construction
Kaanapali 2 Courses	107,000	108,000	No	No ⁴	60%	Additional course is under consideration for N. Beach Expansion
Wailea 2 Courses	105,000	110,000	\$105/\$60	90	70%	Additional course is under consideration
Mauna Lani 1 Course	45,000	44,000	\$100/\$60	No	66%	Additional course is being designed

¹- Desired Maximum Rounds refers to rounds which the operator feels are achievable under current conditions due to seasonality of play. Theoretical maximum capacity is approximately 70,000 rounds per course.

²- Two tiered Pricing refers to a policy of pricing which discriminates in favor of complex (resort) guests. Resorts have priority reservations policies which give priority to hotels in making reservations for golf play. Operators have seasonal pricing policies. Rates shown are for high season. Kaanapali did not offer low season rates in 1987 or 1988.

³- Wailea and Princeville have guaranteed availability for hotel guests. Kaanapali provides no guarantee but gives reservation priority. Mauna Lani owns both resort and hotel. In 1989, Shinwa (Wailea Resort Owner) acquired the Stofer Wailea Beach Hotel.

⁴- Princeville course is 27 holes and capable of higher level of play; however, management considers the course the principal recreational asset and therefore wishes to maintain the lower level of play. Note Figure from 1987 Hotel closed for renovation in 1988/1989.

⁵- While no two tiered pricing is available, a coupon book allowing the bulk purchase of 15 plays allows for lower priced golf for complex and local residents.

SOURCE: John Zapotocky, Consultant

ii. Growth of Eastbound Tourist Business

Eastbound tourists are expected to account for a larger and larger share of the Hawaiian visitor industry. The Japanese are well known for their "national golf obsession". Japanese interest in golf is attested to by the purchase of a number of Oahu and neighbor island golf courses by Japanese investors in recent years. To date, the Japanese golfer has been a significant but not overwhelming factor in Hawaiian golf play, but this is expected to change. As the Japanese tourist market grows and the market matures, more and more Japanese visitors can be expected to take advantage of the availability and affordability (compared with Japan) of Hawaiian golf.

From 1980 to 1987 westbound tourists increased by 38% while eastbound tourists increased by 79%. (See *Exhibit 11*) This, coupled with the fact that Japanese visitors, the primary component of eastbound visitors, spend, on the average, substantially more per trip than westbound visitors, indicates a trend towards higher average visitor spending. The average Japanese tourist spends (1989 est.)

EXHIBIT 11

VISITOR ARRIVALS AND AVERAGE VISITOR CENSUS: 1964 TO 1987

[For earlier years, 1921-1963, see Data Book 1987, table 210]

Year	Visitors staying overnight or longer			Average number of visitors present		
	Total	West-bound ^{1/}	Other	Total	West-bound ^{1/}	Other
1964	563,925	460,290	103,635	16,037	14,901	1,136
1965	686,928	567,218	119,710	17,369	16,057	1,312
1966	835,456	686,886	148,570	20,918	19,271	1,647
1967	1,124,818	893,103	231,715	27,630	24,898	2,732
1968	1,314,571	1,015,844	298,727	32,335	28,784	3,551
1969	1,527,012	1,181,029	345,983	37,198	33,088	4,110
1970	1,746,970	1,326,135	420,835	36,943	32,028	4,915
1971	1,818,944	1,430,325	388,619	40,889	36,504	4,385
1972	2,244,377	1,782,737	461,640	50,143	45,098	5,045
1973	2,630,952	2,067,861	563,091	59,578	53,407	6,171
1974	2,786,489	2,184,620	601,869	63,535	56,939	6,596
1975	2,829,105	2,207,417	621,688	66,308	59,495	6,813
1976	3,220,151	2,551,601	668,550	75,532	68,225	7,307
1977	3,433,667	2,763,312	670,355	83,030	75,684	7,346
1978	3,670,309	3,030,999	639,310	92,034	85,028	7,006
1979	3,960,531	3,139,455	821,076	98,676	89,678	8,998
1980	3,934,504	3,046,132	888,372	96,497	86,788	9,709
1981	3,934,623	2,974,791	959,832	95,968	85,449	10,519
1982	4,242,925	3,278,525	964,400	105,310	94,740	10,570
1983	4,368,105	3,396,115	971,990	108,045	97,395	10,650
1984	4,855,580	3,721,380	1,134,200	118,660	106,260	12,400
1985	4,884,110	3,708,610	1,175,500	116,700	103,820	12,880
1986	5,606,980	4,256,390	1,350,590	132,910	118,110	14,800
1987	5,799,830	4,204,010	1,595,820	134,270	116,780	17,490

^{1/} Arriving from the Mainland United States or Canada. Based on a 20-percent sample through 1983 and a 10-percent sample thereafter.

Source: Hawaii Visitors Bureau, Annual Research Report (annual) and records.

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approximately \$586 per day vs. \$119 for U.S. tourists. Thus while Japanese tourists made up 22% of the visitors to Hawaii, they accounted for 43% of all visitor expenditures. The impact would have been even greater except that the average length of stay for eastbound tourist is about one half of that for westbound tourists.

It is anticipated that the eastbound tourist market particularly the Japanese market will continue to grow over the long term. In the short term the Japan Ministry of Transport in September of 1987 announced *The Ten Million Plan — A Plan to Double the Number of Japanese Outbound Travelers*. This plan aimed at reducing Japan's foreign trade surplus is expected to double the number of Japanese that travel to foreign countries during the next five years. The program is a comprehensive effort on the part of the Japanese government to encourage foreign travel through: expanding destinations; promoting longer holidays; establishing the International Tourism Development Institute; offering incentives to promote travel. The incentives include: simplifying visa requirements; expansion of the working holiday program; increasing the tax exemption from 100,000 to 200,000 yen (\$800 to \$1,600 at current exchange rates); and providing tax incentives.

While there is no specific goal for increasing tourism to Hawaii as part of the program, it is logical to assume that with its existing tourist infrastructure and the familiarity of Japanese tourists with the Hawaiian vacation experience, Hawaii should be a major participant in the increase in Japanese foreign tourism. There has been exceptionally strong growth in Japanese tourism to Hawaii since inception of *Ten Million Plan*. Note: The Ten Million Plus Program is expected to achieve its goal in approximately half the anticipated time, i.e., 1990 vs. a projected 1992.

Over the longer term, it is anticipated that the number of eastbound visitors will increase substantially. The Department of Business and Economic Development Series M-K projections dated November 1988 assume that Japanese tourists will account for 25% of the visitor arrivals by 2005 vs. the 20% assumed in the previous M-F projections. In addition, the M-K projections assume a higher growth rate for tourism than the previous M-F projections.

iii. Potential Impact of Japanese Tourists on Golf Demand

In order to estimate the potential impact of Japanese golfers the consultant undertook a survey of Japanese golf play on the island of Maui. The reason for using the island of Maui is that it is noted for its availability of golf,

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seven resort courses to serve approximately 2,000,000 visitors versus three on Oahu for approximately 4,000,000 visitors². (See Exhibits 12 and 13.)

While Japanese travel (overnight or longer) totaled only 8% of total overnight or longer visitors to Maui³, it accounted for 77,000 or 22.2% of the 348,000 rounds of resort golf played on Maui in 1987. In 1985, the Maui courses estimated that the Japanese golfers accounted for only a negligible amount of the play. It should be noted that there is a significant amount of Japanese play on Oahu golf courses, however, for the most part Oahu golf courses are operating at capacity and until new golf facilities are opened and the supply of golf times are increased, increases in golf play by visitors must necessarily come from reductions in golf availability to local residents. The historic reliance by local golf facilities on local golfers and club play as well the potential for negative publicity have resulted in a relatively stable balance of play. In most cases Maui resort courses with the exception of the months of January, February and March operate at less than full capacity so that increases in play can be accommodated.

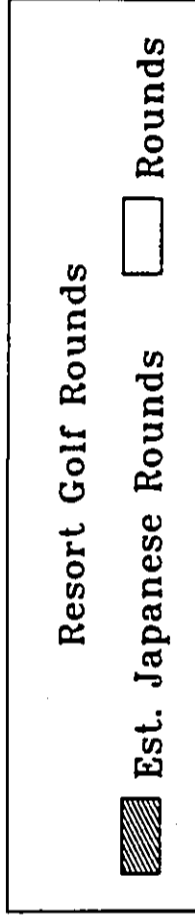
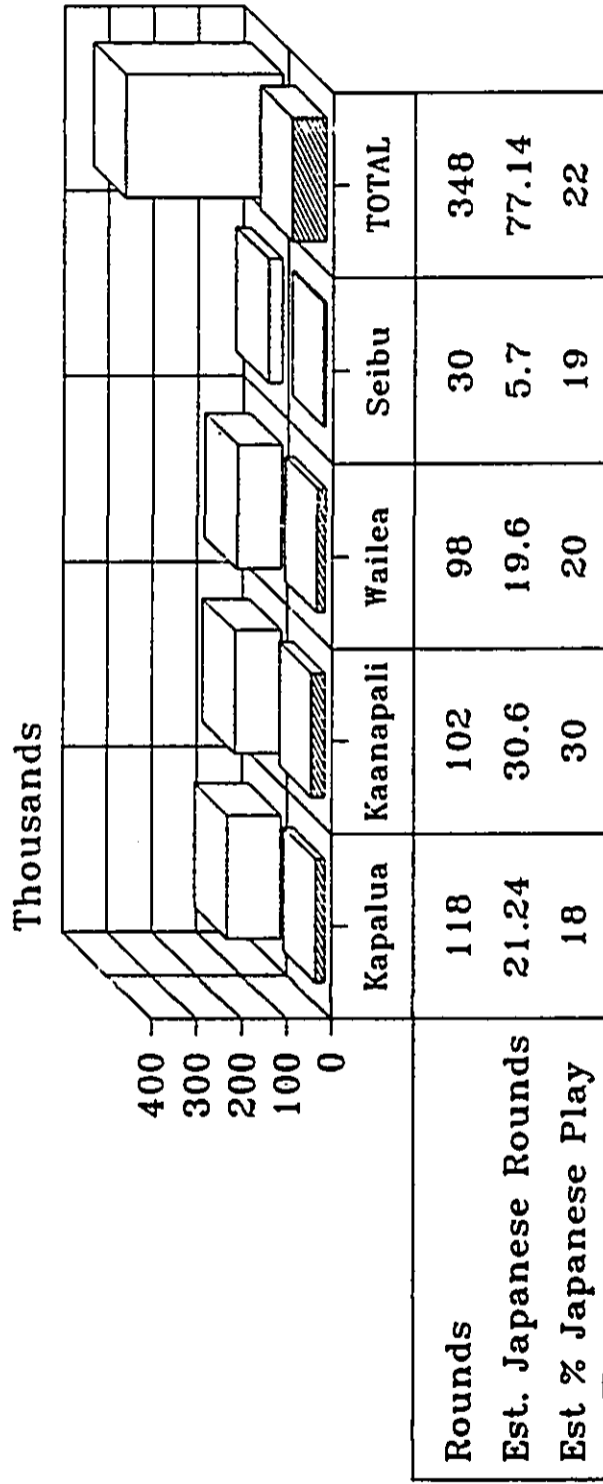
Beginning in the second quarter of 1988, the Hawaii Visitors Bureau added a question relating to golf participation in its regular surveys⁴ of Japanese visitors. For the three quarters ending in December 1988, the survey indicated that 12% of the Japanese visitors played golf.

² Hawaii Visitor's Bureau 1987 Annual Research Report. May 1988.

³ IBID.

⁴ Hawaii Visitor's Bureau 1988 Study of Japanese Visitors to Hawaii. April 1989.

Exhibit 12 Japanese Golf Demand Maui Island 1987



Estimated Number of Japanese Visitor Arrivals Maui 1987: 164,300
Est Rounds per Japanese Visitor: 0.47

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EXHIBIT 13

**Japanese Golf Demand
Maui Island 1987
Resort Golf Courses**

<u>Maui Resort Golf Courses</u>	<u>Rounds</u>	<u>Estimated Japanese Play (%)</u>	<u>Estimated Japanese Rounds</u>
Kapalua	118,000	18%	21,240
Kaanapali	102,000	30%	30,600
Wailea	98,000	20%	19,600
<u>Seibu</u>	<u>30,000</u>	<u>19%</u>	<u>5,700</u>
Total	<u>348,000</u>		<u>77,140</u>

Percent of Resort Rounds 22.2%

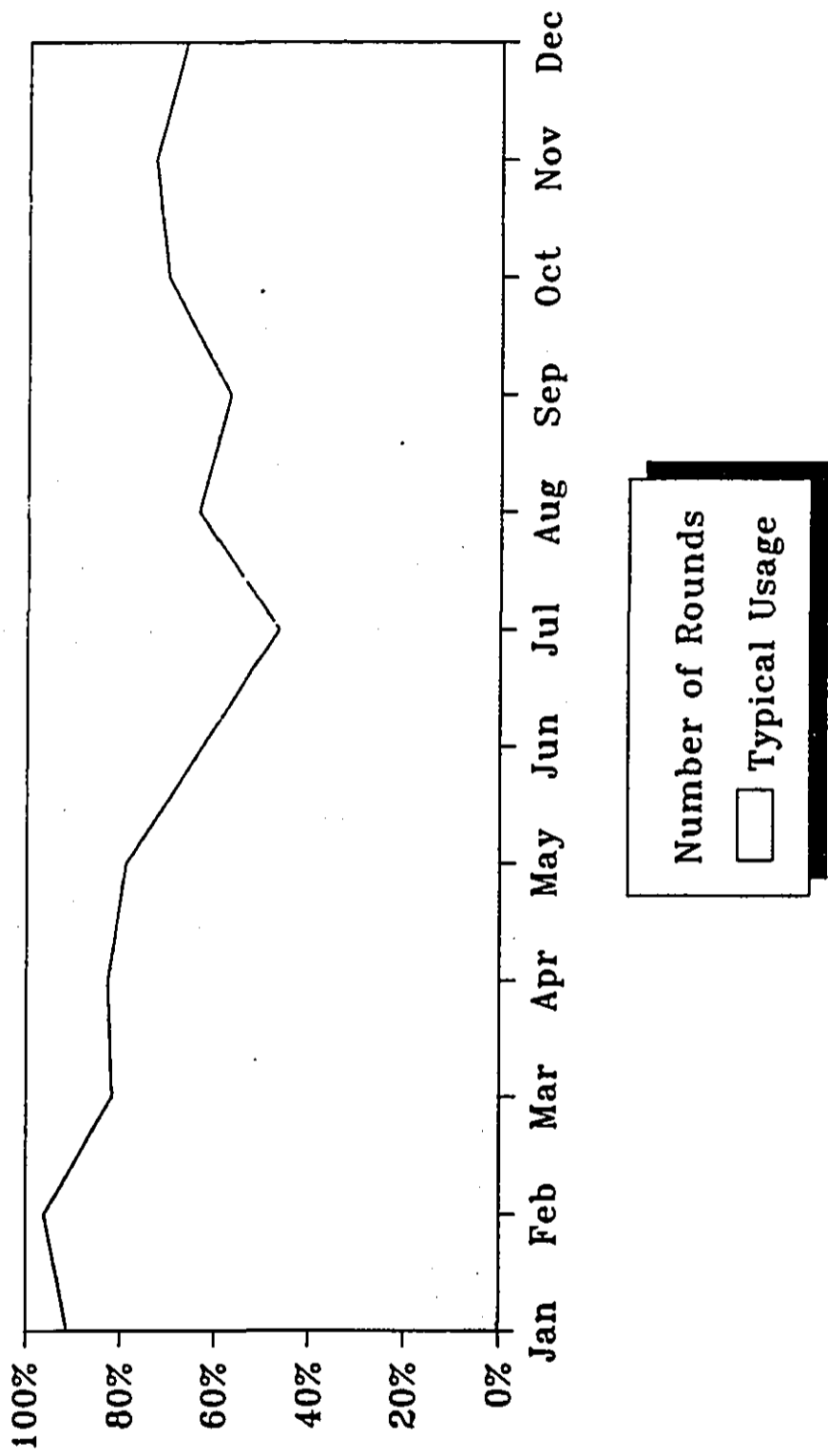
Estimated Number of Japanese Visitor
Arrivals Maui 1987: 164,300

Estimated Rounds per Japanese Visitor Arrival: .47

b. Seasonality of Resort Golf

Maintaining the quality of resort play has been stressed time and again by resort management and development executives. Review of desirable annual levels of play and desirable daily levels of play indicate a wide discrepancy between a desirable annual level of play versus the theoretical annual level of play at the stated desired daily level. The reason for this situation is that demand for resort golf is seasonal in nature (See *Exhibit 14*). In fact, it is not unusual at Hawaiian resort developments for January through March to account for in excess of 30% of total annual rounds played. Note: The percentage of rounds played during the high season understates the demand during that time due to the fact that many requests for starting times go unsatisfied during that period. This seasonality has been recognized by resort managers for many years. The competition for high season starting times at many resorts has led to the allocation of these starting times. Many courses have supplemented existing priority of reservation schedules with high and low season rates as well as pricing policies designed to give favorable treatment to guests of the complex. As the

Exhibit 14
Typical Utilization of Mature
Hawaiian Resort Golf Facilities



Source: John Zapotocky, Consultant

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marketing strategies have become more sophisticated for the high season times, low season times have been getting extra attention, benefitting local players with lower rates and more starting times. (Resort managers have become increasingly aware of the large number of starting times which go unused during the low season and have been attempting to attract both tourist and local play to tap this unused resource.

c. Number of Rounds Available Per Golf Course

Golf course capacity itself is the product of a number of physical and aesthetic considerations. Resort courses in Hawaii have in general limited play to between 175 and 215 rounds per day. At this level of play, golfers can enjoy the game at a leisurely pace with only a minimum of waiting and with minimum interaction with others playing on the course. Assuming an average of 200 rounds per day and 365 playing days per year, the capacity of resort courses should be at 73,000 rounds annually. Experience has shown that demand for golf from resort guests is strongest during the winter months. (*Exhibit 14*) In addition, demand for golf is also skewed in favor of morning times. Therefore, resort courses are generally operated below capacity during most of the year. A yearly average of 50,000 rounds per year is considered achievable and desirable by resort golf operators.

d. Range of Demand - Hawaiian Resorts

Exhibit 15 indicates the range of demand for selected Hawaiian Island resorts. Based on the information provided in *Exhibit 15*, rounds of golf generated by resort hotels per day ranges between .08 per room at Wailea and .4 at Mauna Kea. Resort condominiums provide between .07 and .11 rounds per day.

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EXHIBIT 15

**GOLF DEMAND FOR RESORT HOTEL AND RESORT RESIDENTIAL
DEVELOPMENT AT SELECTED DESTINATION RESORTS IN HAWAII**

	<u>ANNUAL ROUNDS PER HOTEL ROOM</u>	<u>ANNUAL ROUNDS PER RESORT RES. UNIT</u>
ISLAND OF HAWAII¹		
Mauna Kea Beach Hotel	145	
Mauna Lani Bay Hotel	70	
Mauna Lani Resort Res.		36
ISLAND OF MAUI²		
Wailea Development Company Hotels	30	
Resort Residential		39
ISLAND OF KAUAI³		
Princeville Development Company Hotels	125	
Resort Res. Owners		31
Resort Res Guests		19

1. Belt, Collins & Associates, *Final EIS Revised Master Plan for Mauna Lani Resort*, June 1985 and Updated Information from Mauna Lani Planning Staff.

2. Unpublished Information Wailea Development Co. Operating Plan Assumptions.

3. Princeville Development Co., *Projection of Golf Rounds at Princeville Due to Phases One and Two Development*, Land Use Commission Filing 1985.

NOTES:

HOTELS: Information presented above shows hotel generated rounds on a daily basis ranging from .4 rounds per room at Mauna Kea to .08 round per room at Wailea.

RESORT RESIDENTIAL: Information presented above shows resort residential units generating between .11 rounds per unit at Wailea and .07 rounds per unit at Princeville.

SOURCE: John Zapotocky, Consultant

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IV. GOLF DEMAND (ISLAND OF OAHU)

A. OAHU GOLF SURVEY (EXCLUDING MILITARY)

The rounds of golf played on Oahu's 19 non-military courses in 1988 were surveyed in March of 1989. The survey included private membership courses, resort courses, privately owned daily fee courses and municipal courses. The purpose of including all types of courses with the exception of military courses was to determine how much golf was played by non-military residents and visitors. Military courses were excluded, because in most cases, civilians are prohibited from obtaining starting times unless guests of military personnel, their dependents or retirees. To the extent that civilian play is actually occurring, the amount is offset by the number of rounds played by military, dependents and retirees on Oahu's resort, municipal, private and daily fee courses. The results of this survey showed that during 1988 approximately 1,500,000 rounds were played on Oahu's non military courses. Of the total approximately 1,240,000 rounds or 79% were played by residents and 270,000 rounds or 21% were played by visitors. (See Exhibit 16)

B. ESTIMATE OF NUMBER OF ROUNDS PLAYED PER VISITOR AND PER RESIDENT IN 1988.

Estimates for the non-military resident population and visitor population for 1988 were developed using the same methodology used in the Department of General Planning report "Golf Course Development on Oahu" dated July 1989. The estimates indicated that in 1988 1.81 rounds were played by the average resident and 3.58 rounds were played by the typical visitor. (See Exhibit 17) Note: The average rounds figure is based on average daily visitor population and not actual visitors.

C. ESTIMATE OF GOLF COURSE DEMAND THRU YEAR 2000

The consultant developed demand projections thru 2000 using estimated alternate rates of growth in the demand for golf of 0%, 2%, 5% and 10%. Resident and visitor population estimates developed by the State of Hawaii Department of Business and Economic Development in the "Population and Economic Projections for the State of Hawaii to 2010" (Series M-K) dated November 1988 serve as the base assumptions for the consultants projections. The increased rounds was divided by the average play on the Oahu golf courses surveyed to determine the future demand for golf courses on Oahu. The results of these calculations showed that the City and County of Honolulu would require the following number of new courses by year 2000 under the 0%, 2%, 5% and 10% growth scenarios: 2.5, 7.5, 17.8, and 44.1 respectively. (See Exhibits 18, 19, 20 and 21) Given the strong growth in demand for golf nationally and the expected growth in the percentage of Hawaii visitors from Japan a reasonable yet conservative estimate of the number of courses needed is expected to range within the 2% and 5% growth factors.

EXHIBIT 16

**Oahu Golf Courses (non-Military)
Total Rounds
Year 1988**

Course/Location	Type	YR Rounds Per Site #	Avg Rounds Per Week	Tourist Rounds-yr	Percent	Resident Rounds-yr	Percent
1 Ala Wai Golf Course	Public	188,000	3,615	7,187	4%	180,813	96%
2 Kahuku Golf Course *	Public	48,000	923	2,760	6%	45,240	94%
3 Pali Golf Course	Public	144,000	2,769	3,038	2%	140,962	98%
4 Ted Makalena G.C.	Public	165,000	3,173	307	0%	164,693	100%
5 Bay View Golf Center *	Daily Fee	12,000	231	0	0%	12,000	100%
6 Hawaii Kai Champ	Daily Fee	53,000	1,019	28,500	54%	24,500	46%
7 Hawaii Kai Exec	Daily Fee	53,000	1,019	28,500	54%	24,500	46%
8 Honolulu C.C.	Private	70,000	1,346	7,000	10%	63,000	90%
9 Mid-Pacific Country Club	Private	59,700	1,148	0	0%	59,700	100%
10 Mililani Golf Club	Daily Fee	94,000	1,808	42,300	45%	51,700	55%
11 Moanalua Golf Course (est) *	Semi-P ^	45,000	865	0	0%	45,000	100%
12 Oahu Country Club (1985)	Private	45,000	865	0	0%	45,000	100%
13 Olomana Golf Links	Daily Fee	94,000	1,808	5,640	6%	88,360	94%
14 Pearl Country Club	Daily Fee	80,000	1,538	8,000	10%	72,000	90%
15 Waialae Country Club	Private	80,000	1,538	0	0%	80,000	100%
16 Hawaii Country Club	Semi-P ^	83,000	1,596	16,600	20%	66,400	80%
17 Makaha Valley C.C.	Daily Fee	70,000	1,346	24,500	35%	45,500	65%
18 Sheraton Makaha Resort & C.C.	Resort	58,000	1,115	53,360	92%	4,640	8%
19 Turtle Bay Hilton & C.C.	Resort	65,000	1,250	42,250	65%	22,750	35%
OVERALL TOTAL		1,506,700	28,975	269,942		1,236,758	
OVERALL AVERAGE *		86,097	1,656	15,425	21%	70,672	79%

Notes:

- * City course data from "Proposed Golf Course Number 2," page 15 and from Cipro Golf Consultants
- * Nine Hole Courses Counted as Half Courses in Average Calculation
- * Hawaii Country Club (HCC) and Moanalua Golf Course (MGC) have some characteristics of private clubs. HCC has a limited number of members, but the course is open on a daily fee basis, MGC is open to the public on weekdays only.

EXHIBIT 17

Oahu Golf Courses
Visitor/Resident Rounds
Based on 1988 Rounds
Based on 1988 Visitor/Resident Estimates

Population Group	Total Population	Total # Rounds	Rounds per Group
Resident *	683,700	1,236,758	1.81
Visitors ^	75,300	269,942	3.58
Total		1,506,700	

Notes:

Non-military resident population excludes military personnel, dependents, retirees and their dependents.

* From "Golf Course Development on Oahu, City & County of Honolulu, 1989, page 18.

^ Extrapolated from data in Department of Business and Economic Development, "Population and Projections for the State of Hawaii to 2010", November 1988, pages 4, 18;

City course data from "Proposed Golf Course Number 2," page 15 and from Cipro Golf Consultants

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**Oahu Golf Courses
Estimated Demand 1990 - 2000
Residents/Visitors
Based on Forecast Visitor/Resident Populations
December 1989**

Year	Estimated Population #		Total Estimated Demand for Rounds [*]		Total Estimated Rounds	Estimated Increase in Rounds	Growth Need ^{**}	Cumm. Demand
	Resident	Visitor	Resident	Visitor				
1989	693,800	78,600	1,255,028	281,772	1,536,800			
1990	703,900	82,100	1,273,298	294,319	1,567,617	30,817	0.36	0.36
1991	713,660	83,540	1,290,953	299,481	1,590,435	22,817	0.27	0.62
1992	723,420	84,980	1,308,608	304,644	1,613,252	22,817	0.27	0.89
1993	733,180	86,420	1,326,263	309,806	1,636,069	22,817	0.27	1.15
1994	742,940	87,860	1,343,918	314,968	1,658,887	22,817	0.27	1.42
1995	752,900	89,300	1,361,935	320,130	1,682,066	23,179	0.27	1.69
1996	757,180	90,800	1,369,677	325,508	1,695,185	13,120	0.15	1.84
1997	761,660	92,300	1,377,781	330,885	1,708,666	13,481	0.16	2.00
1998	766,140	93,800	1,385,885	336,262	1,722,148	13,481	0.16	2.15
1999	770,820	95,300	1,393,989	341,640	1,735,629	13,481	0.16	2.31
2000	775,100	96,800	1,402,093	347,017	1,749,110	13,481	0.16	2.47

Notes:

Department of Business and Economic Development, Population and Economic Projections for the State of Hawaii to 2010, November 1988, pages 4, 18;

1989 Projection from "Golf Course Development on Oahu, City & County of Honolulu, 1989, page 18.

* Calculated by using the average rounds per individual times the estimated population of the group

** Calculated by taking the projected increase in rounds and dividing it by the average annual rounds played on courses on Oahu

EXHIBIT 19

**Oahu Golf Courses
Estimated Demand 1990 - 2000
Assuming 2% Annual Growth Factor
Residents/Visitors
Based on Forecast Visitor/Resident Populations
December 1989**

-----2%-----

Year	Estimated Population #		Average Rounds *		Total Estimated Rounds	Estimated Increase in Rounds	Growth Need **	Cumm. Demand
	Resident	Visitor	Resident	Visitor				
1989	693,800	78,600	1.85	3.66	1,567,536			
1990	703,900	82,100	1.88	3.73	1,630,949	63,413	0.74	0.74
1991	713,660	83,540	1.92	3.80	1,687,782	56,833	0.66	1.40
1992	723,420	84,980	1.96	3.88	1,746,236	58,454	0.68	2.08
1993	733,180	86,420	2.00	3.96	1,806,353	60,117	0.70	2.77
1994	742,940	87,860	2.04	4.04	1,868,176	61,823	0.72	3.49
1995	752,900	89,300	2.08	4.12	1,932,165	63,989	0.74	4.24
1996	757,180	90,800	2.12	4.20	1,986,180	54,015	0.63	4.86
1997	761,660	92,300	2.16	4.28	2,042,015	55,835	0.65	5.51
1998	766,140	93,800	2.21	4.37	2,099,288	57,274	0.67	6.18
1999	770,620	95,300	2.25	4.46	2,158,036	58,748	0.68	6.86
2000	775,100	96,800	2.29	4.55	2,218,295	60,258	0.70	7.56

Notes:

* Department of Business and Economic Development, Population and Economic

Projections for the State of Hawaii to 2010, November 1988, pages 4, 16;

1989 Projection from "Golf Course Development on Oahu, City & County of Honolulu, 1989, page 18.

** Calculated by using the average rounds per individual times the estimated population of the group

*** Calculated by taking the projected increase in rounds and dividing it by the average annual rounds played on courses on Oahu

Oahu Golf Courses
Estimated Demand 1990 - 2000
Assuming 5% Annual Growth Factor
Residents/Visitors
Based on Forecast Visitor/Resident Populations
December 1989

-----5%-----

Year	Estimated Population #		Average Rounds *		Total Estimated Rounds	Estimated Increase in Rounds	Growth Need **	Cumm. Demand
	Resident	Visitor	Resident	Visitor				
1989	693,800	78,600	1.90	3.76	1,613,640			
1990	703,900	82,100	1.99	3.95	1,728,298	114,658	1.33	1.33
1991	713,660	83,540	2.09	4.15	1,841,127	112,829	1.31	2.64
1992	723,420	84,980	2.20	4.36	1,960,918	119,791	1.39	4.03
1993	733,180	86,420	2.31	4.58	2,088,085	127,167	1.48	5.51
1994	742,940	87,860	2.42	4.80	2,223,067	134,982	1.57	7.08
1995	752,900	89,300	2.55	5.04	2,366,835	143,769	1.67	8.75
1996	757,180	90,800	2.67	5.30	2,504,560	137,725	1.60	10.35
1997	761,660	92,300	2.81	5.56	2,650,702	146,142	1.70	12.05
1998	766,140	93,800	2.95	5.84	2,805,197	154,495	1.79	13.84
1999	770,620	95,300	3.09	6.13	2,968,515	163,317	1.90	15.74
2000	775,100	96,800	3.25	6.44	3,141,151	172,636	2.01	17.74

Notes:

* Department of Business and Economic Development, Population and Economic

Projections for the State of Hawaii to 2010, November 1988, pages 4, 18;

1989 Projection from "Golf Course Development on Oahu, City & County of Honolulu, 1989, page 18.

** Calculated by using the average rounds per individual times the estimated population of the group

*** Calculated by taking the projected increase in rounds and dividing it by the average annual rounds played on courses on Oahu

EXHIBIT 21

Oahu Golf Courses
 Estimated Demand 1990 - 2000
 Assuming 10% Annual Growth Factor
 Residents/Visitors
 Based on Forecast Visitor/Resident Populations
 December 1989

-----10%-----

Year	Estimated Population #		Average Rounds ^		Total Estimated Rounds	Estimated Increase in Rounds	Growth Need ^^	Cumm. Demand
	Resident	Visitor	Resident	Visitor				
1989	693,800	78,600	1.99	3.94	1,690,480			
1990	703,900	82,100	2.19	4.34	1,896,817	206,337	2.40	2.40
1991	713,660	83,540	2.41	4.77	2,116,869	220,052	2.56	4.95
1992	723,420	84,980	2.65	5.25	2,361,962	245,094	2.85	7.80
1993	733,180	86,420	2.91	5.77	2,634,906	272,944	3.17	10.97
1994	742,940	87,860	3.20	6.35	2,933,819	303,913	3.53	14.50
1995	752,900	89,300	3.53	6.99	3,277,870	339,051	3.94	18.44
1996	757,180	90,800	3.88	7.68	3,633,780	355,910	4.13	22.57
1997	761,660	92,300	4.27	8.45	4,028,946	395,166	4.59	27.16
1998	766,140	93,800	4.69	9.30	4,466,808	437,862	5.09	32.25
1999	770,620	95,300	5.16	10.23	4,951,952	485,144	5.63	37.88
2000	775,100	96,800	5.68	11.25	5,489,457	537,505	6.24	44.12

Notes:

Department of Business and Economic Development, Population and Economic

Projections for the State of Hawaii to 2010, November 1988, pages 4, 18;

1989 Projection from "Golf Course Development on Oahu, City & County of Honolulu, 1989, page 18.

^ Calculated by using the average rounds per individual times the estimated population of the group

^^ Calculated by taking the projected increase in rounds and dividing it by the average annual rounds played on courses on Oahu

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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D. EXISTING SHORTFALL OF GOLF COURSE ON OAHU

A number of factors argue strongly that there is an existing shortfall of golf facilities on Oahu including the following: 1) Existing golf courses operating at maximum capacity; 2) Escalating greens fees; 3) Institution of a telephone lottery system for allocating golf rounds at municipal courses; 4) Much higher levels of play by both residents and visitors in Maui county, the State's second largest visitor market; 5) The flurry of activity among land owners and developers to develop new golf course properties, and 6) Extrapolation of past trends.

1. Courses Operating at Capacity

Most of the golf courses on Oahu are operating at or near capacity. While there is a large variance in rounds played at various courses, it is primarily due to the type of golf course (9, 18 hole, municipal, resort, private) and the level of service and golfing enjoyment each attempts to provide.

2. Escalating Green Fees

While the recent doubling of fees at municipal courses cannot be attributed exclusively to the shortage of courses, the fact that it was accomplished with a minimal decline in play is some indication of the level of demand. In addition, the daily fee and resort courses have seen escalating revenues in recent years as a result of increased green fees and the institution of tiered pricing policies where visitors are charged higher prices than residents.

3. Municipal Telephone Lottery

The city instituted a system under which calls for starting times were picked randomly by computer. This system was instituted due to the percentage of golfers complaining about the difficulty in getting starting times. An analysis of the system, *Playing Favorites: An Analysis of the Dial-a-Time Telephone Reservations System for Honolulu's Municipal Golf Courses*, November 1989, indicated that on the average Oahu's three 18 hole municipal courses receive approximately 38,000 calls daily for approximately 1,300 available times. Note: since the calls are randomly selected by computer, it is estimated that most of these calls are multiple calls, however, it is considered one indication of excess demand whenever an allocation system must be implemented.

4. Comparison with Maui Play

The consultant conducted a study of the golf play on the Island of Maui. The results of that study indicated that the average individual in the visitor population played 12.06 rounds while the resident played 2.79 rounds in 1989. (See *Appendix 1*) Thus, the typical Maui visitor played 3.3 times and resident played 1.5 times more golf than Oahu visitors and residents, respectively. Given that the green fee structure is somewhat compatible between the two counties, the most plausible

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explanation for this tremendous differential in play is the supply of golf facilities. *Figure 2* shows a shortfall depending on the assumption of 16 to 20 courses.

Figure 2

	Oahu Non-Military Population ¹ 1989	Rounds/ Person Maui ² 1989	Total Demand	Oahu ³ Average Course Rounds	Maui ⁴ Average Course Rounds
Resort	683,700	2.79	1,907,523		
Visitor	75,300	12.06	<u>908,114</u>		
Total Demand			2,815,641		
Existing Average Play for 18-Hole Courses				86,097	57,312
Demand for Golf Courses				32.7	49.1
Existing Courses (18-Hole Equivalent)				<u>17</u>	<u>17</u>
Shortfall				<u>15.7</u>	<u>32</u>

1 - Exhibit 17
2 - Appendix I
3 - Exhibit 16

5. Proposed New Golf Facilities

Appendix 2 shows the golf courses currently proposed or mentioned as possible sites for golf facilities. The fact that so much interest exists is testimony to the existing shortfall of these types of facilities.

6. Extrapolation of Past Trends

The consultant projected golf course demand based on the relation between population and golf holes between 1950 and 1980. (See *Appendix 2-A*). Based on this projection, 597 golf holes would be required by 1990 against an existing inventory of 459 holes leaving a shortfall of 138 holes or 7.6 18 hole courses.

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7. Summary

The above mentioned factors offer strong evidence that there is currently an existing shortfall in golf facilities on Oahu. The consultant has used two methods to determine the existing shortfall of courses. Assuming the trend in past relationships between population and golf holes continue the shortfall is 8 courses. Assuming, lack of supply, prevents Oahu visitors and residents from playing at the same rate as Maui residents and visitors would indicate on existing shortfall of sixteen (16) 18-hole courses.

Thus the range of the existing shortfall estimated by the consultant is 8 to 16 18-hole golf courses.

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Country Courses at Kahuku Malaekahana Area*

V. FUTURE SUPPLY OF GOLF COURSES ON OAHU

Municipal courses on Oahu are some of the busiest in the country and the world. (See Exhibit 22) Public pressure has been increasing to construct new municipal courses and several alternative sites are under consideration. There is strong interest in development of private courses with over forty courses under consideration by various developers. Others may be under consideration that have not been announced. (See Appendix 2)

While the potential supply of 44 new courses looks overwhelming in light of the number of existing courses it must be viewed in terms of the likelihood of development and the long term demand for golf on Oahu.

A number of factors suggest that not all of the courses will be built, including: unsuitable infrastructure, including water availability and access; incompatibility with surrounding uses: incompatibility with city and state use guidelines; and the inability to obtain the necessary financing.

In the opinion of the consultant, less than half of the proposed courses will be developed prior to the year 2000.

EXHIBIT 22

**CITY & COUNTY OF HONOLULU
MUNICIPAL GOLF COURSES
FY 1986, FY 1987 and FY 1988**

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Ala Wai	197,000	198,000	188,000 ¹
Pali	144,000	140,000 ²	144,000
Makalena	155,000	165,000	165,000
Kahuku	<u>38,000</u>	<u>42,000</u>	<u>48,000</u>
TOTAL	534,000	545,000	545,000

¹ - Ala Wai Course undergoing major renovation in FY 1988 and FY 1989.
² - Increased rainouts experienced in 1987.

NOTES:

The City has started construction of a new municipal golf course in the West Loch area. The first full year of operation for this course is estimated to be Fiscal Year 1990 if no snags develop during the construction phase of the project. The City's golf administrator believes that a total of eight municipal golf courses would be needed to accommodate the current level of demand at municipal golf courses.

According to the *Golf Course Operating Survey* June 1986, prepared jointly by the National Golf Foundation and the Professional Golfing Association of America, average total rounds for municipal golf courses in the United States were 50,000 on 18-hole courses and 18,000 on 9-hole courses.

SOURCE: Dave Mills, Golf Administrator, City & County of Honolulu

*Market Assessment For
Country Courses at Kahuku Malaekahana Area*

VI. GOLF DEMAND FOR THE COUNTRY COURSES AT KAHUKU

A. RESIDENTIAL

The Koolauloa and North Shore development plan areas are expected to be the primary market area for the "Country Courses at Kahuku" golf development. However, the bulk of this demand is expected to come from the development of the Kuilima Resort area. Residential population targets set in the Koolauloa and North Shore development plan areas by the City and County of Honolulu's adopted general plan have been reduced in order to preserve the rural character of the areas.

The Koolauloa and North Shore development plan areas currently contain approximately 3% of Oahu's population and 5% of Oahu's golf facilities. There are currently two golf courses located within the North Shore and Koolauloa development plan areas, the Turtle Bay Resort and Country Club course (a resort course) and the Kahuku Golf Course, (a nine hole municipal facility). Play at the Turtle Bay course is 75% tourists and 25% resident play. The bulk of the tourist play at the Turtle Bay course consists of groups and individuals staying within the Waikiki tourist complex although the existing hotel and condominium facilities provide between 25% and 30% of the play. In fiscal 1989, 93% of the play at the Kahuku Municipal course was local residents. While records of the residence location (by development plan area) are not kept, a significant amount of the play at the course is from residents outside the Koolauloa and North Shore DP areas. Patronage at the Kahuku Course has increased dramatically during the past 4 years from 38,000 rounds in 1985 to over 59,000 rounds in 1989. One factor in this 50% growth has been the fact that the city's other municipal courses are at maximum capacity and therefore Kahuku is benefiting from the excess demand at the other municipal courses. However, the large number of rounds being played by golf clubs at the existing Kahuku and Turtle Bay courses indicated an islandwide demand by residents for golf at the Kahuku location.

The resident population growth in the Koolauloa and North Shore area is expected to keep pace with the population growth for the island as a whole. General Plan population targets for the Koolauloa and North Shore areas suggest that the population percentages for the two areas will continue at close to 3% through the year 2010. Thus the consultant believes that increased residential demand will increase at the same rate as the growth in population and golf demand on Oahu in general.

B. RESORT

The concept of the "Country Courses at Kahuku" is to utilize the projected resort capacity of the Kuilima development as the primary demand for the golf supply being created in the area. The "Country Courses at Kahuku," and the courses being developed in conjunction with the Kuilima resort, will allow the Kuilima resort to become known as the golf resort in Hawaii.

Market Assessment For Country Courses at Kahuku Malaekahana Area

Probably the best example of the golf centered resort concept is the Pinehurst Hotel in Moore County, North Carolina which has seven golf courses as part of its facilities. The hotel, which consists of 445 resort units including 220 hotel rooms and 225 condominium units, operated as resort units, is known nationally and internationally as a golf mecca. Telephone interviews with marketing and operating personnel of the Pinehurst Hotel suggest that well over 80% of the guests staying at the hotel play golf.

The Pinehurst golf complex consists of 2 championship and 5 resort courses. The range of difficulty as well as the range of fees vary widely in order to attract a wide spectrum of golfers. Thus golfers from beginners to pros and with income levels demanding budget golf to luxury golf are accommodated.

Following this concept other golf course development proposed in the North Shore and Koolauloa areas would be supportive of and add to the potential success of the proposed resort golf complex by building the concentration of golf courses in the area and therefore increasing the area's attractiveness to golfers.

The Pinehurst Hotel was the catalyst and continues to be the heart of a resort community of 60,000 people which supports 30 golf courses within a 15 mile radius with 8 more courses planned or under construction. While there are other resort related activities available in the Pinehurst area, there is a sufficient mass of golf courses in the Pinehurst area that they are the primary draw.

There are a number of golf oriented resorts across the United States. A survey of characteristics of selected golf based resorts is contained in *Exhibit 23*. In each of the resorts surveyed, golf is the primary attraction of the resort with at least 50% of resort guest participating in golf. As can be seen from *Exhibit 23* each of the resorts surveyed provided the following:

- A variety of golf experiences as well as enough golf courses to insure the availability of starting times for their guests.
- The availability of instructional schools
- Conference rooms to attract the business golfer.
- Tournaments to enhance prestige as well as generate publicity for the facilities.
- In three out of the four resorts surveyed a wide range of fees to accommodate the disposable income of a wide range of golfers.
- Incorporated tennis facilities to provide variety for the golfer as well as for non-golf but sports oriented companion.

The Kuilima Resort expansion, which is now underway with the start of construction of the second Kuilima golf course scheduled for January of 1990 can generate the demand for a Pinehurst like resort. An important

**Market Assessment For
Country Courses at Kahuku Malaekahana Area**

consideration in the demand for golf is whether the golf amenity at the resort is heavily promoted and in sufficient supply to accommodate the potential resort populations. A resort which is promoted as a golf resort is likely to be much more attractive to golfers than a resort which happens to have a golf amenity too.

The base information contained in *Exhibit 15* indicates that Hawaiian resort hotels generate from .08 golf rounds per hotel room per day at Wailea to .4 golf rounds per hotel room per day at Mauna Kea. In addition, resort condominiums units generate golf rounds ranging from .07 rounds per unit per day at Princeville to .11 rounds per unit per day at Wailea. Assuming that the mid point of these ranges is applied to the existing and projected units at the Kuilima resort development, resort hotel units could be expected to generate .24 rounds per unit per day while resort condominium units would generate .09 rounds of golf per unit per day. These relationships would be achieved over time as the existing mix of play and golf facility availability would not permit such relationships to occur.

Exhibits 24, 25, and 26 indicate the absorption of the four golf facilities proposed in the "Country Courses at Kahuku" development over a five year period beginning in 1994 and ending in 1998. No provision has been made for a lag in demand due to the need to achieve stabilized occupancy rates. Even during the initial startup period, hotel and resort wide occupancies of 100% can be achieved for short periods particularly during the peak tourist seasons. If golf facilities were scheduled to be available once stabilized occupancies were expected there is a strong possibility that the resort would be unable to fulfill the golf expectations of visitors at a time when the ability to perform is most crucial.

As indicated in the exhibits, courses planned and programmed by the Kuilima Resort Company, developer of the Kuilima Resort, as well as the existing Kahuku municipal golf course have been incorporated into the estimates.

COUNTRY COURSES AT KAHUKU

Characteristics of Selected U.S. Golf Resorts
December 1989

	The Lodge at Pebble Beach	The Boulders	La Quinta Hotel Golf and Tennis Resort	Pinehurst Hotel and Country Club
Location:	Pebble Beach, California	Carefree, Arizona	La Quinta, California	Pinehurst, N.C.
Resort Market:	Monterey-Carmel-Pebble Beach	Phoenix-Scottsdale	Palm Springs	South East North Carolina
Visitor Units:	391	135 ***	269 - 1,500 more planned	220 Hotel - 445 total includes condos, villas
Golf Residentail Lots in project:	Yes	Yes	Yes	Yes
Accommodations:	Luxury	Luxury	First Class/Luxury	Luxury
Associated Golf Holes:	90	27	54	126
Course Type:	3 tournament, 2 resort	3 nine-hole resort	2 resort, 1 club	2 championship, 5 resort
Charge for 18 Holes:	\$35-145 **	\$50-75 ^	\$60 ^	\$35-100
Golf Tournaments:	Annual	Yes	Yes	Yes
Instructional Schools:	Yes	No	Yes	Yes
Other Facilities:	Full-service hotel Tennis (21 courts) Conferences (18 rooms)	Full-service hotel Tennis (6 courts) Conferences (6 rooms)	Full-service hotel Tennis (30 courts, Stadium) Conferences (12 rooms) Convention Center	Full-service hotel Tennis (28 courts) Conferences (7 rooms)

^ Includes cart rental and other charges.

** Cart rental additional.

*** Includes 15 golf frontage residences managed by hotel.

SOURCE: John Zapotocky, Consultant, based on telephone interviews conducted in December 1989.

EXHIBIT 24

**Country Courses at Kahuku
Estimated Demand
1990 - 2000**

Year	Hotel Rooms	Potential (1)		Potential (2)		Existing(3) Non Project Resident/ Visitor	Total Golf Demand
		Potential Rounds 24.00%	Potential Rounds 9.00%	Condos	Rounds		
1990	486	58 (4)	33	368	33	296	388
1991	486	58 (4)	33	368	33	308	399
1992	1,549	186 (4)	33	368	33	316	535
1993	1,549	186 (4)	33	368	33	328	547
1994	1,549	372	33	368	33	336	741
1995	1,549	372	51	568	51	350	773
1996	2,585	620	69	768	69	362	1,051
1997	2,585	620	87	968	87	370	1,078
1998	2,585	620	105	1,168	105	382	1,107
1999	2,585	620	123	1,368	123	393	1,137
2000	3,000	720	123	1,368	123	405	1,248

(1) Comparable to ratio of golf rounds to hotel rooms upper end Hawaii resort hotels.

(2) Estimated average rounds per Hawaii resort condominium John Zapolocky, Consultant

(3) Existing non project rounds @ Kulima and Kahuku Municipal Golf Course

EXHIBIT 25

**Country Courses at Kahuku
Estimated Supply of Golf Rounds
1990 - 2000**

Year	Existing(1) Kahuku Municipal	Kuilima Resort		Country Courses at Kahuku			Grand Total Supply
		Existing	Course 2 Malaekahana	#1	#2 Punamano	#3 Malaekahana	
1990	190	180					370
1991	180		180				370
1992	190	150	150				490
1993	180	150	150				490
1994	190	150	150			140	745
1995	190	150	150			140	745
1996	180	150	150	140	140	140	1025
1997	190	150	150	140	140	140	1025
1998	190	150	150	140	140	140	1165
1999	180	150	150	140	140	140	1165
2000	190	150	150	140	140	140	1165

(1) Assumes Kahuku Course maximum play at 85% equivalent rounds of 18 hole muni. course

(2) KPMG Peat Marwick "Market Assessment Country Courses at Kahuku" February 1989

Note: KPMG study prepared for Kuilima Resort Company owner developer Kuilima Courses.

(3) Consultant Estimate desirable level play on resort courses 50,000 rounds annually



EXHIBIT 26

Country Courses at Kahuku
 Comparison Estimated Supply and Demand
 1990 - 2000

Year	Total Golf Demand	Grand Total Supply	(Shortfall) Excess
1990	388	370	(18)
1991	399	370	(29)
1992	535	490	(45)
1993	547	490	(57)
1994	741	745	4
1995	773	745	(28)
1996	1,051	1,025	(26)
1997	1,078	1,025	(53)
1998	1,107	1,165	58
1999	1,137	1,165	28
2000	1,248	1,165	(83)

*Market Assessment For
Country Courses at Kahuku Malaekahana Area*

**VII. ADVANTAGES OF IMPLEMENTING THE
"PROPOSED COUNTRY COURSES AT KAHUKU" —
MARKETING/OPERATIONAL**

A. SYNERGY OF GOLF COURSE CONCENTRATION

Development of the "Country Courses at Kahuku" golf complex will result in an acceleration of demand for golf facilities. Throughout this report, numerous references are made to the existing relationships between golf play and resort development. However, development of the "Country Courses at Kahuku" will result in a totally new relationship between and among resort development and resort golf development. Numerous examples can be cited of development itself creating demand. Local examples include: the development of Ala Moana Shopping Center; development of the James Campbell Industrial Park; and the development of the Hilton Hawaiian Village. In each case prior to the development of the actual facilities no market for their products and services existed or could have been demonstrated. However, the creation of these developments, led to changes in past patterns and practices, which redefined and increased the demand. In a similar manner development of the "Country Courses at Kahuku" are expected to result in an increase in demand as follows:

1. Availability

Golf availability for guests of the Kuilima Resort will exceed that of any existing or planned resorts in Hawaii.

2. Variety

Golf variety of eight courses: the existing Turtle Bay course and two others planned by the Kuilima Resort Company; the four proposed; and the existing municipal course will provide Kuilima guests with a range of playing options unmatched anywhere in Hawaii.

3. Accessibility

The availability and variety described above will be achieved within a ten minute drive of the resort.

4. Versatility

a. Tournaments

The concentration of golf facilities at the Kuilima Resort would allow professional golf tournaments, i.e., the Tournament Players Association (TPA), the Ladies Professional Golfers Association (LPGA) and the Seniors to be held with little or no negative impacts on resort golfing activities.

Market Assessment For Country Courses at Kahuku Malaekahana Area

Many Hawaii based resort developments including the Turtle Bay Resort and Country Club at Kuilima have hosted various professional golf tournaments, however, in the past, this has come at a very high price to the resort. Golfing activities for resort guests have all but been eliminated for two weeks where a single course is involved, as the various activities, i.e., pro-am's, practice rounds, as well as the actual tournament preempt use of the course by non-tournament guests. In addition, maintenance requirements, i.e., increasing the areas of roughs as well as the toughening of the playing conditions in general, impede the ordinary relaxed conditions typically found on resort courses.

Ordinary play is further disrupted both before and after the tournaments as construction of communications facilities, camera towers, and providing power at appropriate locations throughout the course, result in areas being disturbed or placed out of play. Additional damage to the course usually results from spectators attending the tournament.

With eight courses in the immediate vicinity the use of a single course for tournament purposes would have only a minimal impact on golf availability.

In addition, private groups sponsoring tournaments in conjunction with conventions or other activities would have much easier access to playing facilities with less impact on other resort guests.

b. **Maintenance**

Golf courses periodically undergo major maintenance or renovation. Most resort operators are reluctant to close down a course for these events due to the impact on resort guests. Thus, renovations and maintenance have been done on a piecemeal basis, often with long term disruption of the golf experience in order to remain open while work is done.

Concentration of the golf facilities in the Kuilima area will result in maintenance decisions being made which minimize the impact on the resort golfer. This would allow renovations and maintenance to be undertaken in the most economic manner, consistent with maintaining the golfing experience at all times.

*Market Assessment For
Country Courses at Kahuku Malaekahana Area*

**VIII. COMPATIBILITY WITH EXISTING AND PLANNED USES AND
CONDITIONS**

The "Country Courses at Kahuku" - Malaekahana are compatible with existing and planned uses in the area. As discussed earlier in the text, existing and planned uses include agricultural development and another golf course. Golf courses and these current and planned uses coexist at numerous locations on Oahu and throughout the Hawaiian Islands. No negative impacts on golf course marketability are expected from any of the existing or proposed uses.

The Kahuku area is known for windy conditions. However, given the existing levels of play at the Kahuku Municipal and the Turtle Bay courses this factor has not been an impediment to marketing golf times in the past. Further, golf course designers can mitigate wind impact on golf play by design and landscape features.

*Market Assessment For
Country Courses at Kahuku Malaekahana Area*

IX. EMPLOYMENT

Appendix 3 estimates employment at each golf course at 50 persons. Thus the golf course at Malaekahana is expected to employ approximately 50 persons. While this number of employees tends to be at the lower end of the employment spectrum for resort courses, the nearby Kuilima Resort is expected to provide much of the support activities normally associated with stand alone golf facilities including major eating facilities, conference rooms and meeting facilities, and alternate recreation facilities such as tennis. In addition there is the possibility of economies of scale in the operations, particularly in the administrative areas. Centralized accounting, management and reservations systems would minimize administrative and clerical jobs.

*Market Assessment For
Country Courses at Kahuku Malaekahana Area*

X. SUMMARY

The proposed "Country Courses at Kahuku" — Malaekahana will have a number of advantages, from a marketing standpoint, over other golf courses proposed in the North Shore and Koolauloa Development Plan areas.

1. By virtue of its location, less than a ten minute drive east of the entrance to the Kuilima resort, the Malaekahana Course has better access to resort guests at the Kuilima Development than any other existing or proposed golf course save the two located within the Kuilima Resort proper and the Punamano Courses at the complex.
2. The size of the Malaekahana site and its dedication to strictly golf activities, will allow the golf courses designer to maximize the recreational golf aspects of the site.
3. The site possesses natural beauty and at various locations within the site excellent views will add to the enjoyment of the basic recreational golf experience.
4. The existing Turtle Bay and Kahuku Courses are already attracting in excess 100,000 (non-Kuilima Complex) golf rounds annually and the North Shore and Koolauloa areas are already known for their recreational amenities, including: major beach parks; major visitor attractions, i.e., Polynesian Cultural Center and Waimea Falls Park; ocean recreation, including surfing and boating (Haleiwa Harbor); and equestrian activities including polo at Mokuleia and other activities along the entire coast.
5. Will build on the strength of the existing Turtle Bay Resort in attracting golf business while at the same time attracting golfers to the resort.

The proposed Country Courses at Kahuku will help to satisfy the growing demand for golf of Oahu's visitor and resident populations. The development will help to preserve the long term viability of Hawaii's and Oahu's resort industry. At the same time the Country Courses at Kahuku will foster the development of a niche market (golfing visitors) which will be beneficial for the Hawaiian visitor industry as well as for the approved Kuilima Resort Development.

APPENDIX 1

Maui County Golf Courses ** Visitor/Resident Rounds Based on 1989 Rounds Based on 1989 Visitor/Resident Estimates

POPULATION GROUP	TOTAL POPULATION	TOTAL ROUND ^	ROUNDS PER GROUP
Resident *	89,900	250,423	2.79
Visitor #	33,890	408,668	12.06
TOTAL		659,091	

NOTES:

- * DBED "Population and Economic Projections State of Hawaii to 2010 (Series M-K)" Nov. 88 p. 4
- # DBED "Population and Economic Projections State of Hawaii to 2010 (Series M-K)" Nov. 88 p. 18
- ^ Data for 1989 rounds as per Cipro Golf Consultants
- ** Does not include Molokai (Del Monte) or Lanai (Castle & Cooke) courses

Average Rounds/Course

TOTAL ROUNDS	NUMBER OF COURSES^^	AVERAGE PER ROUNDS
659,091	11.5	57,312

^^ Eighteen Hole Equivalent

Source: John Zapotocky, Consultant

Appendix 2

Planned or Proposed Golf Courses: City & County of Honolulu

STATUS, GOLF COURSE (DEVELOPER)	HOLES	DISTRICT	DP AREA
Under Construction			
Ko'Olina (West Beach Estates)	18	Ewa	Waianae
West Loch (City & County of Honolulu)	18	Ewa	Waianae
Minami (Minami Corp.)	18	Windward	Koolau Poko
Close to Construction			
Myers/Seibu Golf Course (Myers Corp.)	27	Ewa	Waianae
Royal Hawaiian Country Club #1 (Y Y Valley Corp.)	18	Windward	Koolau Poko
Puuloa (H. Horita Realty, Puuloa Homes Inc.)	18	Ewa	Waianae
Turtle Bay Expansion (Kulima Development Co.)	18	Kahuku	Koolau Loa
Waikele (Amfac Properties)	18	Waipahu	Central Oahu
Needs Some Additional Discretionary Approval			
Kapolei			
(State of Hawaii Housing Authority)	18	Ewa	Waianae
Makakilo (Finance Realty)	18	Ewa	Waianae
Royal Kunia #1 (Halekua Development Co.)	18	Ewa	Central Oahu
Royal Hawaiian Country Club #2 (Y Y Valley Corp.)	18	Windward	Koolau Poko
Kipapa Ridge Estates (City & County of Honolulu)	9	Ewa	Central Oahu
Needs Substantial Discretionary Approval, Under Review			
Ewa Gentry (Gentry Pacific Corp)	18	Ewa	Waianae
Ko'Olina #2 (West Beach Estates)	18	Ewa	Waianae
Ko'Olina #3 (West Beach Estates)	18	Ewa	Waianae
Royal Kunia #2 (Halekua Development Co.)	18	Ewa	Central Oahu
Waikane (Waikane Development Co.)	27	Windward	Koolau Poko
Kailua Drive-In (Windward Development Co)	18	Windward	Koolau Poko
Lihl Lani Recreational Community (Ohbayashi Hawaii Corp)	36	North Shore	North Shore
Punamano (Campbell Estate)	54	Kahuku	Koolau Loa
Malaekahana (Campbell Estate)	18	Kahuku	Koolau Loa
Ewa Marina (HASEKO Hawaii)	27	Ewa	Waianae
Waihee Valley (City & County of Honolulu)	18	Windward	Koolau Poko
Waiawa (Gentry Companies)	36	Ewa	Central Oahu

Appendix 2

Planned or Proposed Golf Courses: City & County of Honolulu

STATUS, GOLF COURSE (DEVELOPER)	HOLES	DISTRICT	DP AREA
No Official Submittals			
Ohikilolo (Alpha Kai)	18	Waianae	Waianae
Lualuale (Sanjiro Nakode)	18	Waianae	Waianae
Haleiwa (SDZ Land Co.)	9	Waialua	North Shore
Kahuku (City & County of Honolulu)	18	Kahuku	Koolau Loa
Waikane (Undetermined)	18	Windward	Koolau Poko
Heeia (Undetermined)	18	Windward	Koolau Poko
Heeia Kea (Nanatome Hawaii, Inc.)	18	Windward	Koolau Poko
Bay View Expansion (Pacific Atlas Hawaii)	18	Windward	Koolau Poko
Malaekahana (Asahi Jyuken)	18	Kahuku	Koolau Loa
Application Denied or Withdrawn			
Mali Kai (Kaiser Cement Co)	18	Waianae	Waianae
Waianae Kai (H. Horita Investment Inc)	27	Waianae	Waianae
Mokuleia (Mokuleia Land Co.)	36	Waialua	North Shore
Waialua (Oceanic Properties, Inc)	18	Waialua	North Shore

SOURCE: Decision Analysts Hawaii, Inc.
December 1989

APPENDIX 2-A

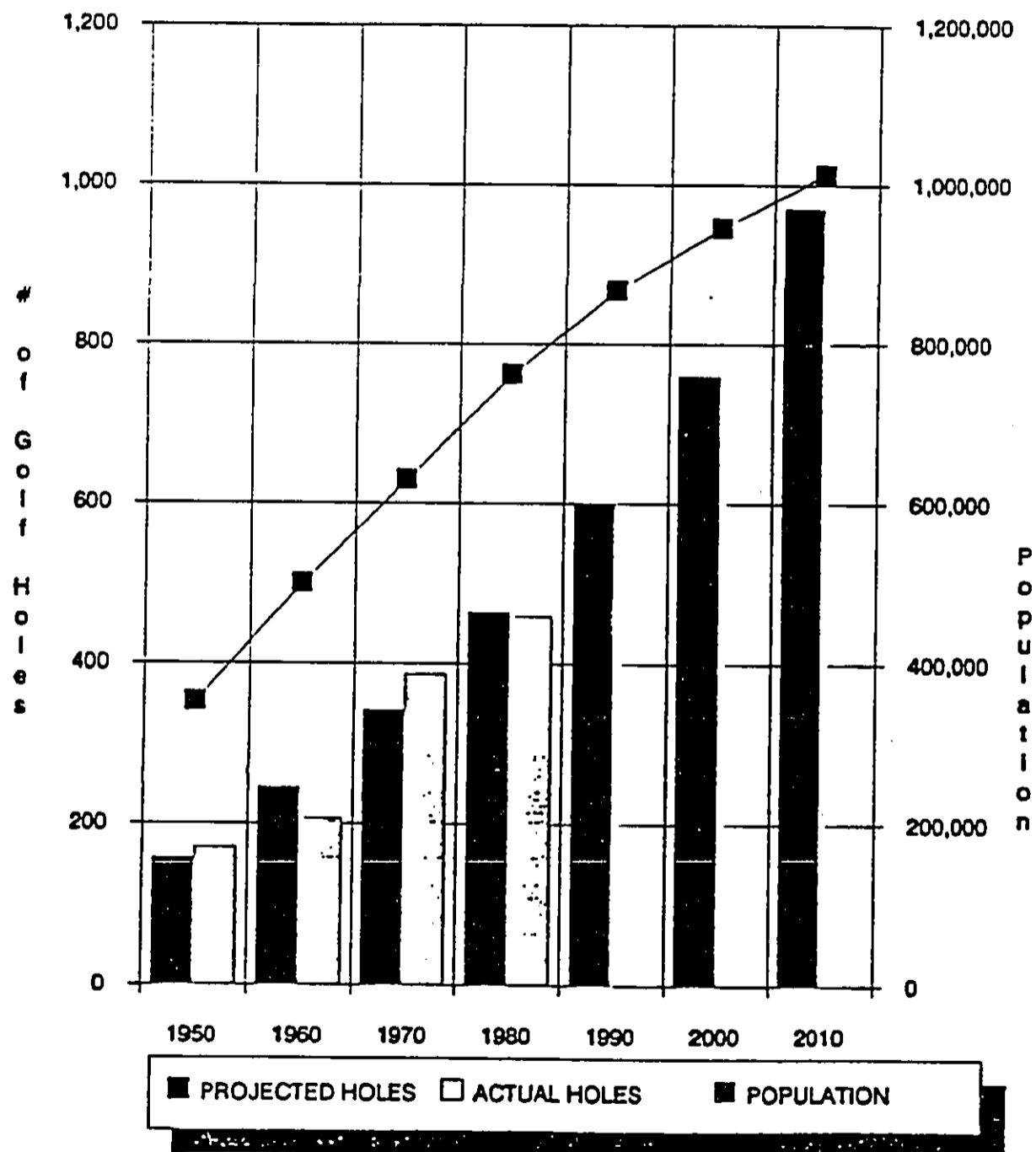
Oahu Golf Demand Projections
Based on Population and Golf Holes
1950-1980

Source: *Market Assessment for Waiola*
John Zapotocky, Consultant
March 1989

NUMBER OF PERSONS PER HOLE
Using a Linear Regression Analysis
And Projection

YEAR	PERSONS PER HOLE		GOLF HOLES		POPULATION
	ACTUAL	PROJECTED	PROJECTED	ACTUAL	
1950	2,064	2,243	157	171	353,020
1960	2,417	2,043	245	207	500,409
1970	1,629	1,843	342	387	630,528
1980	1,661	1,644	464	459	762,565
1990		1,444	597		861,600
2000		1,244	750		932,800
2010		1,044	957		999,500

Golf Holes on Oahu Projections Based On Persons Per Hole



APPENDIX 3

Golf Course Employment

Golf course employment has been estimated by the consultant to be fifty persons. The following is a general breakdown of the golf course employment and is assumes a *minimum level of staffing as follows:*

Maintenance crew of fifteen including a superintendent, an assistant superintendent, two mechanics and eleven maintenance workers.

Pro Shop staff of fifteen including a golf pro, two assistant pros, cart mechanics, cashiers/starters, cart washers, marshals, janitors and an accounting clerk.

Snack Bar/Restaurant staff of twenty people.

Resort golf courses providing a high level of service often range between forty and fifty persons exclusive of food operations.

As the "Country Courses at Kahuku" proposes to provide a range of golfing experiences and is expected to include both high maintenance resort courses as well as lower maintenance golf facilities, and the fact that if the facilities are under single ownership some economics of scale could be achieved, the consultant has opted to retain the conservative estimate of 50 persons per course.

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JOHN ZAPOTOCKY, CONSULTANT, Honolulu, Hawaii 1985 - Present

Principal. Independent consultant specializing in real estate related assignments. Services provided include financial analysis, market assessments, real estate related environmental assessments and environmental impact statements and specific research assignments. Assignments undertaken as the primary contractor, in partnership with other consultants and as a subcontractor. Representative clients and assignments during the past year include:

City Dept. of Housing &
Community Development²..... Waiola Planned Community Market Assessment
Halekua Development Co.¹..... Royal Kunia Phase II Market Assessment
West Beach Estates²..... Ko Olina Phase II Market Assessment
ANA Hotels Hawaii, Inc.²..... Makaha Expansion Market Assessment
VMS Realty Partners¹..... Planned Community Economic Model
K. G. Hawaii, Inc.¹..... Ko Olina Phase II Economic Model
Estate of James Campbell²..... Kahuku Master Plan Market Assessment
Hawaii States Properties²..... Makena Surf Expansion Market Assessment

¹ Prime Contractor
² Sub-Contractor

MOKULEIA HOMESTEADS, Honolulu, Hawaii 1979 - 1984

General Manager. Managed development activities for the \$80 million 3,000 acre proposed agricultural/residential community on the site of the former Dillingham Ranch in Mokuleia. Coordinated planners, engineers, attorneys and consultants to obtain infrastructure and subdivision approvals. Met and negotiated with government agencies and achieved approvals for a \$5 million water system and a \$4 million sewer system. Reviewed bids, selected contractors and administered contracts for drilling of three water wells with a total capacity of 4.5 million gallons per day. Prepared annual budgets for both development and operation activities. Other responsibilities included miscellaneous real estate transactions related to operations, i.e., pasture leases, polo field lease, and guesthouse rentals; and management responsibility for fifteen ranch employees.

John Zapotocky

WAILEA DEVELOPMENT COMPANY, Kihei, Maui

1975 - 1979

Project Coordinator. Coordinated development of the Wailea Ekolu project, a \$25 million 150-unit luxury condominium within the 1,200 acre Wailea Resort Community. Responsibilities included feasibility analysis, coordination of the design process, preparation of exhibits and communications for government approval authorities. Supervised preparation of sales and condominium documentation and participated in development of the marketing plan. Simultaneously worked on the Wailea Kai project, a \$10 million 100-lot residential subdivision, and the Wailea Elua II project, a \$20 million 66-unit luxury resort.

Financial Administrator. Supervised the preparation of annual and long-range plans and responsible for cash planning. Participated in the redesign of the accounting reports in order that they be more effective management tools. Supervised the day-to-day financial and accounting activities of the company.

Director of Planning and Budget Analysis. Prepared annual and long-range plans. Performed variance analysis on financial reports. Analyzed financial statements of prospective tenants for the Wailea Town Center, a 50,000 square foot commercial project.

KAISER AETNA (KACOR), Honolulu, Hawaii

1973 - 1975

Manager, Administration & Contract Control. This position encompassed four primary areas of responsibilities: escrow, contract administration, architectural control and office management.

Manager, Hawaii Kai Golf Courses. Directly responsible for all planning and operations. Prepared operating and capital budgets. Directed operations through three department heads who in turn supervised forty persons. Responsible for developing and implementing the marketing program.

EDUCATION: College of Business Administration
University of Hawaii

1974: Postgraduated work in Finance
1973: M.B.A.
1969: B.A. in Economics

**PROFESSIONAL AND VOLUNTEER
ORGANIZATIONS:**

Land Use Research Foundation
(Mokuleia Representative)
Hawaii Society of Corporate Planners
(President Fiscal Year 1983)
Kukui Plaza Owners Association
(Director)
