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FINAL

**ENVIRONMENTAL IMPACT STATEMENT
NIHONKAI LEASE COMPANY, LTD.**

**PROPOSED GOLF COURSE
KUNIA, OAHU**

Tax Map Key: 9-4-04: 9

WILLIAM E. WANKET, INC.

MARCH 1988



Office of Environmental Quality Control
235 S. Beretania #702
Honolulu HI 96813
586-4185

DATE DUE

JAN 10 2001

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NIHONKAI LEASE COMPANY, LTD.**

**PROPOSED GOLF COURSE
KUNIA, OAHU**

March, 1988

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



**WILLIAM E. WANKET, INC.
Pacific Tower 1010
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DEIS Comment and Response Letters.....Color Code: **LIME**

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A. TRAFFIC ASSESSMENT, Parsons Brinckerhoff	Buff
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C. ARCHAEOLOGICAL SURVEY, Archaeological Consultants of Hawaii	Gray
D. BOTANICAL SURVEY, Char & Associates	Gold
E. AVIFAUNAL AND FERAL MAMMAL SURVEY, Phillip L. Bruner	Cherry
F. IMPACT ON AGRICULTURE, Decision Analysts Hawaii, Inc.	Green
G. MARKET ANALYSIS, John Zapotocky	Canary
H. DP PUBLIC FACILITIES MAP AMENDMENT, Hida, Okamoto & Associates, Inc.	Pink
I. FERTILIZER AND PESTICIDE IMPACTS, Richard E. Green, Ph.D. and Charles L. Murdoch	Orchid

I. SUMMARY

The applicant, Nihonkai Lease Company, Ltd., is requesting a change to the Central Oahu Development Plan Land Use Map to designate as Recreation a 203.171 acre site (TMK 9-4-04: 9) along Kunia Road Mauka of the Village Park development. The proposed development is an 18-hole championship-style golf course, club house and restaurant, together with recreational facilities including tennis, swimming and other amenities.

The Department of General Planning (DGP) reviewed an environmental assessment for the project and determined that an Environmental Impact Statement (EIS) was required. The accepting authority for the EIS is DGP. The EIS Preparation Notice (EISPN) was published in the November 9, 1987 issue of the Office of Environmental Quality Control (OEQC), per Chapter 343, Hawaii Revised Statutes.

Twenty (20) comment letters were received on the EISPN. Fifteen (15) response letters were sent by the applicant.

The project site is currently under lease to Oahu Sugar Company and in sugar cane use. The Oahu Sugar Company lease expires the end of December 1996 and they have indicated their intentions to cultivate the area until that time. The land is classified "A" (Land Study Bureau Classification) and "Prime" (ALISH Classification). It is in the State Agriculture District and planned and zoned by the City and County of Honolulu as Agriculture.

Major permit approvals needed for the project include a Development Plan Amendment, a State Land Use District Boundary Amendment or State Special Permit, a zoning change from AG-1 Restricted Agriculture, and various water permit approvals from the State Department of Land and Natural Resources, State Department of Health, and the Board of Water Supply.

A Market Analysis (*Appendix G*) was performed and it demonstrated a need for additional golf courses to serve the needs of Ewa and Central Oahu, and concluded that the applicant's proposed golf course is an ideal location to serve the golf needs of the area. The proposed golf course aids the diversification of Oahu's economic base and enlarges the employment options for its residents. The proposed golf course will provide employment opportunities for approximately 50 residents. Construction and equipment cost for the project is estimated at close to \$18 million. The economic and fiscal impacts attributable to the proposed project appear to be favorable to the State of Hawaii and the City and County of Honolulu in both the short and long run. The project is nonpolluting and there is an absence of endangered species and archaeological resources on the site.

Major issues involving the project are its impact on State agricultural policies and on the economic viability of Oahu Sugar Company. The land is agriculturally suitable and it is presently in sugar cane. The impact of the proposed development on these issues are addresses in details in *Appendix F* and in the applicant's response letters to the State Department of Agriculture, State

Department of Business and Economic Development and to Oahu Sugar Company. The conclusion reached by the applicant was that the development could occur without jeopardizing the economic viability of Oahu Sugar Company, and without adversely affecting the growth of diversified agriculture.

Another major issue involves the availability of suitable water for the development, an issue that remains at this time unresolved. Alternatives included in the EISPN that are no longer being considered are the use of the private water system of Hawaii Country Club and water from Waiahole Ditch. Alternatives being considered include the drilling of a new well onsite or offsite. If tests indicate contaminants, a Granulated Activated Carbon, Pack Tower Aeration, Reverse Osmosis, Deionization or other appropriate treatment will be necessary.

Other impacts and mitigating measures include:

<u>Impacts</u>	<u>Mitigating Measures</u>
Increased traffic	Traffic Study (<i>Appendix A</i>) indicates that the project will not have significant impact on traffic conditions on Kunia Road. Separate lanes for right and left turns exiting the site will be provided.
Storm water runoff	Earthen berms will be constructed which will create retention basins that will prevent runoff from the site into Waiahole Ditch.
Wildlife hazards	Proper selection and application of chemicals, as recommended by Green and Murdoch (<i>Appendix N</i>), will pose little or no hazard to birds. Also, refer to applicant's response letter to the US Fish and Wildlife Service.
Sewage treatment	Connection will be made to the existing Municipal system at Village Park. The Kunia wastewater pump station will require expansion.
Construction impacts including noise, dust, grading and traffic	Compliance with State Department of Health rules and regulation governing noise and vector control and compliance with City and County of Honolulu Ordinances governing grading and other construction activities.

A number of alternatives were considered. In each alternative, it is recognized that Oahu Sugar Company has a lease on the property that runs through 1996. None of the alternatives, including the proposed action will adversely impact the current lease.

Alternatives Considered	Comment
No Action	This would result in no action being taken to implement the golf course. This alternative could result in the land ultimately becoming inactive and vacant. None of the economic benefits of the proposed development would occur. However, any adverse impact of the proposed development will also not occur.
Agricultural Conditional Uses (refer to Land Use Ord.)	None of the uses listed are considered economically viable and some would result in adverse impacts greater than the proposed action.
Residential	This alternative would require, similar to the proposed action, a development plan amendment and a land use boundary change. Also a General Plan amendment would be required to increase the population allocation for the Central Oahu area. The City Council in the past has rejected such amendments.

As discussed above, the only issue at this time that is truly unresolved in the question of water availability for the proposed golf course. The project is located within the Pearl Harbor Ground Water Control Area, which is administered by the State Department of Land and Natural Resources. The Department is awaiting a study which it commissioned to estimate the sustainable yield of the Pearl Harbor Basin system. Currently a draft of the study has been submitted by the consultant and is undergoing agency and water user review. The final study should be complete by the beginning of 1989. This study will enable the department to make more informed decisions on future requests for water within the Pearl Harbor Basin. This issue will be resolved prior to the development of a golf course as it is essential to have water available for both irrigation and potable requirements. The Department of Land and Natural Resources will decide the issue.

The proposed development does not comply with existing land use policies for the specific site, hence the request for an amendment to the existing land use plans. The proposed development is consistent with a number of important state and county goals and policies as demonstrated in *Section V* of the text of the EIS. Further the approval of the proposed development should have little or no impact on the land use policies for the surrounding areas. Throughout the EIS references have been made to mitigation measures which would serve to minimize any possible impacts. The following lists of approvals necessary for the project to proceed indicates a number of opportunities for agencies, organizations and the public to identify potential problems and to suggest further mitigation measures.

APPROVAL	APPROVING AUTHORITY	STATUS
Central Oahu Development Land Use Amendment/Public Facilities Amendment	City Council	Application filed
Rezoning	City Council	Application to be filed
Grading Permits	Department of Public Works	Application to be filed
Building Permits	Building Department	Application to be filed
State Land Use Boundary Amendment	State Land Use Commission	Application to be filed
Approval of Drainage System	County Department of Public Works (DPW)	Application to be filed
Approval of Potable Water	State Department of Land and Natural Resources/State Department of Health/County Board of Water Supply	Application to be filed
Permit for Construction within State Highway Rights-of-Way	Department of Transportation	Application to be filed
Permit for installation of utility lines within State Highway Rights-of-Way	Department of Transportation	Application to be filed
Electric Connection Approval	Hawaiian Electric (HEI)	Application to be filed
Telephone Connection Approval	Hawaiian Telephone Company	Application to be filed

II. BACKGROUND

A. ESSENTIAL INFORMATION

1. Applicant : Nihonkai Lease Company, Ltd.
c/o Central Realty, Ltd.
Suite 1400
2222 Kalakaua Avenue
Honolulu, Hawaii 96815
(808) 922-4900

- Agent : William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813
(808) 533-4937
- 2. Land Owner : Same as Applicant
- 3. Request : To designate certain land in Central Oahu as Recreation/Golf Course on the Central Oahu Land Use Map and to amend the Public Facilities Map.
- 4. Area : 203.171 acres. See *Exhibit 2*.
- 5. Location : In Central Oahu along Kunia Road and contiguous to the makai boundary of the existing Hawaii Country Club Golf Course. See *Exhibit 1*.
- 6. Tax Map Key : 9-4-04: 9
- 7. Existing Use : Agriculture/sugar cane/Oahu Sugar Co.
- 8. State Land Use : Agriculture. See *Exhibit 3*.
- 9. DP Land Use Map : Agriculture. See *Exhibit 4*.
- 10. Existing Zoning : AG-1 Restricted Agriculture. See *Exhibit 5*.

B. DESCRIPTION OF PROPERTY

1. Property Boundary

The site is a portion of R.P. 4490, L.C.A.W. 10474, AP.9 to N. Namauu at Hoaeae, Ewa, Oahu, Hawaii. See *Exhibit 2*.

2. Topography, Slope and Drainage

The project site is located on the relatively constant slope plateau. The elevation of the project area ranges from approximately 650 feet to 775 feet. (*Exhibit 11*). Overall, slope averages a gentle 4 percent measured along a northwest-southeast axis, with minor variations caused by drainage way through the parcel.

The plateau stands 10 to 40 feet higher than adjacent Ekahanui Gulch to the north.

The project site is generally well drained and not prone to flooding. What runoff is generated flow across the site following the natural terrain. Currently, stormwater runoff by overland flows into nearby OSCo field and into Ekahanui Gulch. (*Exhibit 12 and 13*)

3. **Historical and Existing Uses**

In 1860, the project site was portions of Royal Patent 4490 Land Court Award 10474 Apana 9 to N. Namauu. James Robinson purchased in the late 1800's lands in Hoaeae and Waikele and that included the project site. About 1897, the project site as part of a larger land area, was leased to the Oahu Sugar Company. The lease to Oahu Sugar Company was amended in 1967 to extend to the end of 1996. The land is presently in sugar cane.

4. **Soils**

According to the "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii (Foote, 1972)", soil types on site consist of:

KyA, KyB and KyC	Kunia Silty Clay
KuB	Kolekole Silty Clay
WaA and WaC	Wahiawa Silty Clay
HLMG	Helemano Silty Clay

The location of these soil types on the subject site are shown in *Exhibit 8*. The Soil Conservation Service (SCS) soil classifications provide descriptions of soil profiles, topography, water holding capacity, pH, depth of root penetration, erosion hazard and crop capability rating. The following description of soil types are based on the *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii*.

Kunia Series

Kunia silty clay, 0 to 3 percent slopes (KyA)
Kunia silty clay, 3 to 8 percent slopes (KyB)
Kunia silty clay, 8 to 15 percent slopes (KyC)

The Kunia soils are classified as low-plasticity silt and clay and has moderate shrink-swell potential. The soils are suitable for use as fill and can support low-rise structures.

Kolekole Series

Kolekole silty clay, 1 to 6 percent slopes (KuB)

The Kolekole soils are classified as low-plasticity silt and clay and has moderate shrink-swell potential. The soils are erodible and can support low-rise structures.

Kawaihapai Series

Kawaihapai clay loam, 0 to 2 percent slopes (K1A)

The Kawaihapai soils are classified as low-plasticity clay and has moderate shrink-swell potential. The soils are suitable for use as fill and capable of supporting low-rise structures.

Wahiawa Series

Wahiawa silty clay, 0 to 3 percent slopes (WaA)
Wahiawa silty clay, 8 to 15 percent slopes (WaC)

The Wahiawa soils are classified as high-plasticity silt and clay and has low shrink-swell potential. The soil can support low-rise structures and are generally unsuitable for use as fill.

Helemano Series

Helemano silty clay, 30 to 90 percent slopes (HLMG)

The Helemano soil is classified as high-plasticity silt and clay and has moderate shrink-swell potential. The soil is suitable for use as fill and capable of supporting low-rise structures.

Agricultural Land of Importance to the State of Hawaii (ALISH) designations for the site are shown on *Exhibit 6*. Under ALISH, entire parcel is classified as "prime" agricultural land. Prime Agricultural Lands are defined as the best suited for the production of food, feed, forage and fiber crops. When treated and managed, including water management, according to modern farming methods, the land is capable of producing sustained high yields of crops economically.

Exhibits 7, 9 and 10 illustrate the Land Study Bureau classification and the LESA proposed classifications and IAL Map designation.

5. **Location Map**

See *Exhibit 1*

6. **Topo Map**

See *Exhibit 11*

7. **Project Layout**

See *Exhibits 19 and 20*

C. ORGANIZATION

The Environmental Impact Statement Preparation Notice (EISPN) was organized to comply with the Department of General Planning's Application Outline for Development Plan Amendment and Environmental Assessments. The Draft Environmental Impact Statement has been prepared to conform with Title 11 Department of Health Chapter 200

Environmental Impact Statement Rules. Every effort has been made to maintain continuity between the EISPN and the Draft EIS.

D. FIRMS/PERSONS INVOLVED IN THE PREPARATION OF THE EIS

An endeavor the size and scope of this EIS often require the efforts of a number of firms and persons of various discipline in order to achieve a product which meets the requirements of the EIS process. This EIS is the result of the efforts of the following firms and persons.

FIRM	TASK	INDIVIDUAL
William E. Wanket, Inc.	Primary Author/ Consultant Coordinator	William E. Wanket
A. McCarter Computer Services	Typing	Ann McCarter
PIP	Printing	Ralph Hee
Belt Collins & Asso.	Preliminary Golf Course Layout	Rodney Wright
Parsons, Brinkerhoff, Quaid, and Douglas, Inc.	Traffic and Air Quality	Julian Ng
Char & Associates	Botanical Survey	Winona Char
Decision Analysts Hawaii, Inc.	Agricultural Impact	Bruce Plasch
Hida, Okamoto, & Associates, Inc.	Civil Engineering Consultants	Harvey Hida
John Zapotocky, Consultant	Market/ Economic Studies	John Zapotocky
Dr. Phil Bruner	Fauna Survey	Phil Bruner
Archaeological Consultants of Hawaii, Inc.	Archaeological	Joe Kennedy
Dr. Green/Dr. Murdoch	Fertilizer/Pesticide	Dr. Green/Dr. Murdoch
Robert B. Jones, Planner	Federal, State, City Plans/Programs	Bob Jones

E. PURPOSE OF THIS DOCUMENT

This environmental impact statement has been prepared in conjunction with the Central Oahu Development Plan Amendment Proposal to amend the designation of the Land Use Map for the subject parcel from Agriculture to Recreation/Golf Course and to amend the Public Facilities Map. The initial application and Environmental Assessment were submitted to the Department of General Planning (DGP) in October 1987. DGP

determined that the project met the significance criteria of Section 343 and required an EIS. This EIS has been prepared to comply with that determination.

III. DEVELOPMENT PROPOSAL

A. PROPOSED USE OF PROPERTY

Applicant proposes to build an 18-hole Championship-style Golf Course, club house, and restaurant, together with recreational facilities including tennis, swimming, and other amenities. The golf course layout and building locations have been oriented to take advantage of the spectacular views of the mountains, Honolulu skyline, and the ocean (Pearl Harbor direction).

B. DEVELOPMENT TIMETABLE

In addition to the need to amend the Central Oahu Development Plan, a land use boundary amendment to Urban (alternatively a State Special Use Permit), and a zone change to P-2 Preservation District will be needed. A three (3) year effort is expected to accomplish these permit approvals. Another couple years will be required for final design and construction. Any development will depend on the current lease with Oahu Sugar Company, which has stated its intention to continue sugar production through 1996.

C. APPROXIMATE COST

Plans for development at this point are conceptual. Detailed engineering plans have not been developed. Rough estimate of approximate cost is in the range of \$10 to \$12 million.

D. LIST OF NECESSARY APPROVALS

APPROVAL	APPROVING AUTHORITY	STATUS
Central Oahu Development Land Use Amendment/Public Facilities Amendment	City Council	Application filed
Rezoning	City Council	Application to be filed
Grading Permits	Department of Public Works	Application to be filed
Building Permits	Building Department	Application to be filed
State Land Use Boundary Amendment	State Land Use Commission	Application to be filed
Approval of Drainage System	County Department of Public Works (DPW)	Application to be filed
Approval of Potable Water	State Department of Land and Natural Resources/State Department of Health/County Board of Water Supply	Application to be filed
Permit for Construction within State Highway Rights-of-Way	Department of Transportation	Application to be filed
Permit for installation of utility lines within State Highway Rights-of-Way	Department of Transportation	Application to be filed
Electric Connection Approval	Hawaiian Electric (HEI)	Application to be filed
Telephone Connection Approval	Hawaiian Telephone Company	Application to be filed

E. PUBLIC FUNDS OF LANDS

No public funds or lands will be required for the action, if granted.

F. STATEMENT OF OBJECTIVES

It is the objective of Nihonkai Lease Company to develop a first-class champion-style private golf course and recreational complex that will:

- Support the economic health and quality of the visitor industry.
- Provide employment options for nearby residents.
- Help diversify the economic opportunities in the area.
- Offer a distinct recreational and social complex for golfers.
- Expand the golfing facilities which are being used at or close to capacity.

IV. NEED FOR PROPOSED DEVELOPMENT

A. PUBLIC PROBLEM OR NEED

National and State of Hawaii golf trends and the supply and demand for golf facilities in the City and County of Honolulu and in the areas of Ewa and Central Oahu were analyzed by John Zapotocky (see *Appendix G*).

Nationally, the outlook for golf participation between 1987 and 2000 looks very positive because of the following factors: expected higher incomes, aging population, early retirement, more leisure time and flex-time. A recent study indicated that nationally, golf participation may increase from 17,500,000 to a range of 19,900,000 to 41,450,000 by the year 2000 using growth assumptions ranging from 0% to 5%. This projected growth, when analyzed from the point of view of additional golf courses needed, showed potential demand for between 1,400 to 7,900 golf courses by the year 2000 assuming 0% and 3% growth rates.

The prospects for golf in the State of Hawaii are tied to the growth of population and tourism as well as the potential growth in the participation in golf. Because of the important role tourism plays in the economy of Hawaii, resort development is a primary factor in projecting demand for golf in the State of Hawaii. In 1965 only two golf courses in Hawaii could be considered resort courses; by 1985 there were 20 golf courses classified as resort courses out of the 57 golf courses in the State. Presently only three of the State's resort courses are on Oahu; however, additional courses are expected to be built with proposed resort developments at West Beach and Kuilima.

A recent study on the State's participation in the recreational industry indicated that in 1985 Hawaii attracted 200,000 golfers who spent \$30,000,000 at the State's resort courses. The maturing of the resort industry and the golf reputation being developed by the State is expected to generate increased golf interest in Hawaii.

The City and County of Honolulu contains approximately 80% of the State's population and a large segment of the tourist industry, yet contains a disproportionately small share of the golf facilities. This disparity is increased if the ratio of population to golf holes is adjusted to account for the military golf facilities which are not available to the general public. The ratio of golf holes on Oahu is approximately one hole per 2,000 persons while for the State as a whole, it is closer to one hole per 1,100 persons.

Presently, golf facilities on Oahu are being used at or close to capacity. The City government has come under increasing pressure to develop new municipal facilities and currently planning is underway for a new municipal course. A review of known projects indicates that 19 golf course developments are under study by private developers in addition to the new municipal course.

An analysis of the resort and residential demand for golf in the City and County of Honolulu indicates a demand for seven golf courses on Oahu by the year 2000 with no growth in golf participation. If Oahu attains the 2% growth factor (the mid-range of growth projected nationally) an additional nine courses will be required to meet the demand. Therefore a potential of 16 new courses may be required on Oahu by the year 2000 to meet the anticipated need.

It should be noted that five of the golf courses proposed for Oahu are the recreational and open space components of new planned developments and therefore would provide additional internal residential support for their development, e.g., Waiawa. *It is unlikely that all of the courses under consideration would be built and even less likely that all of them would be built by the year 2000.* In fact, there is pressure to convert existing golf courses into other uses as has been suggested at Ala Wai Golf Course (using a portion of the course for a convention center).

The Ewa and Central Oahu Development Plan areas currently contain six golf courses: three military and three open to the public. All of the existing courses are operating at capacity. Those courses that are open to the public service primarily the local market with the exception of Mililani, which services a mix of local golfers and tourists. There are ten golf courses proposed for the Ewa and Central Oahu areas, with one of the ten, the West Beach Golf Course, now under construction.

An analysis of the demand for golf in the Ewa and Central Oahu areas between 1987 and 2000 indicates that approximately five courses will be required by the year 2000 if just the projected growth in population and tourism occurs without any increase in golf participation. If it is assumed that growth of 2% annually occurs in golf participation, then an additional three courses will be needed to satisfy the demand, for a total of eight courses by the year 2000.

As pointed out above, not all of the courses planned are likely to be built, and even less likely that all of them would be built by the year 2000. Furthermore, some of the courses are integral parts of a larger development (that are not yet approved) that would provide additional support for the course.

The market analysis clearly demonstrates a need for additional golf courses to serve the needs of Ewa and Central Oahu and it concludes that the Nihonkai Lease Company proposed Kunia Golf Course is an ideal location to service the golf needs of the Ewa and Central Oahu development plan areas. It has numerous advantages over other proposed golf facilities in the Ewa and Central Oahu area. It is one of the few that has been proposed by an experienced country club owner and operator. It is one of three that is a stand-alone golf facility and not part of a larger overall development scheme, allowing designers to use the site to the best golf advantage without regard to other "more valuable" land uses. The Kunia site is at the highest elevation of all of the proposed golf courses, allowing for panoramic views of the ocean and the mountains. The Kunia site is located on a secondary state highway with excellent freeway access. With a first class facility and a strong marketing program, the proposed Kunia Golf Course should find strong demand and be absorbed by the market over a four-year period at any time between 1991 and 2000.

B. INTENDED MARKET

The Central Oahu and Ewa areas will present a number of markets for golf services including the resort market, the foreign market, the residential market, the municipal market and the private club market. A number of these facilities could be developed simultaneously and not be directly competitive.

The proposed Kunia golf course is initially intended to operate as a private club facility. According to Zapotocky's market analysis, demand for private clubs in the Ewa and Central Oahu area will come from three distinct sources: foreign memberships, resort memberships, and local memberships. It is anticipated that demand for golf memberships will exceed 1,200. Existing private clubs on Oahu limit golf membership to between 600 and 1,000, with full membership (resident) generally limited to 400 to 700. Demand for at least one private club and perhaps a second will exist by the year 2000 in the Ewa and Central Oahu area.

C. DESIGNATED USE VS. PROPOSED USE

The site is currently designated as Agriculture. An agricultural impact analysis (see discussion under *Impacts, Section E.5. and Appendix F*) performed by Decision Analysts Hawaii, Inc. concluded that the proposed project would not adversely affect the economic viability of Oahu Sugar Company and would not limit the growth of diversified agriculture.

Based on a market analysis by John Zapotocky (see discussion under A and B above and *Appendix G*), a need does exist for additional golf facilities in the Ewa and Central Oahu areas, and the proposed Kunia golf facility is ideally located to meet this need. The proposed golf facility will provide an estimated 50 jobs, or 10 percent of the employment of OSCo on just 1.4 percent of OSCo's current acreage under cultivation. The proposed project will also meet a number of State and City and County of Honolulu Objectives and Policies (see discussion under Federal, State and City Plan/Programs).

V. FEDERAL, STATE AND CITY PLAN/PROGRAMS

A. FEDERAL

N/A

B. STATE OF HAWAII

1. Hawaii State Plan

The proposed project will affect the following Objectives and Policies of the Hawaii State Plan:

Objectives and policies for the economy - in general.

- (a) Planning for the State's economy in general shall be directed toward achievement of the following objectives:
 - (1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaii's people.
 - (2) A growing and diversified economic base that is not overly dependent on a few industries.

Comment: The proposed golf course will provide employment opportunities for approximately 50 residents. The employment base for the golf course will cover a range of employment choices from food services to course maintenance and management. The golf course development will diversify the economic opportunities in an area lacking convenient job choices for the expansive population base living in Central Oahu. The Hawaii Country Club adjoins the proposed golf course. The two golf courses as a unit creates a strong employment nucleus while at the same time offering a distinct recreational and social complex for golfers.

Objectives and policies for the economy - visitor industry.

- (a) Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawaii's economy.
- (b) To achieve the visitor industry objective, it shall be the policy of this State to:
 - (1) Assist in the overseas promotion of Hawaii's vacation attractions.
 - (2) Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawaii's people.
 - (3) Improve the quality of existing visitor destination areas.

- (5) Ensure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities.
- (6) Develop the industry in a manner that will provide the greatest number of primary jobs and steady employment for Hawaii's people.

Comment: The proposed golf course will serve a large segment of overseas visitors as well as local residents. The proposed golf course provides an additional option for a golfing experience thereby strengthening the golfing choices on Oahu and enlarging the service facilities for visitors. The proposed project will equally meet the social, economic and physical needs of Hawaii's residents by providing primary jobs, steady employment and the opportunity to engage in recreational pursuits.

Objectives and policies for the economy - potential growth activities.

- (a) Planning for the State's economy with regard to potential growth activities shall be directed towards achievement of the objective of development and expansion of potential growth activities that serve to increase and diversify Hawaii's economic base.
- (b) To achieve the potential growth activity objective, it shall be the policy of this State to:
 - (2) Expand Hawaii's capacity to attract and service international programs and activities that generate employment for Hawaii's people.
 - (7) Promote Hawaii's geographic, environmental and technological advantages to attract new economic activities into the State.

Comment: The proposed project, through its appeal to overseas visitors, provides an impetus for expanding a growth activity which serves to increase and diversify Hawaii's economic base. Recent estimates indicate approximately 200,000 visitors annually play golf in Hawaii, spending 30 million dollars on green fees.

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/historical resources.
- (b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:
 - (3) Promote the visual and aesthetic enjoyment of mountains, ocean vistas, scenic landscapes, and other natural features.

- (5) Encourage the design of developments and activities that complement the natural beauty of the islands.

Comment: The golf course by its physical nature, an expansive open space recreational experience, will complement Oahu's natural beauty and at the same time provide an opportunity for the golfing enthusiasts to enjoy the visual and aesthetic wonders of the Koolau and Waianae Mountains. The course will blend in with the spacious openness of Central Oahu.

The Priority Directions in Part III of the Hawaii State Plan are applicable to the proposed golf course in a number of the priority guidelines.

Economic priority guidelines.

- (a) Priority guidelines in the area of general business and finance:

- (1) Stimulate the economy to provide needed jobs for Hawaii's people without stimulating unnecessary immigration.
- (2) Support business expansion and development to achieve a stable and diversified economy.
- (7) Promote Hawaii as an attractive market for investment activities that benefit Hawaii's people.

- (b) Priority guidelines for the visitor industry:

- (1) Foster a social environment which enhances the Aloha Spirit by minimizing inconveniences to Hawaii's people and visitors.
- (2) Protect the economic health and quality of the visitor industry.
- (9) Maintain and enhance visitor satisfaction.

- (e) Priority guideline for developing economic activities to encourage the development of industries which promise long-term growth potentials and which have the following characteristics:

- (1) An industry that can take advantage of Hawaii's unique location and available manpower resources.
- (2) A clean industry that would have minimal effects on Hawaii's environment.
- (4) An industry that would provide reasonable income and steady employment.

Comment: The proposed project provides new and steady jobs for Hawaii's residents without stimulating unnecessary in-migration. The golf course supports the economic health and quality of the visitor industry by providing an additional high quality recreational facility which is in heavy demand by visitors. The course equally supports the aspirations and recreational needs of Hawaii's enthusiastic golfers by providing a new course for play and at the same time reducing the demands on other Oahu courses. The open environmental attributes of a golf course support the visual and aesthetic qualities of Oahu's natural landscape.

C. CITY

1. **General Plan:** The 1982 General Plan sets out the growth patterns for Oahu through a set of Objectives and Policies addressing the needs and aspirations of its residents. This next section will cover those particular areas of concern within the General Plan which will relate to the proposed project.

Economic Activity

Objective A: To promote employment opportunities that will enable all the people of Oahu to attain a decent standard of living.

Policy 1: Encourage the growth and diversification of Oahu's economic base.

Policy 2: Encourage the development of small businesses and larger industries which will contribute to the economic and social well-being of Oahu residents.

Policy 3: Encourage the development in appropriate locations on Oahu of trade, communications, and other industries of a nonpolluting nature.

Comment: The proposed golf course aids the diversification of Oahu's economic base and enlarges the employment options for its residents. The project is nonpolluting and situated adjacent to the Hawaii Country Club which further enhances the recreational options for golfers. This recreational complex is ideally located to provide employment for the nearby residential areas in Central Oahu, thereby assisting in relieving the Honolulu-bound traffic corridors of some vehicular trips.

Objective B: To maintain the viability of Oahu's visitor industry.

Policy 9: Encourage the visitor industry to provide a high level of service to visitors.

Comment: The additional golf course broadens the recreational base for visitors and provides another alternative in selecting a golf course for play.

Objective C: To maintain the viability of agriculture on Oahu.

Policy 4: Provide sufficient agricultural land in Ewa, Central Oahu and North Shore to encourage the continuation of sugar 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.

Comment: The Agricultural Impact Study (appendix F, Color code GREEN) fully addresses the proposed project's impact on agriculture. Since the Kunia Golf Course is not expected to adversely affect the economic viability of OSCo, and would not limit the growth of diversified agriculture, the project is consistent with the major thrust of the agricultural portion of the General Plan (as well as the Hawaii State Plan and State Agriculture Functional Plan). This thrust is to preserve the economic viability of plantation agriculture and to promote the growth of diversified agriculture. Furthermore, the project would not adversely affect the cultivation of adjacent sugarcane acreage and, therefore, complies with the Hawaii Rights-to-Farm Act.

Energy

Objective B: To conserve energy through the more efficient management of its use.

Policy 1: Ensure that the efficient use of energy is a primary factor in the preparation and administration of land use plans and regulations.

Comment: Permitting the proposed golf course along Kunia Road provides employment options for nearby residents living in Central Oahu, thereby reducing driving distances to employment centers which in turn curtails the use of fossil fuels.

Culture and Recreation

Objective D: To provide a wide range of recreational facilities and services that are readily available to all residents of Oahu.

Policy 2: Develop and maintain a system of regional parks and specialized recreation facilities.

Policy 10: Encourage the private provision of recreation and leisure-time facilities and services.

Comment: The proposed golf course increases the specialized recreational facilities for Oahu residents and visitors. The need for more golf courses in Central Oahu is borne out by the State Recreation Functional Plan. The Reference Document for the functional plan, dated December 1985, indicated the Central Oahu Planning Area, which extends from Pearl Harbor to Wahiawa, has an

estimated high need for field games, pool swimming, tennis and golf. Central Oahu was the only Planning Area on Oahu with a projected high need for golf courses. Reference: Table V-9, Projected Need for Action, City and County of Honolulu.

The course construction and its maintenance will be privately financed, relieving Hawaii's residents of governmental expenditures in the realization of a new golf course.

2. **Development Plan**

a. **Common Provisions**

b. **Special Provisions**

Comment: The Common Provisions and the Special Provisions of the Development Plan for Central Oahu both address private golf courses as an open space resource. Its functions are to provide visual relief and contrast to the built environment and to serve as outdoor space for public use and enjoyment. The golf course will provide another opportunity for residents and visitors to enjoy the scenic beauty of the surrounding mountains while engaging in a leisurely recreational activity.

c. **Land Use Map:** The project area is designated Agriculture on the Central Oahu Development Plan.

d. **Public Facilities Map:**

N/A

3. **Others**

N/A

VI. DESCRIPTION OF ENVIRONMENTAL SETTING AND THE PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT AND MITIGATION MEASURES WHERE APPROPRIATE

A. DEMOGRAPHIC IMPACTS

1. **Residential Population**

N/A

2. **Visitor Population**

The proposed golf course by itself is not anticipated to generate additional visitors. However, indirectly the presence of the course helps to solidify Hawaii's world position as a golfing mecca for year round visitors.

3. Character or Culture of the Neighborhood

The project site is bordered by the Hawaii Country Club on the north and east. Waiahole Ditch and Kunia Road are the southern and western boundaries respectively. Agricultural activities border the latter boundary areas. The proposed project with its open space attributes will not alter the basic character of the neighborhood. The new course will complement the Hawaii Country Club and intensify the recreational focus of this golfing nucleus.

4. Displacement

The golf course will occupy an area currently utilized for the growing of sugar cane. This aspect of project impact will be discussed in the Agricultural Section of this assessment.

5. Other Social Impacts

N/A

B. ECONOMIC IMPACTS

1. Economic Growth

Economic impacts of the proposed project will include both short-term impacts relating to the construction phase, and long term, relating to the operational phase. These impacts have been estimated using the Department of Planning and Economic Development's (DPED) Input-Output Model. This model measures the impact of spending throughout the economy as dollars spent in one industry impact other industries and, therefore, have a multiplier effect on the overall economy.

DPED is constantly refining the multipliers and coefficients used in the State model in order to incorporate new data. The multipliers and coefficients used in this analysis were provided by Dr. John Mapes of DPED and are from unpublished updates of the State Input-Output model as of September 1987.

Short-term and long-term impacts have been broken down into three categories - total sales, household income and employment.

Short-Term Impacts (Construction)

Sales Impact:

The output (sales) multiplier for construction is 2.0. This multiplier includes the impact of direct, indirect and induced expenditures.

\$12 million X 2.0 = \$24 million

Household Income

Total household income is estimated by multiplying the income coefficient of .7 by the construction cost.

$$\$12 \text{ million} \times .7 = \$8.4 \text{ million}$$

2. **Employment**

In 1985 there was one direct construction job for each \$83,000 of construction¹ put in place. If this ratio is applied to the golf course project, 145 direct construction jobs will result from the expenditure of \$12,000,000.

Using the construction multiplier of 2.5 results in the following:

$$145 \text{ jobs} \times 2.5 = 362 \text{ jobs.}$$

Summarizing, the construction of a golf course and clubhouse facility for \$12,000,000 will result in direct, indirect and induced expenditures of approximately \$24,000,000; household income approximating \$8.4 million, and the creation of a total of 362 jobs. It is anticipated that construction of the golf course and clubhouse facilities would occur over an 18-month period.

Long-Term Impacts

Long-term impacts are expected to result from the day-to-day operation and maintenance of the golf course and clubhouse facilities. In addition, a substantial revenue is expected to be generated by food and beverage sales. For the purpose of this analysis, the golf sales and the food and beverage sales have been separated so that the appropriate multipliers can be applied. In reviewing the long-term economic impacts of the proposed golf course and clubhouse, two factors should be kept in mind: first, the analysis assumes the income is received by the club annually rather than in a lump sum in early years (in the form of membership fees) with a smaller maintenance fee collected thereafter, and second, that membership in the club is expected to be divided equally between foreign members/resort members and local members. To the extent that local membership and revenues are involved, economic impacts are, in a sense, a substitution for alternate recreational opportunities and are, therefore, not considered to be *new* or *outside* dollars contributing to the expansion of the economy.

1. DPED, *The State of Hawaii Data Book 1986*, December 1986, pp. 339 and 541.

Sales Impact

Golf Course/Other Recreation	\$3 million X 2.3	=	\$6.9 million
Eating and Drinking Establishments	\$7 million X 1.95	=	<u>\$1.4 million</u>
Total			\$8.3 million

Household Income

Golf Course/Other Recreation	\$3 million X .9	=	\$2.7 million
Eating and Drinking Establishments	\$7 million X .6	=	<u>\$.4 million</u>
Total			\$3.1 million

Employment Impact
(Full time equiv)

Golf Course/Other Recreation	30 jobs X 1.7	=	51 jobs
Eating and Drinking Establishments	20 jobs X 1.7	=	<u>34 jobs</u>
Total			85 jobs

Summarizing, ongoing operations of the proposed country club will produce a sales impact of approximately \$8.3 million annually, household income of \$3.1 million annually, and an estimated total of 85 jobs. It is estimated that approximately one-half of the impact will be from out-of-state sources and thus has not been anticipated by the DPED Input-Output Model.

3. Government Revenues (Taxes)

The proposed project will also impact state and local tax revenues during both the construction period (short run) and throughout the life of the operation (long run). The impact of total tax collection attributable to the proposed project is difficult to determine as economic actions do not occur in a vacuum. However, an estimate can be made by assuming that the share of the State and local tax revenue of the proposed golf development is equal to the part of the State household income produced by the golf course. In 1985, State and local tax collections totaled \$1,806,169,000² while State Household Income totaled \$11,896,000,000.³ Thus, State and local taxes totaled 15.2% of household income. If that relationship is assumed to remain the same, the State and local taxes attributable to the proposed project should total 15.2% of the household income generated by the project. In the short term, construction revenues should generate \$1.3 million in State and local tax revenues while ongoing operations should generate an annual State and local tax revenue of \$.5 million per year.

Projected Impacts on Government Expenditures**Economic Impact**

-
2. DPED, *The State of Hawaii Data Book 1986*, December 1986, pp. 276 and 370.
 3. DPED, *The State of Hawaii Data Book 1986*, December 1986, pp. 276 and 370.

It is even more difficult to determine government expenditures related to the proposed project. First, it should be stressed that the project will not generate any major capital improvements which will be funded by government. It is difficult to attribute how the proposed project benefits from any government services other than rudimentary public safety services such as police and fire protection and the benefits of a stable government. In 1985, these services made up less than 16% of State expenditures and less than 36% of County expenditures.⁴

Summary of Economic and Fiscal Impacts

The economic and fiscal impacts attributable to the proposed project appear to be favorable to the State of Hawaii and the City and County of Honolulu in both the short and the long run.

4. **Location vis-a-vis Intended Market**

The market analysis by John Zapotocky concludes that the proposed Kunia golf facility is ideally suited to service the golf needs of the Ewa and Central Oahu Development Plan areas. Being programmed only for golf and other recreational needs, the proposed facility can be planned and developed to take maximum advantage of the site for these purposes. The site location is close to areas of major residential and resort growth.

C. **HOUSING IMPACTS**

1. **Increase Supply**

The project will have no impact on the housing supply.

2. **Affordable Units**

The project will have no impact on affordable housing units.

D. **PUBLIC SERVICES**

1. **Access and Transportation**

Kunia Road provides access to the project site. Kunia Road is a two-lane, two-way rural highway with 11-foot lanes and 4-foot wide paved shoulders. The road is a Federal-aid Secondary highway connecting the communities of Waipahu to the south with Wahiawa to the north.

Parsons Brinckerhoff Quade Douglas, Inc. was commissioned to evaluate the traffic impacts associated with the proposed project. They also evaluated future traffic volumes on Kunia Road without the proposed project. Their study is attached to this application as *Appendix A*.

4. Tax Foundation of Hawaii, *Government in Hawaii 1986*, December 1986.

The Traffic Consultant's conclusions and recommendations were as follows:

The proposed project will not have a significant impact on traffic conditions on Kunia Road. Although traffic volumes are projected to increase, the highway has sufficient capacity to accommodate the added traffic; levels of service are not expected to change because of the project. The proposed project's access will be through a new unsignalized intersection; the analysis indicates that sufficient capacity will be available, even recognizing OSCo can haul crossing in the area.

Separate lanes for right and left turns exiting the site will minimize delays and should be provided. The projected traffic volumes also indicate that a separate turn lane should be provided for southbound traffic wishing to turn left into the site (this lane would allow turning traffic to leave the through lane, thereby not delaying other southbound traffic; the length of the lane should be 175 feet long for storage and deceleration). The installation of the turn lane, however, should not be done unless similar improvements are provided at other unsignalized intersections along the two-lane segments of Kunia Road, so that a consistent highway design can be maintained.

2. Water

The site is currently used for sugar can cultivation and the water used is not being provided by a public water system.

Water requirements and improvements needed to serve the proposed development were assessed by Hida, Okamoto and Associates, Inc. According to the consultant, water requirements for the project generally fall into three categories: potable domestic water, fire protection, and golf course irrigation. Depending on available source, operational requirements, and construction, operation and maintenance costs, there are several options available. In all of the options, however, it seems prudent to integrate the fire and irrigation systems. See Exhibit 18. Both the fire and irrigation water demands are much greater than the potable domestic demand, and the water quality requirements for potable domestic water are far more stringent than necessary for fire protection and golf course irrigation.

Estimated average daily water requirements as calculated by Hida, Okamoto and Associates are as follows:

Potable Water - 68,000 gallons per day
Fire Flow - 240,000 gallons per day
Irrigation - 580,000 gallons per day

- a - Fire flow indicated need for system capacity in order to meet fire emergencies, not an actual demand for water.
- b - Irrigation demand is an average demand with actual demand fluctuating on a seasonal basis. During heavy rains the irrigation system may be shut down while during hot dry periods application of water at the rate of 1 and 1/2 inches per week may result in a daily demand of 970,000 gallons.

Thus the total average daily water requirement for the project is approximately 648,000 gallons per day.

Source

Alternative 1

A well could be drilled on the site to tap ground water from the aquifer underlying the project site. (*Exhibit 16*). It is fairly certain that water could be developed in this manner to serve both the potable and irrigation requirements of the site. There are numerous wells in the area surrounding the proposed site which attest to the technical feasibility of tapping the aquifer.

Alternative 2

A source of water could be developed off-site by the applicant and the water transmitted to the site via a pipeline. Another variation on this alternative would be to develop a new source offsite which could be substituted for or traded to users in the area of the proposed golf course.

Alternative 3

Water may be available for purchase from existing users in the area. The proposed golf course site is currently under lease to Oahu Sugar Company and in sugar cultivation. It is being irrigated from the Waiahole Ditch. Oahu Sugar has stated that water from this source would not be available for golf course irrigation. Note: Water from Waiahole Ditch is currently being used to irrigate the Mililani Golf Course.

The site of the proposed development is within the Pearl Harbor Ground Water Control Area administered by the State Department of Land and Natural resources. Any plan for development of new water sources within the water control area or reallocation of water within the area would have to be approved by the Department of Land and Natural Resources (DLNR). The State Water Commission which was formed pursuant to legislation enacted by the legislature in 1987 may assume responsibility for control of water in the future when rules and regulations governing its operation are adopted. The DLNR and the Water Commission are charged with protecting and administering the state's water resources. Factors considered in granting a water allocation will include availability of water, the needs of existing users, and the needs of other proposed uses. DLNR has informed the applicant that it is awaiting the completion of a study commissioned to determine the sustainable yield of the Pearl Harbor Ground Water Control area before making further determinations on source development in the area. A draft study has been submitted by the consultant (George Yuen and Assoc.) to DLNR for review. According to DLNR staff responsible for the review as much as a year's time may be required to obtain the necessary input from both government agencies and existing water users. Until the review process is complete the results of the study will not be publicly available. The final study is expected to be completed by 1989. The results of the study may have a significant impact on future water development in the area.

The Department of Health has indicated that any new source or substantially modified source of potable water developed to serve the proposed golf course would be subject to approval of the Director of Health (DOH) prior to its use under the terms of Section 11-20-29 and or Section 11-29-30 of Chapter 20, Title 11, Administrative Rules. Further the DOH advises that groundwater contamination has been found in several wells in the Kunia area and that due to this finding the DOH has increased the scope of its testing program for contaminants. Detection of contaminants in new or existing sources may prohibit their use as potable water sources without treatment. Information supplied by the DOH drinking water section indicates a number of treatments including, carbon filtration, pack tower aeration, reverse osmosis and deionization could be employed to rid water of various contaminants. To date the DOH has not encountered any contamination problems which could not be treated with available technology, although some treatment alternatives have been considered uneconomic by some water system operators. The applicant intends to minimize costs by treating only that water to be used as potable water.

The applicant is aware of the requirements of the Departments of Land and Natural Resources and Health and will comply with all laws and rules and regulations governing the development and operation of water systems.

3. Wastewater

There are no existing sewer facilities in the immediate vicinity of the project site. The closest municipal facilities are a sewer system in Village Park development located some 2.5 miles south of the project.

Since the project site is located above the "no pass" line, cesspools or wastewater ground injection (leaching) disposal systems are not ordinarily permitted. The "pass/no pass" line was established by the Board of Water Supply and the State Department of Health to protect potential groundwater supplies.

According to Hida, Okamoto & Associates, Inc. the average daily wastewater generated by the proposed development is estimated to be approximately 68,000 gallons per day (gpd). Wastewater will be disposed of as follows:

Construct 8-inch gravity transmission main along Kunia Road to the existing municipal sewer system at Village Park development, a distance of about 13,000 feet. Expand the capacity of the Kunia Wastewater pump station.

Cost for expansion of the Kunia pump station and for sewer main extensions to and within the project site will be paid by the applicant. The wastewater system within the City right-of-way will have to be built in accordance with the City Standards and will be dedicated to the City. (*Exhibit 14*)

4. Drainage

The golf course will maintain existing drainage patterns and will utilize overland flow to existing gulches and ditches. Retention and sediment basin will be incorporated into the golf course design. The avoidance of major topographic changes limits the topographical impact of the development. Other mitigating measures will include compliance with the City and County of Honolulu grading ordinances which contain provisions for erosion control during construction.

After construction is completed and activities within the project site are in operation, slight increase in stormwater runoff due to higher runoff coefficients for golf course fairways and green, road, parking areas and other impervious surfaces will occur. However, other features of the golf course such as bunkers, ponds and retention basins will offset the increase in runoff flows. Consequently the proposed golf course improvements are not expected to create a significant increase in stormwater runoff and would not adversely affect the nearby gulch and ditches. Earthen berms constructed along the periphery of the site will be allowed to create temporary flooding within the golf course, under maximum precipitation conditions.

5. Solid Waste

Because the project site is currently used for agricultural purposes, it is not served by public nor private refuse collection companies.

According to Hida, Okamoto & Associates, Inc., it is anticipated that the activities within the project site will generate approximately 1,400 pounds of refuse each day.

Solid waste will be collected by private collection companies and disposed of at public or private landfills. The proposed activities within the project site will place additional demand on County waste disposal facilities.

It is expected that State and County revenues derived from the completed golf course will be sufficient to finance the development's fair share of the cost for major capital improvements such as solid waste disposal facilities.

6. Schools

The proposed development will have no impact on the demand for schools in the area.

7. Parks

The proposed development will have no impact on the parks in the area.

8. Police

The Wahiawa Station serves the project area. The development will likely increase calls for police services. As a general rule construction of any project will have an immediate impact on the calls for police service because of the noise, dust and traffic problems that are generated. Given the remote location of the project site and the sparse development in the area, the project is not likely to generate many calls for service. Although the police facilities are considered adequate, the level of service will depend on receiving budget increases for additional manpower and equipment. The project is not expected to have a major impact on calls for police service in the area.

9. Fire

The project site is served by the Waipahu Station. The Wahiawa Fire Station would provide secondary protection. Response time from either station is five to eight minutes. Fire facilities are considered to be adequate.

10. Utilities

Existing electrical and telephone service to the site is currently supplied by overhead lines along Kunia Road. Electrical service to these 12kv power lines is supplied by the Waipio Substation.

Electrical and telephone infrastructure may have to be upgraded to serve the development.

The developer will work closely with HECO in order to ensure that timely service can be provided.

No other mitigating measures are necessary since the Electric Company has indicated that adequate service can be provided.

The electrical system within the development will be built to appropriate government standards. Any new utility lines will be underground to mitigate any visual impacts.

The developer will maintain contact with Hawaiian Telephone Co. to assure necessary service levels.

11. Other

N/A

12. List of Agencies Consulted

State Department of Land and Natural Resources

State Department of Health

Board of Water Supply

City and County of Honolulu Public Works Department

City and County of Honolulu Department of General Planning

City and County of Honolulu Department of Land Utilization

State Land Use Commission Office

E. ENVIRONMENTAL IMPACTS

1. Noise

Given the low volume of estimated project traffic, noise from this source is not expected to be significant. Noise levels will increase in the area during golf course construction (temporary/short term). Noise minimization features will be utilized such as appropriate type and use of equipment and hours of operation. All appropriate noise control ordinances and regulations will be followed.

Regarding long term noise impacts resulting from operation of the proposed project, no adverse impact is expected. The project site adjoins an existing golf course and agricultural lands. Through proper design and siting of structures and landscape treatment, noise can be reduced to a level which should not be adverse to the area.

2. Air Quality

a. Construction/Vehicles

The only direct short term adverse air quality impact that the proposed project is likely to create is the emission of fugitive dust during construction. State of Hawaii regulations stipulate the control measures that are to be employed to reduce this type of emissions. Primary control consists of wetting down loose soil areas. An effective watering program can reduce particulate emission levels from construction sites by as much as 50 percent. Other control measures include good housekeeping on the job site and pavement or landscaping of bare soil areas as quickly as possible. Muffler control devices will be used on construction equipment to control exhaust emissions from these vehicles.

Air quality impact from mobile sources was studied by Parsons Brinckerhoff Quade Douglas, Inc. Increased traffic generated by the project development will slightly increase emissions of carbon monoxide along Kunia Road. Modeling of the current and projected peak hour average and worst case concentrations of carbon monoxide at a receptor site, 60 feet southwest from the intersection of Kunia Road and the project access road, indicate that levels are well within the Hawaii and National one-hour carbon monoxide limits. Eight-hour CO levels were also estimated and determined to be within Hawaii and National standards.

The consultant concluded that the proposed project is expected to have little direct impact on the air quality of the surrounding area. The estimated increase in pollution levels is very small and State and Federal air quality standards will continue to be met. A copy of the air quality assessment report is included as Appendix B.

b. Pesticides

CRITERIA AND STANDARDS FOR PESTICIDE

Investigation by Parsons Brinckerhoff of several federal and state agencies found that there has been no significant development of air quality standards for pesticides or fertilizers. However, the federal Occupational Health and Safety Administration (OSHA) has established health standards for workers applying pesticides and fertilizers. In addition, the Environmental Protection Agency (EPA) has an approved list of pesticides and fertilizers to be used for the protection of the environment.

EPA Region IX (which encompasses Hawaii) and the EPA Washington, D.C. office were contacted for information on allowable ambient air quality standards for pesticides. None have been established. Also, the states of Hawaii, California and Arizona were contacted. All three states have substantial agriculture programs and many golf courses. It was determined that pesticide use is monitored for agricultural crops primarily where water quality is concerned. No state data is available for the effects of pesticide use on air quality.

POTENTIAL IMPACTS FROM PESTICIDE USE AT KUNIA GOLD COURSE

While air pollution from vehicle emissions will occur daily, air pollution from the use of pesticides will be intermittent depending on the application schedule. The use of pesticides and fertilizers are routinely required at golf courses in order to maintain fairways and greens. Pesticides include a wide range of insecticides, herbicides, and fungicides. Detailed research has found that the fertilizers, herbicides, fungicides commonly used in golf course maintenance should pose little or no hazard to air quality.

With the exception of herbicides, pesticide applications are normally made only to greens on golf courses. Greens comprise only approximately 3 acres of a typical golf course. Because the area treated with pesticides on a golf course is small, the total amount of pesticide applied is relatively small also.

Fertilizers are relatively non-toxic and all herbicides and fungicides used in golf course maintenance in Hawaii are low to moderate toxicity (see Appendix I Table 1 of the EIS report for the Kunia Golf Course). The only chemicals used in golf course maintenance in Hawaii which are highly toxic are the organic phosphate insecticides, especially diazinon and chlorpylfos.

The labeling of pesticides for particular uses by OSHA and the EPA with strict laws (enforced by the Hawaii Department of Agriculture) for their use are perhaps the best assurance of protection of air quality. The primary purpose of these labels is to provide occupational safety and health guidance regarding proper handling and application. If properly used in accordance with label instructions, all of the chemicals listed in Table 2, Appendix I 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 considering the dilution factor in application solutions.

There are, however, certain precautions that must be followed in order to prevent significant downwind drift from pesticide spraying. Primary among these is the use of a coarse, rather than fine, spray, and application under wind conditions that would not contribute to potential drift toward sensitive areas. Should a user improperly apply these chemicals under wind conditions which would contribute to drifting then there would be an increased possibility of downwind exposure.

EXISTING CONDITIONS

Some herbicide application presently occurs on the existing sugarcane fields within the project site, and the change to golf course use will probably result in an increased use of agricultural chemicals. Because of the relatively small area of a golf course to which fertilizers and pesticides are applied, and the nature of the pesticides used in turfgrass management, there is less likelihood of contaminating the air environment. The proposed increase in use of chemical agents would not be significant.

The summary, conclusions and recommendations of a study by Richard E. Green, Ph.D. and Charles Murdock, Ph.D. of the University of Hawaii concerning the use and environmental impact of chemicals likely to be used on the proposed Kunia Golf Course and impacts to water quality are fully described in Appendix I.

SIMILAR STUDY RESULTS

Two other recent studies involving golf courses in Hawaii at Waialua and in Windward Oahu determined that the use of pesticides and herbicides at golf courses should not present a significant problem if applied according to prescribed methods. The use of EPA approved herbicides and pesticides was also recommended at these sites.

CONCLUSIONS

Based on the results of previous studies, an evaluation of the proposed Kunia site, and management factors involved in golf course maintenance, Parsons Brinckerhoff concluded that it is unlikely that development of the proposed Kunia golf course would pose environmental risks associated with the use of chemical fertilizers and pesticides. Therefore potential for significant degradation to overall air quality in the Kunia area from golf course pesticide use is judged to be minimal. In any event, as a mitigation measure, proposed chemical agents should be used judiciously. It is also anticipated that the use of windbreaks and a buffer strip around the project area could be implemented as mitigation measures, if necessary to reduce off-site lateral drift of pesticide.

For additional discussion on pesticides, please refer to SECTION VI.E5i.

3. Compatibility with Surrounding Environment

The golf course by its physical nature, an expansive open space recreational experience, will complement Oahu's natural beauty and at the same time provide an opportunity for the golfing enthusiasts to enjoy the visual and aesthetic wonders of the Koolau and Waianae Mountains. The course will blend in with the spacious openness of the surrounding area. Siting of buildings and the layout of the course are oriented to take advantage of various viewpoints on the property.

4. Historic and Archaeological Resources

Based on the findings of Archaeological Consultants of Hawaii (see *Appendix C*), the subject property contains no above-ground archaeological features and offers little chance of subsurface recovery. The supportive reasons are field observations under ideal conditions, a complete lack of indicator data from the literature and map sources, and an environmental setting that is not consistent with habitation or irrigated agricultural techniques. Some gathering and/or limited dry land cultivation may have taken place, but these practices do not easily lend themselves to archaeological investigations. The consultant concluded that there is no need for additional archaeological work on the subject property.

5. Natural Features

a. Water Resources

The proposed development site is within the Koolau sub-area of the Pearl Harbor Ground Water Control Area. The Board of Land and Natural Resources (BLNR) controls water allocations within a water control area under authority of Chapter 177, H.R.S., and Chapter 166 of Title 13, Administrative Rules.

The proposed development would require the use of approximately 68,000 gallons of potable water for domestic consumption and additional 580,000 gallons of water per day for irrigation purposes.

The availability of water for the proposed development ultimately comes down to two fundamental questions. First, is there water available within the Pearl Harbor Ground Water control area which can be allocated to the proposed development? (Basically a technical question, i.e., estimating total supply and potential supply and estimating existing demand to determine if there is any excess). Second, how should the water be allocated among users? (Basically a political question, i.e., allocating water resources among a group of competing interests: housing, commercial, industrial, agricultural, recreational and conservation). As discussed in Section VI D 2 of this EIS the Department of Land and Natural Resources and the State Water Commission will be responsible for determining water allocations in the area. Among the many issues to be considered in these deliberations are, sustainable yield of the aquifer, recharge of the aquifer and the allocation of potable quality water. The following is a discussion of these questions:

Sustainable Yield Study

A draft of the sustainable yield study of the Pearl Harbor Basin Aquifer has been completed and submitted by the consultant (George Yuen & Assoc.) to the Department of Land and Natural Resources. This draft is at the beginning of an

extensive internal DLNR review process which will be coordinated with other governmental agencies as well as the existing water users. According to Dan Lum the DLNR staff person responsible for the review process, the review will be time consuming in order to give all parties an opportunity to have input before the final report is issued. It is possible that this process may involve six months or longer. The study will not be available to the public until it is in final form.

It should be noted that the State Water Commission (which was created by the 1987 Legislature) is responsible for administering public policy on water related matters including the determination of safe sustainable yields for various aquifers in the state. It is expected that the Water Commission will rely heavily on the final report when it is issued.

In fact the DLNR response to the subject DEIS contains the following statement: "The applicant is...aware that the Board is currently evaluating the sustainable yield limits of the aquifer in the Ground Water Control Area and that the Board will subsequently act on his application for project water use, which amounts to 650,000 gpd."

Water Recharge

One of the complexities that must be addressed by the DLNR and the Water Commission is the question of water recharge rates for various types of uses within the Pearl Harbor Ground Water Control area. A recent study of Oahu's past, present and future water usage patterns makes a number of observations regarding the potential impacts of these changes:

The study Land Use Effects on the Water Balance of a Tropical Island by Thomas W. Giambelluca, 1986 indicates that drip irrigation sugarcane can recharge groundwater in quantities approximately three times greater than urban irrigated park land (golf courses). In fact, Table 2. Monthly and Annual Water Balances (mm) on page 138 indicates that for areas of 1,000 mm precipitation recharge rates for urban park land are 261 mm per year as compared with 829 mm per year for drip irrigated sugarcane.

The study continues, however, to discuss the ultimate impact on the water supply is dependent not solely on recharge but on the net effect of water usage vs. water recharge. Table 4. Groundwater Recharge and Groundwater Use for Different Land Uses in Southern Oahu (1,000 mm precipitation) demonstrates this relationship as follows:

Land Use	Groundwater Recharge (mm)	Groundwater Use (mm)	Net Effect (mm)
Drip-irrigated Sugarcane	829	1,331	-502
Urban park/golf course	261	318	-57

Thus the net effect of Urban Park/Golf Course is -57 vs. Irrigated Sugarcane net effect of -502. It appears that the negative impact of a golf course use is only 11% of that of drip irrigated sugarcane.

In the case of the proposed development the issue is even more complex in that the cane currently being grown on the site is irrigated by water from the Waihole Ditch which comes from sources outside of the Pearl Harbor Ground Water Control Area. Therefore, neither of the relationships specified in the aforementioned report may be indicative of the final result of the development. As discussed previously the use of water for the proposed development is dependent on approval from the DLNR which is charged with protecting and promoting the public interest in its decisions on water usage allocations.

Potable Water Allocation

The Honolulu Board of Water Supply and the Oahu Sugar Company are the major users of the water resources of the Pearl Harbor Aquifer. The Board's primary responsibility is to supply potable water to the areas developed for residential and commercial use. The Board is one of the competing interests for water resources and would prefer to minimize competition for water from potable sources for irrigation usage.

The applicant will consider the use of non-potable water for irrigation purposes. However, at the present time no source of non-potable water is available to the applicant for this purpose. Drilling of wells in any location on the subject property would result in potable water. Regarding this issue, Lawrence Whang of the Board of Water Supply was consulted and he referred us to Mr. George Hiu, also of the Board of Water Supply staff. Mr. Hiu indicated that as a matter of policy the Board is opposed to the use of potable water for irrigation purposes for golf courses within the Pearl Harbor Water Control area.

Mr. Hiu indicated that while the Board of Water Supply would entertain requests for potable water (for clubhouse usage) from the proposed development but any request for the use of potable water for irrigation purposes would have to be made to the State of Hawaii, Department of Land and Natural Resources.

As indicated elsewhere in the text, sugarcane being grown on the site of the proposed development is irrigated by water from the Waihole ditch which comes from sources outside of the Pearl Harbor Ground Water Control Area. Oahu Sugar has indicated that it intends to use this water for irrigation on other portions of its sugar growing operations. Therefore the

proposed project should have no impact on the availability of water for agricultural purposes.

The applicant proposes to develop a new private water system to provide potable water for domestic consumption. The applicant will comply with the requirements of Section 11-20-30 of Chapter 20, Title 11, Administrative Rules and Regulations. As State law is very explicit in detailing the approval requirements and process for new sources and distribution systems for drinking water, no further mitigating measures are necessary. The developer and his engineering consultants will work closely with the Department of Health and its designees in meeting the requirements of the law.

b. Flood Plain Management

According to the Flood Insurance Study for the City and County of Honolulu, the project site is located in Zone D, an unstudied area with possible flood hazards. The Land Use Ordinance (LUO) of the City and County of Honolulu does not include Zone D areas as Federal Hazard Districts.

c. Wetlands Protection

N/A

d. Coastal Zone Management

The project lies within the broader framework of Part I of the Coastal Zone Management (CZM) program and as such relationships should be identified between the proposed project and the CZM objectives and policies.

The essence of the CZM objectives and policies are embodied within various portions of the EISPN and especially the State and City and County policy documents which are referenced. However, for purposed of clarity the seven CZM program objectives and their related policies are reviewed below:

Recreation Resources

The proposed golf course while not coastal related provided and additional recreational facility in an area which has a deficiency in convenient golf courses. The proposed course will expand the golfing opportunities for both residents and visitors.

Historic Resources

Field observations were conducted on the site and no above-ground archaeological features were found and it was concluded the site offers little chance of subsurface recovery.

Scenic and Open Space Resources

The proposed project will not materially alter the existing natural landform. The golf course represents an open space resource which retains the open scenic qualities of the area. Buildings will not infringe into any scenic viewing corridors and the placement of the clubhouse will be oriented to take advantage of the viewing opportunities offered by the central plateau and the bracketing mountain ranges.

Coastal Ecosystems

The golf course will incorporate retention and sediment basins as well as earthen berms to control runoff into the nearby gulches and ditches. The environmental impact of chemicals which will be used on the golf course will be studied (Green and Murdoch).

Economic Uses

The economic impact of the proposed golf course is reviewed in detail in the Market Analysis. The course will in brief provide new employment opportunities while promoting Hawaii's geographic and environmental advantages in attracting new economic activities to meet visitor and resident demands. The course is located and will be designed and constructed to minimize adverse social, visual, and environmental impacts in the CZM area.

Coastal Hazards

As noted earlier, the course will be designed to minimize runoff into adjacent gulches. A special study will be conducted on the impact of chemicals used on the course. The site is well drained and not prone to flooding.

Managing Development

The proposed project is in its initial stage of development. The Environmental Impact Statement being prepared will offer the general public an opportunity to participate in the early stages of project review. The proposed golf course requires the processing of a Development Plan Amendment, a State Special Permit or Land Use Boundary Change and a Zoning Amendment. These application procedures will offer the general public ample opportunity to participate in the planning process for the proposed golf course.

In summary the proposed Kunia Golf Course will not adversely impact the Objectives and Policies of the CZM program. The proposed project will be managed in a manner to comply with the spirit and intent of the CZM program.

- e. Soils

Clearing and grubbing activities during construction will temporarily disturb the soil retention values, and expose the soils to erosional conditions. The impact of construction activities can be mitigated by conforming to strict erosion control measures, particularly those specified in the City and County of Honolulu's Grading, Grubbing and Stockpiling Ordinance No. 3968, 1972; DPW's Soil Erosion Standards and Guidelines, 1975; the State Department of Health's Water Quality Standards, Chapter 37-A, Public Health Regulations, 1968; and the SCS's Erosion and Sediment Control Guide for Hawaii, 1968. Other control measures include planting with landscaping or ground cover vegetation immediately after the grading of an area is completed to preclude barring large contiguous areas.

f. **Vegetation and Animal Life**

Flora

A Botanical Survey was performed by Char & Associates. The study is included as Appendix D.

There is very little variation in relief on the site. Almost all of the more or less 203 acres is covered by pure stands of sugarcane (*Saccharum officinale*) that appear to be ready for harvest. There are few other species mixed in with the sugarcane, and these are restricted to the margins, seldom extending more than a foot or two farther in. The canefield roads into the interior of the site are very dry and hard-packed red soil, and are largely covered with finger-grass (*Chloris barbata*). Few other species seem to tolerate the physical conditions. Almost all of the remaining species were encountered only around the perimeter of the site, associated with the neighboring golf course, ditches, the syphon, or the highway. All of these features represent increased water availability for the ruderal (wayside) plants, and this may explain why there was such a diversity compared to the interior roads. With the exception of finger-grass, which was abundant throughout, the vegetation was variable enough that seldom did one species dominate over more than a small area, before giving way to another. An especially rich assemblage of plants was found adjacent to the reservoir and a small ditch feeding it. Though these were just outside the site, they were sampled to see what the local vegetation would be under constantly moist conditions. As no species of concern were found in these wet areas, and as they constitute such a small area, they are not differentiated from the drier areas in the species list.

There are no plant communities or individual species located in the study site requiring protection, nor are any species on the site considered rare, threatened, or endangered. Only four of the 93 species are considered to be native, but their behavior is that of ruderal weeds. They are common throughout the state in low elevation waste areas.

Some of the species may be considered highly undesirable weeds, but in the local climate of the golf course and with the high maintenance it will receive, they pose no future threat to the area.

Fauna

An Avifaunal and Feral Mammal Survey was performed by Phillip L. Bruner, Assistant Professor of Biology, BYU-H. The study is included as *Appendix E*.

In terms of broad conclusions related to bird and mammal activity on the project site, the consultant offered the following observations:

- The present monoculture of sugar cane preclude widespread use of this site by birds. Most activity was noted along the perimeter where alternative types of vegetation created the diversity of habitats needed in order to support a variety of species.
- Mammal activity was limited. More detailed data would involve a long-term trapping program.
- The irrigation pond located below the SW corner of the property provides an additional habitat type which potentially could be an important link in the ecological picture. The trees about its edge serve as nest sites and places of refuge.
- A change of land use of the type proposed will significantly alter the present habitat by creating a much larger diversity of living spaces than are available in a monoculture of sugar cane. The planting of trees and the creation of grassy open areas will provide new habitats which will likely result in an increase of species like plover and Common Mynah (*Acridotheres tristis*). Mammal populations will also likely change following development. The loss of the dense cover provided by sugar cane will reduce mongoose and rat/mice populations significantly. Although not recorded on the survey, game birds such as Common (Ring-necked) Pheasant (*Phasianus colchicus*) will also be impacted by a loss of cover with the changes in habitat types due to development. This species is widespread and relatively common in sugar cane and second growth habitats on Oahu.
- Overall the conversion of the property from a sugar cane monoculture to a more diversified habitat of trees and grass should be a positive change with a resultant increase in the populations of most bird species.

The consultant's recommendations are:

- * A diversity of trees and plants in the new golf course will increase its usefulness to birds. If ponds are created, emergent vegetation about the edges of these ponds would make them more attractive to water birds as well as enhance their beauty.
- * The present⁵ OSCO irrigation reservoir adjacent to the proposed property at the SW corner may play an important role in the wildlife of this site. Where possible this pond and its surrounding vegetation should be preserved.

g. Agricultural Lands

An agricultural impact analysis was performed by Decision Analysts Hawaii, Inc. Its report is included as *Appendix F*. Following is a summary of the report.

The development of the proposed Kunia Golf Course would result in the urbanization of approximately 190 acres of sugarcane lands which are currently under cultivation by Oahu Sugar Company, Ltd. (OSCo). Assuming that U.S. sugar prices will continue to be high enough to justify continued sugar operations in Hawaii, an important question is whether Kunia Golf Course - combined with other planned and proposed projects - would eventually cause the closing of OSCo, either by reducing sugarcane acreage sufficiently to reduce economies of scale, and/or by contributing to a scattered and therefore inefficient plantation rather than a more compact and efficient one. Water is not an issue to the future viability of OSCo because water now used on fields proposed for the Kunia Golf Course as well as other proposed developments will remain with OSCo for use on other fields, unless the water is not needed by OSCo.

Assuming that all proposed projects will be approved, and that it would take about 20 years to realize the full development of all projects, OSCo would retain about 11,760 acres under cultivation in 1995 when its major lease expires. If yields increase from their current average of about 15 tons of raw sugar to 16 tons per acre by the end of 1995 (which is a conservative projection), then 11,760 acres would be sufficient land to maintain the current production of about 90,000 to 95,000 tons of raw sugar per year, without any loss in economies of scale. No layoffs of sugar workers would be expected, since OSCo has a practice of reducing its employment by attrition.

However, if the sequence of urbanization results in a scattered plantation that is too inefficient to operate at the current level

5. The OSCo irrigation reservoir is not on the property proposed for development as a golf course. Development near the reservoir will be coordinated with the U.S. Fish and Wildlife Service, although the Wildlife Service has no authority or jurisdiction over them.

of production, or if urbanization and loss of sugarcane acreage proceeds at too rapid a rate to be compensated by increasing yields, then a switch from a two- to one-mill operation would be required to maintain an efficient and economically viable operation. For this case, land requirements would be 8,440 acres, assuming a yield of 16 tons per acre and production of about 67,500 tons per year. This would provide a buffer of 3,320 acres from which to assemble an efficient plantation; this figure is based on 11,760 acres remaining after projected urbanization (assuming approval of all planned and proposed projects), minus the estimated 8,440 acres required for a one-mill operation. It is uncertain whether or not attrition would be sufficient to accommodate a reduction in employment associated with a switch to a one-mill operation.

At full development of all the planned and proposed projects (assuming approval of all projects), the amount of land under cultivation by OSCo would be about 8,520 acres. If development proceeds gradually, and if yields increase sufficiently (as a result of genetic engineering and other advances), then it is conceivable that OSCo could maintain production near its current level. In order for this to occur, the average yield would have to increase by about 45 percent, from 15 to 21.7 tons per acre.

It is more likely, however, that a switch to a one-mill operation would be required to maintain economic viability. Assuming an average yield of 18 tons per acre by the time the various projects reach full development (which is a conservative projection), a one-mill operation would require about 7,500 acres. This would provide a buffer of about 1,020 acres from which to assemble an efficient plantation; this figure is based on 8,520 acres remaining after urbanization (assuming approval and full development of all planned and proposed projects), minus the estimated 7,500 acres needed for a one-mill operation.

To summarize the above, Kunia Golf Course, in combination with other approved and proposed projects, is not expected to threaten the economic viability of OSCo; economies of scale and a compact efficient plantation would be possible by (1) switching to a single-mill operation, or (2) retaining a two-mill operation provided that urbanization proceeds gradually and yields can be increased rapidly to compensate for the loss of acreage.

If OSCo were to cease operations for whatever reason (most likely because of low sugar prices), the loss of jobs would be less than 450 direct jobs and 510 indirect jobs. This would be equivalent to the loss of a hotel about half the size of the Hyatt Regency in Waikiki. Immediately following the mill closing, significant economic loss and social disruption would occur. But over the long term, the economic loss would be absorbed easily by expanding economic opportunities in the Ewa/Central-Oahu area.

Assuming that OSCo does close, revenues to Waialua Sugar Company, Inc. (WSCO) would be decreased slightly because OSCo's contribution to shared terminal facilities and services would be lost. At worst, the economic effect would correspond to an increase in production cost of less than 2 percent. But rather than absorb increased terminal charges, a more profitable alternative would be to increase the refining capacity of C&H in Aiea to process all of the WSCO production. Refined sugar in excess of the Hawaii requirements would be shipped at favorable backhaul rates to Los Angeles and Seattle. Currently, Hawaiian sugar is delivered to these markets by rail from the C&H refinery in Crockett, California near San Francisco. Consequently, the net economic effect of the closing of OSCo on WSCO would be small, and would be unlikely to force the closing of WSCO - like OSCo, the future economic health of WSCO will be determined primarily by the price of sugar in the U.S. market.

The development of Kunia Golf Course on sugarcane acreage would eliminate the possibility of using these lands for diversified agriculture (including aquaculture). However, it is extremely doubtful that this would adversely affect the growth of diversified agriculture in Hawaii. There are four reasons for assessment: (1) an extensive amount of prime-agricultural land and water has been freed from sugar and pineapple production because of past mill closing and reductions in operations; (2) a very real possibility exists that additional land and water will be freed from sugar production given the outlook for low sugar prices; (3) some - if not most or even all - of the sugar operations will make their lands available for profitable replacement crops to the extent that such crops are available; and (4) compared to the available supply, a very small amount of land and water is required to grow proven and promising crops to achieve a realistic level of food and animal-feed self-sufficiency, and to increase exports. The increasing availability of prime agricultural land in Hawaii is part of very long-term and accelerating trends occurring throughout most developed and developing market economies. Productivity and yields have been increasing faster than population growth, and genetic engineering and other advances, combined with slower population growth, indicate an acceleration of these trends. Rapid productivity and yield increases require that labor, land, and other resources be withdrawn from agriculture in order to restore balanced markets and to increase farm income for those who remain.

Since the Kunia Golf Course is not expected to adversely affect the economic viability of OSCo, and would not limit the growth of diversified agriculture, the project is consistent with the major thrust of the agricultural position of the Hawaii State Plan, the State Agriculture Function Plan, and the General Plan of the City and County of Honolulu. This thrust is to preserve the economic viability of plantation agriculture and to promote the growth of diversified agriculture. Also, the project would

provide a public benefit (i.e., increased employment) which would override the proposed "important agricultural lands" designation of the Land Evaluation Site Assessment (LESA) Commission. Furthermore, the project would not adversely affect cultivation of adjacent sugarcane acreage and, therefore, complies with the Hawaii Right to Farm Act.

h. Open Space

A golf course is essentially an open space use. It will complement the open space character of the immediate area.

i. Impact of Fertilizers and Pesticides

The summary, conclusions and recommendations of a study by Richard E. Green, Ph.D. and Charles L. Murdock, Ph.D. of the University of Hawaii concerning the use and environmental impact of chemicals likely to be used on the proposed golf course is shown below. (The study in its entirety is included as *Appendix I* [color code: Orchid] in the Draft EIS.) Also included below is a discussion of chemical impacts on bird life.

Table 1. Approximate fertilizer use rates for different areas of a typical 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	3 weeks	1.15
Fairways	50	1.5	8 weeks	10.0
Roughs	30	1.0	3 months	2.60
Total	86			14.60

Table 2. A typical pesticide program for golf courses in Hawaii.

Turfgrass area	Area (acres)	Chemical	Frequency	Rate/application	Annual total
I. Herbicides					
A. Greens	3	MSMA	6 times/year	2lb. ai./acre	36 lb. ai
		bensulide	2 times/year	12 lb ai./acre	72 lb. ai
B. Tees	3	MSMA	6 times/year	2 lb. ai./acre	36 lb. ai
		33 Plus	3 times/year	1 pint/acre	9 pints
		bensulide	2 times/year	12 lb. ai./acre	72 lb. ai
C. Fairways	50	MSMA	6 times/year	2 lb. ai./acre	600 lb. ai
		33 Plus	3 times/year	1 pint/acre	19 gallons
		metribuzin	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.
		diazinon	As needed	5 lb. ai./acre	Approx. 250 lb. ai.
III. Fungicides					
A. Greens	3	metylaxyl	As needed	1.3 lb. ai./acre	Approx. 25 lb. ai.
		chlorothalonil	As needed	8 lb. ai./acre	Approx. 72 lb. ai.
B. Tees	3	metylaxyl	As needed	1.3 lb. ai./acre	Approx. 25 lb. ai.
		chlorothalonil	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.

Summary and Conclusions

Analysis of the site and management factors involved in golf course maintenance suggest that it is unlikely that development of the proposed Kunia golf course would pose environmental risks associated with the use of chemical fertilizers and pesticides. The site is a relatively low-rainfall (approximately 31 inches/year) high-ET (approximately 53 inches/year) area with a net ET deficit. There will be little recharge from rainfall in this area except during unusually high rainfall periods. Since such events will occur at infrequent intervals, the leaching of significant quantities of fertilizer nutrients and pesticides is not expected. There is no historical evidence of the leaching of herbicides used in sugarcane production in this area to the Pearl Harbor aquifer, even through irrigation of sugarcane provided much more recharge than will result from irrigation of turf on the golf course. Proper irrigation practices will contribute little recharge, so leaching of chemicals should not be a problem.

Nitrate would be the only fertilizer element of concern in runoff waters. However, because of the small amount applied at any one application, and the large dilution from water off-site in the surface drainage way, nitrate content of drainage water would be insignificant.

With the exception of herbicides, pesticide applications are normally made only to greens on golf courses. Since greens comprise only approximately 3 acres of a typical golf course, contribution of fungicide and insecticide contamination of surface waters would be small. The herbicides used on golf fairways are primarily MSMA, metribuzin and 33 plau (or other mixtures of 2,4-d, mecoprop and dicamba). These herbicides are rapidly degraded and/or are tightly sorbed on soil colloids and organic matter and have little potential for water contamination.

Development of a golf course in the proposed area would likely reduce the sediment load in Waikele stream. Data of Green et al. (1977) showed that diuron in West Loch of Pearl Harbor was associated with sediment. While the levels were not high, sediment was apparently the major source of contamination. Turfed areas would reduce the sediment level because of the

permanent nature of turf and the trapping of sediment as it flows through grassed drainage ways.

It is apparent that sugarcane culture has not led to serious contamination of either surface or groundwaters in the site of the proposed golf course, or elsewhere on Oahu. Because of the permanent nature of turfgrass cover, the relatively small area of a golf course to which fertilizers and pesticides are applied, and the nature of the pesticides used in turfgrass management, there is perhaps less likelihood of contamination of waters by chemicals applied in maintenance of a golf course.

Recommendations

Irrigation management is critical to the conclusions reached above. If excessive irrigation water is applied, the likelihood of contamination of groundwater, especially with nitrate, is increased. 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. Excellent discussion of irrigation scheduling can be found in the book *Golf Course and Grounds Irrigation and Drainage* (Jarret, 1985).

As our conclusions are also based on sound management practices with regard to fertilizer and pesticide application, we recommend that a well qualified Golf Course Superintendent (preferably a Certified Golf Course Superintendent) be given the responsibility of managing the golf course.

Potential for Poisoning of Migratory Birds and Endangered Hawaiian Waterbirds by Chemicals Applied in Maintenance of the Proposed Kunia Golf Course

The fertilizers, herbicides, 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 (see *Appendix Table 1* of the EIS report for the Kunia Golf Course, attached). The only chemicals used in golf course maintenance in Hawaii which are highly toxic to birds are the organic phosphate insecticides, especially diazinon and chlorpyrifos.

Diazinon in particular has come under close scrutiny by the Environmental Protection Agency (EPA) because of its killing of migratory waterbirds on golf courses in the northeastern mainland United States. RPAR hearings are presently being held to show cause why all labeled uses of diazinon on turfgrasses should not be cancelled. To the best of our knowledge, the reported bird kills were all associated with very heavy applications of a granular formulation of diazinon, resulting in birds (Canadian geese) picking up granules.

Application of proper rates of this pesticide and/or use of a liquid spray might have prevented bird injury in all cases. Diazinon has been used on Hawaii golf courses for more than 20 years (both granular and liquid formulations). As far as we are aware, there have been no reports of bird injury from this pesticide on golf courses in Hawaii. From observations of birds using grassed areas and ponds of golf courses in Hawaii, it appears that golf courses are excellent habitats for birds.

Although both diazinon and chlorpyrifos are highly toxic to birds, they are strongly absorbed on the thatch layer of turf and move little from the site of application. One reason for their weakness in controlling soil infesting insects is the inability to get the insecticides through the thatch layer to the depth needed to contact these insects. Recent studies (Sears and Chapman, 1980; Tashiro, 1980) have shown that diazinon and chlorpyrifos applied to turfgrasses do 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 they are rapidly degraded in the soil, both by hydrolysis and microbial action. Data on persistence of eight organic phosphate insecticides are given below.

Because of the absorption of organic phosphate insecticides on organic layers in turf and their rapid break down, there is little chance of their movement from grasses areas into the ponds associated with the proposed movement from grasses 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.

**Half-life and time required for 95%
disappearance of eight organic phosphate
insecticides in non-sterile sandy loam soil
(adapted from data of Miles, et al., 1979)**

INSECTICIDE	HALF-LIFE (in weeks)	WEEKS FOR 95% DECOMPOSITION
Diazinon	<1	1
Chlorpyrifos	<1	1
Parathion	<1	3
Fensulfothion	<1	4
Chlorfenvinphos	<1	5
Trichloronat	1.5	20
Fonofos	20	20
Ethion	>24	>24

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. The attached table shows that carbaryl and trichlorfon are less toxic to birds than diazinon or chlorpyrifos. In most cases these insecticides may be substituted for diazinon or chlorpyrifos with little loss of effectiveness. For bermuda grass mite control, however, diazinon has been shown to be much more effective than other insecticides tested.

The labeling of pesticides for particular uses by epa with strict laws (enforced by the Hawaii Department of Agriculture) for their use are perhaps the best assurance of protection of humans and wildlife. It is impossible to predict what pesticides will be developed in the future. However, all pesticides must be applied in compliance with federal and state laws regulating their use. Hazards to both humans and wild life 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.

Air Quality Impact of Pesticides

The pesticides used on golf courses are of relatively low mammalian toxicity, ranging from hundreds to several thousand mg/kg body weight. Because they are not highly volatile and are applied in dilute sprays (50 to 100 gallons of spray solution per acre) to open areas, there is little likelihood of toxic levels in the atmosphere because of volatility once the pesticides are applied. The greatest danger of significant airborne concentrations 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 smaller than 100 microns diameter are highly subject to drift. Table 1 below shows a typical distribution of droplet sizes for a flat-fan nozzle (the type used in most golf course spray equipment).

Table 1. Droplet size range for a typical flat-fan nozzle at 20 and 40 psi. (from Hofman et al. 1986¹)

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

At the low concentrations used in pesticide application, this would not result in significant quantities 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 pesticide coverage, spraying in periods of high wind is not common practice. Table 2 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% of the total spray deposited was only 17 feet.

Table 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).

Comparison	Pressure (psi)	Wind speed (mph)	Percent deposited		Distance to drop to 1% of volume
			4 ft.	8 ft.	
14" nozzle ht.	40	3.5	3.1	0.6	7.0
27" nozzle ht.	40	3.5	5.9	1.5	13.0
18" nozzle ht.	30	5.3	9.3	2.2	14.0
18" nozzle ht.	25	9.9	10.3	3.1	15.5
18" nozzle ht.	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 later 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. There is no housing planned on the property of the proposed golf course. In the event that housing is developed near the golf course later, sufficient buffer space with tall vegetation should be maintained to reduce the chance of airborne spray particles.

The worst 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.

Additional discussion on Air Quality Impact of Pesticides can be found in SECTION VI.E.2.

References

1. Hofman, Vern, Henry Kucera and Mike Berge. 1986. Spray equipment and calibration. AE73 revised. Cooperative Extension Service. North Dakota State University, Fargo, North Dakota. 31 pp.

- 6. Hazards
 - a. Nuisances and Site Safety
N/A
 - b. Thermal Explosive
N/A

c. Airport Clear Zone (APZ)

N/A

VII. PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AND MITIGATING MEASURES

<u>Impacts</u>	<u>Mitigating Measures</u>
Increased Traffic	Study (<i>Appendix A</i>) indicates that the project will not have significant impact on traffic conditions on Kunia Road. Separate lanes for right and left turns exiting the site will be provided.
Storm water runoff	Earthen berms will be constructed which will create retention basins that will prevent runoff from the site into Waiahole Ditch.
Wildlife hazards	Proper selection and application of chemicals, as recommended by Green and Murdoch (<i>Appendix I</i>), will pose little or no hazard to birds. Also, refer to applicant's response letter to the U.S. Fish and Wildlife Service.
Sewage treatment	Connection will be made to the existing Municipal system at Village Park. The Kunia wastewater pump station will require expansion.
Construction impacts including noise, dust grading and traffic	Compliance with State Department of Health rules and regulations governing noise and vector control and compliance with City and County of Honolulu Ordinances governing grading and other construction activities

VIII ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES AND THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY.

Construction and operation of the proposed golf facility will result in the irretrievable commitment of resources. During construction, labor, land building materials and capital will be committed to the project. Once committed, labor is irretrievable, and the salvage value of building materials used in the construction is likely to be small or nil for any other purpose. Capital committed to the project will not be available for competing uses, and if the project is not economically viable may be irretrievably lost. The land, once improved with a golf course and club house facilities is likely to remain in that use for the economic life of the

improvements. It should be noted, however, that the bulk of the land will be committed to golf course construction, which, generally maintains the underlying land's agricultural capacity. Further that golf course construction is less intensive from a labor and capital standpoint than other types of development, ie. housing or commercial use, therefore commitment of land to golf course usage does not represent an irretrievable commitment.

Ongoing operation of the golf course is likely to result in a relatively long term commitment of land with agricultural potential to a recreational and open space use. This loss of agricultural potential is not expected to have an impact on the agricultural production or potential agricultural production of the State of Hawaii or the City and County of Honolulu because of the large amount of agricultural land that has been released and is forecasted to be released from sugar and pineapple operations.

Water consumption for the proposed golf facility will be less than that of the current agricultural operation. Water available for agricultural use will not be impacted. Changes in aquifer recharge appear to be minimal.

Short and long term environmental impacts of the proposed golf facility appear to be negligible with proper mitigation. Short and long term economic benefits of the project, including construction and operating jobs and contribution to state and local tax revenues appear to be significant. These benefits appear to be sustainable over the long run.

Assuming the golf course enterprise is successful the capital committed to the development will be paid back and can then be used for alternative purposes. A successful venture may in fact lead to capital creation which in the long run would provide an increase in; the capital available for investment.

The development poses no long term health or safety risks.

IX. UNRESOLVED ISSUES

The water source for the proposed development is the only unresolved issue. This issue will be resolved in the normal course of the approval process. In any event the project will not proceed prior to resolution of this issue.

The text of the EIS indicates that there are a number of alternatives available for the applicant to pursue in order to meet the water requirements of the project. At the present time, however, the Department of Land and Natural Resources is awaiting the results of a study that it commissioned to evaluate the sustainable yield of the Pearl Harbor Ground Water Control Area (in which the proposed development is located). A draft of the study was received in February of 1988 from the consultant (George Yuen & Assoc.). Agency and water user review and comment may delay the issuance of the final report till early 1989. The study is expected to assist the DLNR staff on making recommendations for water well drilling requests and water allocation requests. Whatever the results of the study it seems appropriate that the applicant's request should be considered by the water allocation authority along with all of the other requests for water sources and allocations. In this way the decision making authority can weigh the benefits

available from a wide range of proposals and choose what they consider to be the most appropriate allocation plan.

X. ALTERNATIVES CONSIDERED

A number of alternatives were considered. In each alternative, it is recognized that Oahu Sugar Company has a lease on the property that runs until 1996, which allows the growing of sugar cane. None of the alternatives, including the proposed action, will adversely impact the current lease.

A. NO ACTION

This alternative would result in no action being taken to implement the development of a golf course. Given the outlook on sugar, the abundance of agriculturally zoned lands, the limited market for crops, and the low economic return on investment (see *Appendix F*), it is likely this alternative will ultimately result in the land becoming inactive, vacant and unproductive. None of the economic benefits of the proposed development would occur. However, any adverse impact of the proposed development will also not occur.

B. AGRICULTURAL CONDITIONAL USES

The Land Use Ordinance (LUO) permits certain uses as Conditional Uses, Type 1 and Type 2.

Type 1 (public hearing not required)

Agricultural product processing, minor

Broadcasting antennae, line-of-sight relay devices

Centralized bulk collection, storage, and distribution of agricultural products

Helistops

Use of Historic Structures

Neighborhood grocery stores

Resource extraction

Sale and service of machinery used in agricultural production

Saw mills

Storage and sale of seed, feed, fertilizer and other products essential to agricultural production

Utility installations, Type B

Wind machines with a rated capacity of more than 100 kilowatts

Type 2 (public hearing required)

Agricultural products processing, major, on a site area of one acre or less

Group living facilities

None of the uses listed are considered economically viable uses for the property because of the following reasons:

The property's relative isolation.

The specialized nature and technical needs of some of the uses.

No demonstrated market demand or public need.

Furthermore, it is likely that some of the uses listed would result in adverse impacts greater than the proposed action.

C. RESIDENTIAL

This alternative would require, similar to the proposed action, a development plan amendment and a land use boundary change. In addition, a General Plan amendment would be required to increase the population allocation for the Central Oahu area. The City Council in the past has rejected such amendments.

Summary: As discussed under the agricultural alternative there is a possibility that the sugar operation presently being undertaken on the subject property could be terminated at any time with the property owner left to scramble for an alternative use. Hawaii's governor John Waihee in November of 1987 announced that the restructuring of Amfac, Oahu Sugar's parent company might have dire consequences to the State of Hawaii including the possibility of a cessation of Oahu Sugar Operations. Earlier in 1987 the closure of Waialua Sugar Company, Oahu's only other sugar operation was announced due to poor financial performance. While this closure was recinded these two actions point up the uncertain nature of sugar operations on Oahu.

XI. AN INDICATION OF WHAT OTHER INTERESTS AND CONSIDERATIONS OF GOVERNMENT POLICIES ARE THOUGHT TO OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION

Section V of the Draft EIS indicates that the proposed project is in general compliance with a number of state and county policies relating to economic growth. Comments made by the Department of Agriculture indicate a potential negative impact on the state's agricultural productivity potential. While the applicant believes that it has satisfactorily responded to the comments and the at the proposed project will have no impact on the state's agricultural capabilities, the discussion does point out that state policies contain an number of goals.

Pursuit of individual goals/developments which are in compliance with stated governmental policies may at the same time be in conflict with other stated government policies simply because the same resources must necessarily be allocated among and between projects.

The text of the EIS indicates that the proposed golf course is in compliance with and implements many state and city policies. It also indicates that the project would have few if any environmental impacts and a number of positive economic impacts.

XII. EIS NOTICE OF PREPARATION

The EIS Notice of Preparation (NOP) was officially published in the Office of Environmental Quality Control (OEQC) Bulletin on November 8, 1987. The following agencies, organizations and persons received a copy of the NOP:

A. FEDERAL AGENCIES

- * 1. U.S. Department of Agriculture, Soil Conservation Services
- * 2. U.S. Department of Interior, Fish and Wildlife Service +
- 3. U.S. Department of Transportation

B. STATE AGENCIES

- * 1. Department of Agriculture +
- * 2. Department of Business and Economic Development +
- * 3. Department of Health +
- * 4. Department of Land and Natural Resources
- * 5. Department of Transportation +
- 6. Office of Environmental Quality Control
- 7. Office of State Planning
- * 8. State Land Use Commission (upon request) +
- * 9. University of Hawaii Environmental Center +
- 10. University of Hawaii Water Resources Research Center

C. COUNTY AGENCIES

- 1. Mayor's Office
- * 2. Board of Water Supply +

C. COUNTY AGENCIES (CONTINUED)

- 3. Building Department
- * 4. Department of General Planning +
- * 5. Department of Land Utilization +
- * 6. Department of Parks and Recreation
- * 7. Department of Public Works +
- * 8. Department of Transportation Services
- * 9. Honolulu Fire Department +
- * 10. Honolulu Police Department

D. COMMUNITY ORGANIZATIONS/PERSONS

- 1. American Lung Association of Hawaii
- 2. Audubon Society of Hawaii
- 3. Campbell Estate
- 4. Conservation Council for Hawaii
- 5. Councilman Randy Iwase
- 6. Del Monte Corporation
- 7. Ekahanui, Inc.
- * 8. Hawaiian Electric Company +
- * 9. Hawaiian Telephone Company
- 10. Life of the Land
- 11. Mililani/Waipio/Melemanu Neighborhood Board No. 25
- 12. Mililani Town Association
- * 13. Oahu Sugar Company +
- 14. Representative Mitsuo Shito
- 15. Senator Ron Menor
- 16. Sierra Club, Hawaii Chapter
- 17. Wahiawa Neighborhood Board No. 26
- 18. Wahiawa Community and Businessmen's Association
- 19. Waipahu Community Association

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D. COMMUNITY ORGANIZATIONS/PERSONS (Continued)

20. Waipahu Neighborhood Board No. 22
21. Waipahu 2000 Community Council
22. West Oahu Soil and Water Conservation District
(at the request of Oahu Sugar Company)

Requests for consulted part status came from the state Land Use Commission and one of the consulted parties (Oahu Sugar Company) requested that West Oahu Soil and Water Conservation District be made a consulted party. Both were sent copies of the NOP.

An asterisk (*) placed before the above list of agencies, organizations and persons indicates receipt of comments from the consulted parties (20 total). Most comments received met the 30-day deadline period. In addition, comments on the NOP were received from the Garst Seed Company.

A plus (+) sign following the list of agencies, organizations and persons indicates a response from the applicant to the comments received (14 total). In addition, applicant responded to comments received by the Garst Seed Company. The remaining 6 comments from consulted parties required no response. Copies of the correspondence received and the correspondence sent by the applicant in response are included, COLOR Code Tan. All responses were dated January 15, 1988.

XIII. DEIS DISTRIBUTION/COMMENTS/RESPONSES

The DEIS was officially received by the Office of Environmental Quality Control on January 20, 1988, and was published in the January 23, 1988 OEQC Bulletin. Sixty (60) copies of the DEIS were provided to OEQC. OEQC's distribution list is shown on pages 60, 61, and 62. The deadline for receiving comments was set for March 8, 1988.

A total of 22 comment letters were received and/or postmarked by the deadline date of March 8, 1988. A total of 7 response letters were sent. The remaining comment letters required NO RESPONSE. Following is a summary list of comment letters received within the 45-day review period. A plus (+) sign following the name of the agency, organization and/or person means that a response to the comments were sent by the applicant.

FEDERAL AGENCIES

1. U.S. Department of Agriculture, Soil Conservation Service
2. U.S. Department of the Interior
3. U.S. Department of the Army +
4. U.S. Department of the Navy

STATE AGENCIES

1. Department of Agriculture +
2. Department of Business and Economic Development +
3. Department of Business and Economic Development, Housing Finance and Development Corporation
4. State Department of Defense
5. Department of Land and Natural Resources
6. Department of Public Works
7. Office of Environmental Quality Control, Energy Division
8. Land Use Commission
9. University of Hawaii Environmental Center +
10. Department of Health

COUNTY AGENCIES

1. Building Department
2. Department of Land Utilization
3. Honolulu Fire Department
4. Department of Housing and Community Development
5. Honolulu Police Department
6. Department of General Planning +
7. Department of Public Works +

COMMUNITY ORGANIZATIONS/PERSONS

1. Hawaiian Electric Company +

Copies of the correspondence received and the correspondence sent by the applicant in response are included, COLOR CODE LIME. All applicant response letters were prepared and mailed including response to late comments (see Section XIV) within the 14-day period following the end of the 45-day public review period.

XIV. LATE COMMENT LETTERS

The 1987 Legislature amended the period of time for public review and comments by extending the time period from 30-days to 45-days. According to the Environmental Impact Statement Rules, Title 11, Chapter 200, Subchapter 7, Section 11-200-22, comment letters not received or postmarked to the approving agency or accepting authority (City Department of General Planning in this case) within the 45-day period (in this case, March 8, 1988) need not be considered or responded to by the applicant.

Two (2) agencies failed to meet the deadline for comments, as specified in the EIS Rules - the HONOLULU BOARD OF WATER SUPPLY and the AMERICAN LUNG ASSOCIATION OF HAWAII.

The applicant has reviewed the options available to him under the EIS Rules and, for purposes of producing an EIS that is as complete as possible, has taken action to respond to the comments. Copies of the later correspondence received and the correspondence sent by the applicant in response are included with the correspondence received within the 45-day time period. SEE COLOR CODE LIME.

Note: Subsequent to the finished typing of this EIS, the applicant received an additional late comment letter from the Office of Hawaiian Affairs (OHA) (March 21, 1988). OHA's letter and the applicant's response is included with the others.

DISTRIBUTION LIST

E.A.
 APPLICANT ACTION
 AGENCY ACTION

EIS
 APPLICANT ACTION
 AGENCY ACTION

Title: Proposed Golf Course

Location: Kunia, Oahu

Proposing Agency/Applicant: Nihonkai Lease Co., Ltd.

Accepting Authority/Approving Agency: City and County of Honolulu Dept. of General Plng.

Deadline for Comments: March 8, 1988

Date Sent/By: January 22, 1988 *lt*

STATE AGENCIES

	<u>NO. COPIES</u>	<u>REMARKS</u>
<u>OEQC</u>		
<u>Dept. of Agriculture</u>	1	
<u>Dept. of Accounting and General Services</u>	1	
<u>Dept. of Defense</u>	1	
<u>Dept. of Education (a)*</u>	1	
<u>Dept. of Hawaiian Home Lands (a)*</u>		
<u>Dept. of Health</u>		
<u>Dept. of Land and Natural Resources</u>	1	
<u>DLNR State Historic Preservation Officer</u>	3	
<u>Dept. of Business and Economic Development</u>	1	
<u>DBED Library</u>	1	
<u>Housing Finance & Development Corporation</u>	1	
<u>Dept. of Transportation</u>	1	
<u>State Archives</u>	3	
<u>State Energy Office</u>	1	
<u>State Land Use Commission</u>	1	
<u>UNIVERSITY OF HAWAII</u>		
<u>Environmental Center</u>		
<u>Marine Programs (a)*</u>	4	
<u>Water Resources Research Center</u>	1	
<u>FEDERAL</u>		
<u>Army-DAFE (Facilities Eng.-USASCH)</u>		
<u>Environmental Protection Agency (a)*</u>	1	
<u>Navy</u>		
<u>Soil Conservation Service</u>	1	
<u>U.S. Army Corps of Engineers</u>	1	
<u>U.S. Coast Guard</u>	1	
<u>U.S. Fish and Wildlife Service</u>	1	
<u>U.S. Geological Survey (a)*</u>	1	
<u>Library Copy:</u>	1	

Total Received: 60
 Total Distributed: 60
 File Copy: 1

Copy of Distribution List Sent to: DGP; William E. Wanket
 Date: 1/27/88

(a)* Copy desired only if project involves the agency's responsibilities.

NEWS MEDIA

NO. COPIES

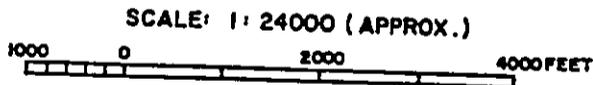
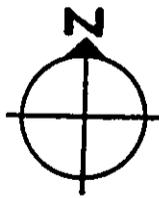
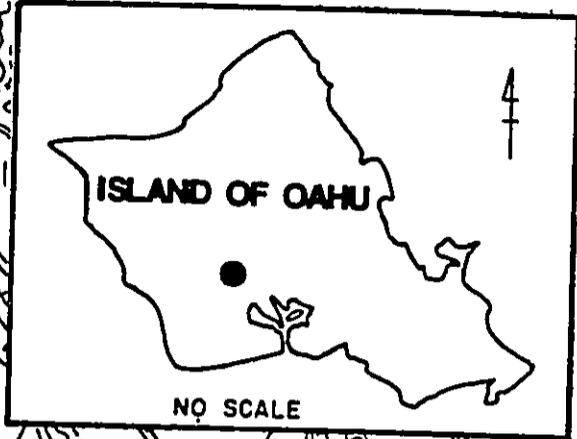
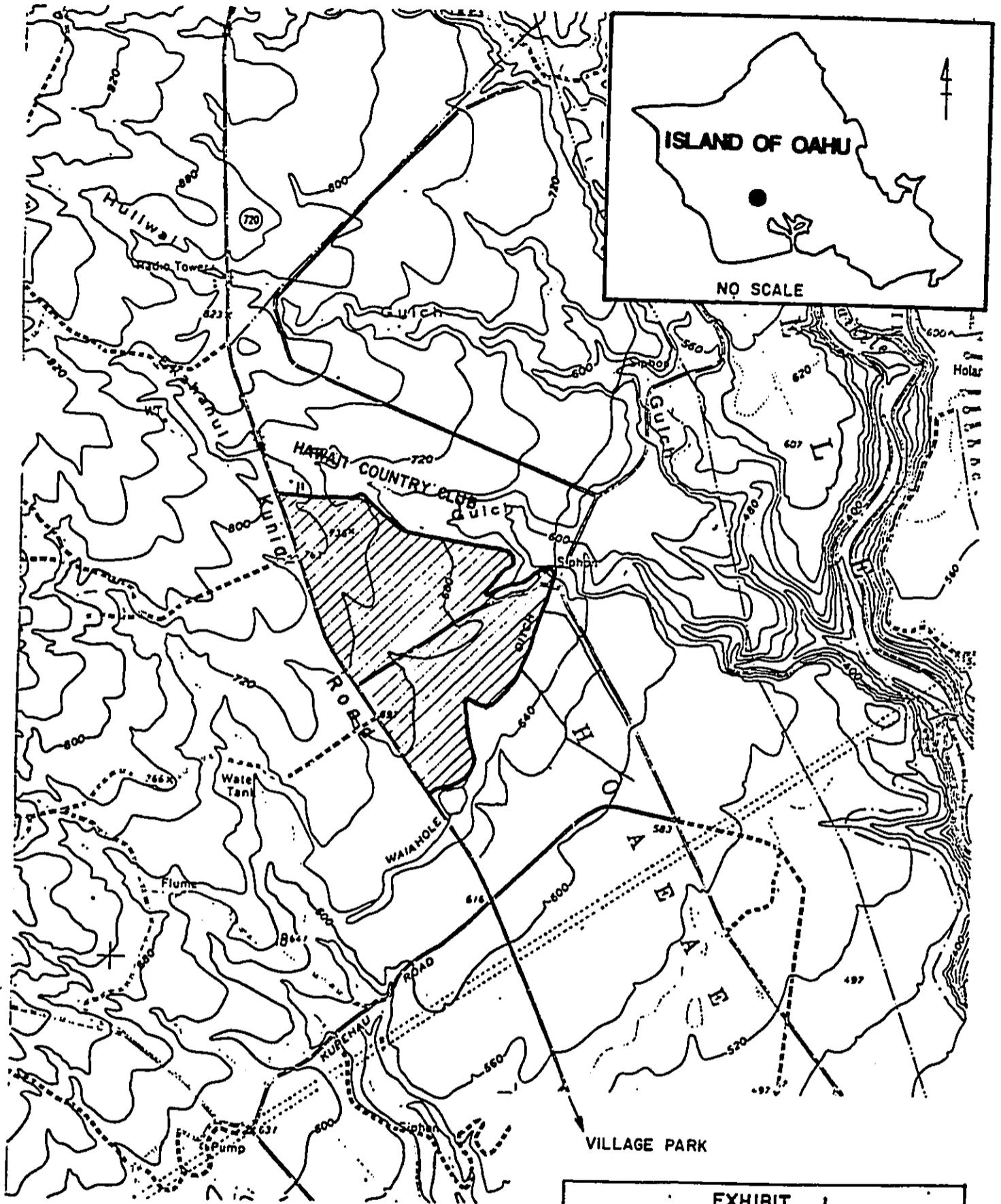
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<input type="checkbox"/> Ka Molokai (b)**		
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<input type="checkbox"/> U.H. Hamilton Library, Hawaiian Collection	1	
<input type="checkbox"/> Legislative Reference Bureau	1	

(b)** Copy desired only if project is in respective county.

LIBRARIES**NO. CO. IES**

Page 62

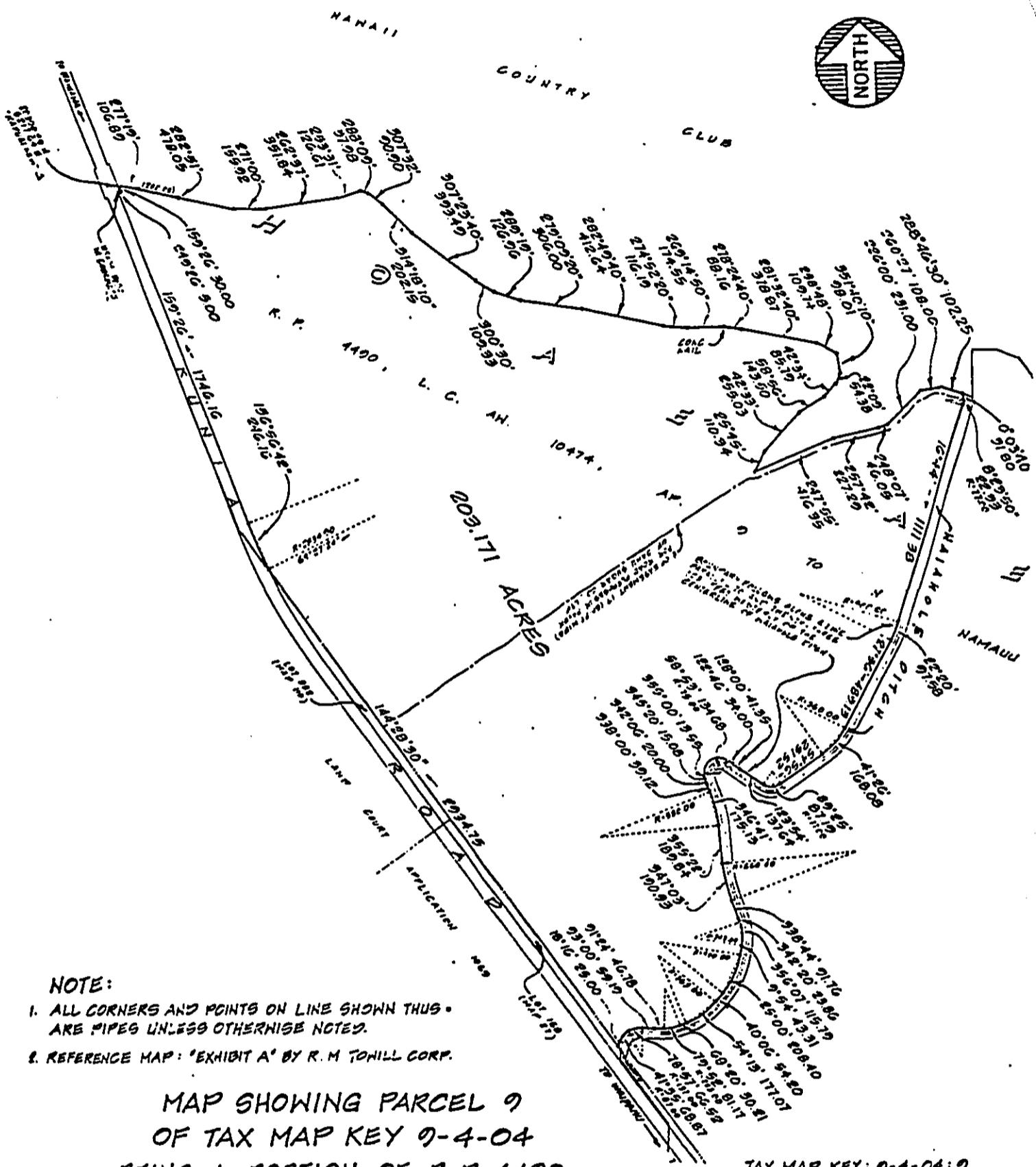
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Aina Haina Library		
Ewa Beach Community-School Library		
Hawaii Kai Library		
Kahuku Community-School Library		
Kailua Library		
Kalihi-Palama Library		
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Manoa Library		
McCully-Moiliili Library		
Mililani Library		
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Waiatua Library		
Waianae Library		
Waikiki-Kapahulu Library		
Waimanalo Community-School Library		
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HAWAII		
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Keau Community-School Library		
Kealahou Library		
Laupahoehoe Community-School Library		
Mountain View Community-School Library		
Pahala Community-School Library		
Pahoa Community-School Library		
Thelma Parker Memorial Library/Waimea Area Library		
MAUI		
Kahului Library		
Lahaina Library		
Makawao Library		
MOLOKAI		
Molokai Library		
LANAI		
Lanai Community-School Library		
KAUAI		
Hanapepe Library		
Kapaa Library		
Koloa Community-School Library		
Waimea Library		



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

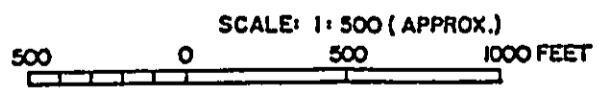
EXHIBIT I
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

GENERAL LOCATIONS



NOTE:
 1. ALL CORNERS AND POINTS ON LINE SHOWN THUS ARE PIPES UNLESS OTHERWISE NOTED.
 2. REFERENCE MAP: 'EXHIBIT A' BY R. M. TOHILL CORP.

MAP SHOWING PARCEL 9
 OF TAX MAP KEY 9-4-04
 BEING A PORTION OF R. P. 4490,
 L.C.A.N. 10474, AP. 9 TO N. NAMAUU
 AT HOAEAE, ENA, OAHU, HAWAII

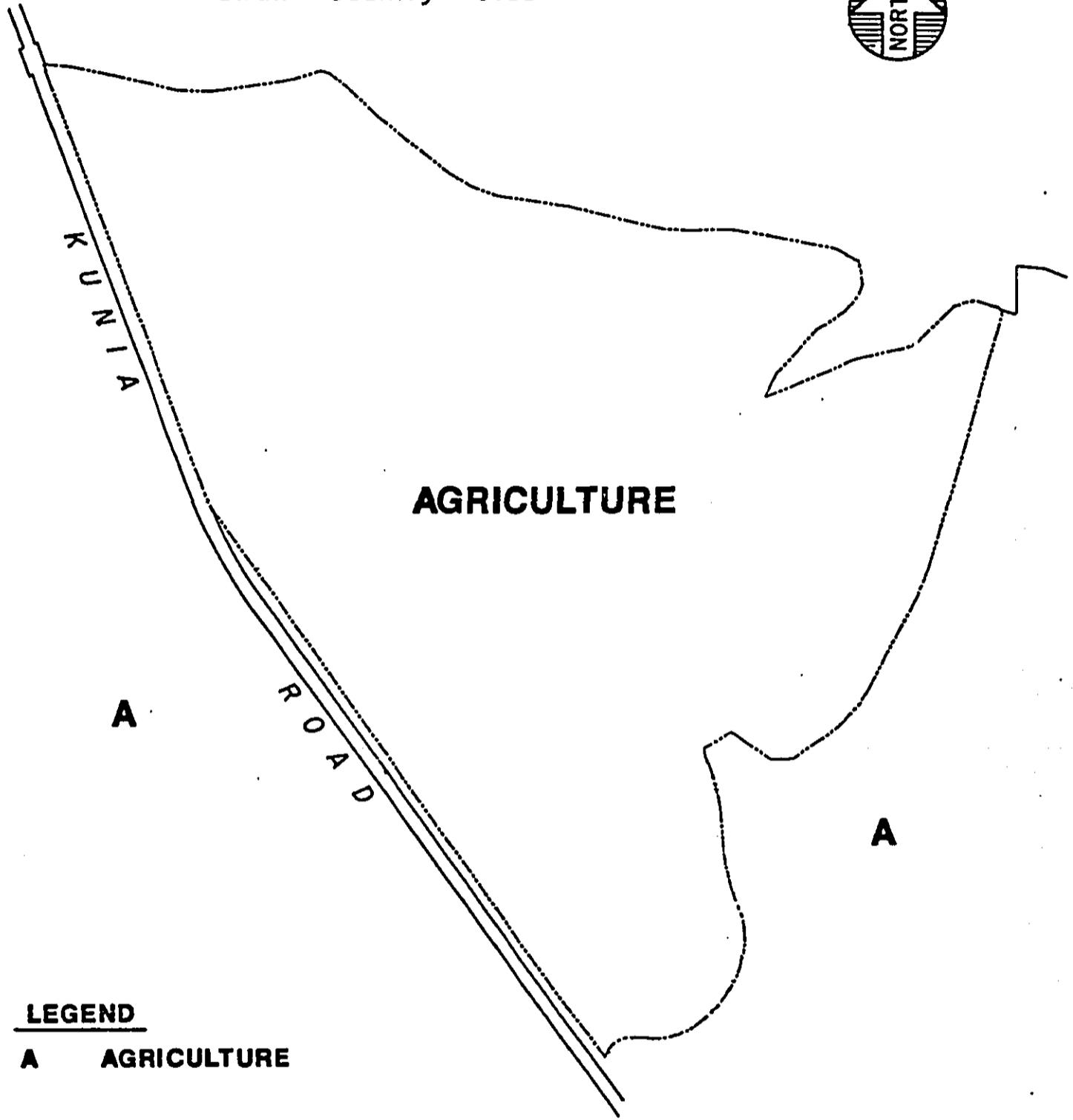


HIDA, OKAMOTO & ASSOCIATES, INC.
 CONSULTING ENGINEERS
 HONOLULU, HAWAII

EXHIBIT 2
 DEVELOPMENT PLAN AMENDMENT
 KUNIA GOLF COURSE
 GENERAL BOUNDARIES
 PROPERTY MAP

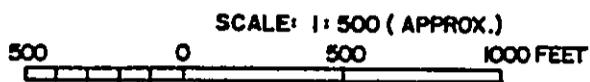
TAX MAP KEY: 9-4-04:9

Hawaii Country Club



LEGEND

A AGRICULTURE



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 3
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

STATE LAND USE CLASSIFICATION

Hawaii Country Club



P

KUNIA

AGRICULTURE

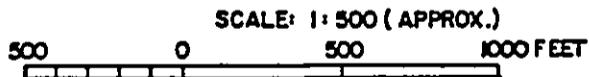
A

ROAD

A

LEGEND

- P** **PRESERVATION**
- A** **AGRICULTURE**



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 4
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

DEVELOPMENT PLAN
LAND USE DESIGNATIONS



Hawaii Country Club

P-2

KUNIA

AG-1

ROAD

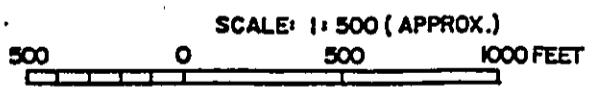
AG-1

AG-1

LEGEND

P-2 GENERAL PRESERVATION DISTRICT

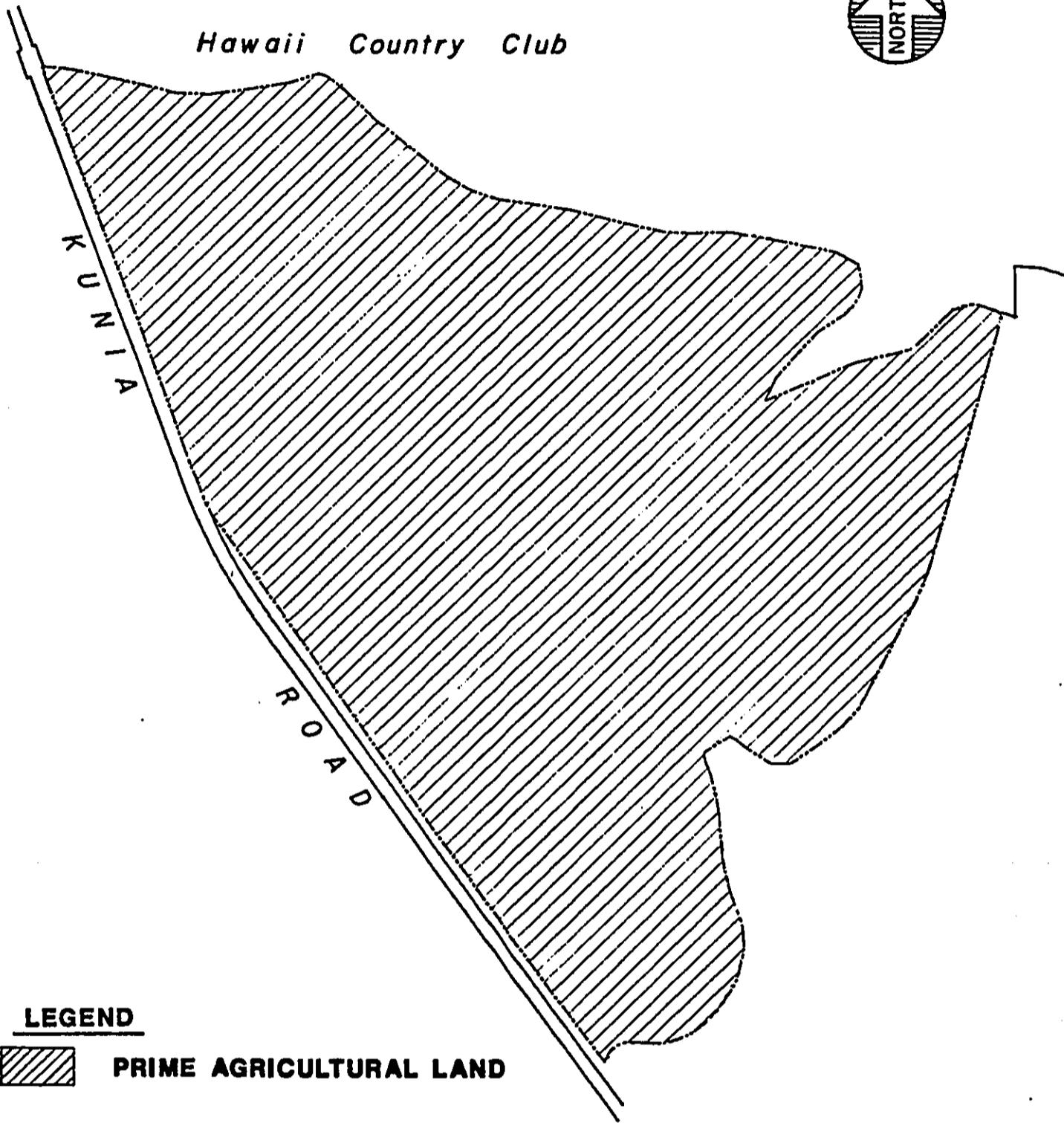
AG-1 RESTRICTED AGRICULTURAL DISTRICT

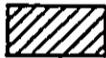


HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 5
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES
LUO ZONING DISTRICTS

Hawaii Country Club



LEGEND
 **PRIME AGRICULTURAL LAND**

SCALE: 1: 500 (APPROX.)
500 0 500 1000 FEET

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 6
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

ALISH CLASSIFICATION



Hawaii Country Club

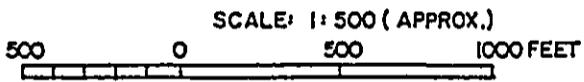
KUNIA

A46i / A47i

ROAD

LEGEND

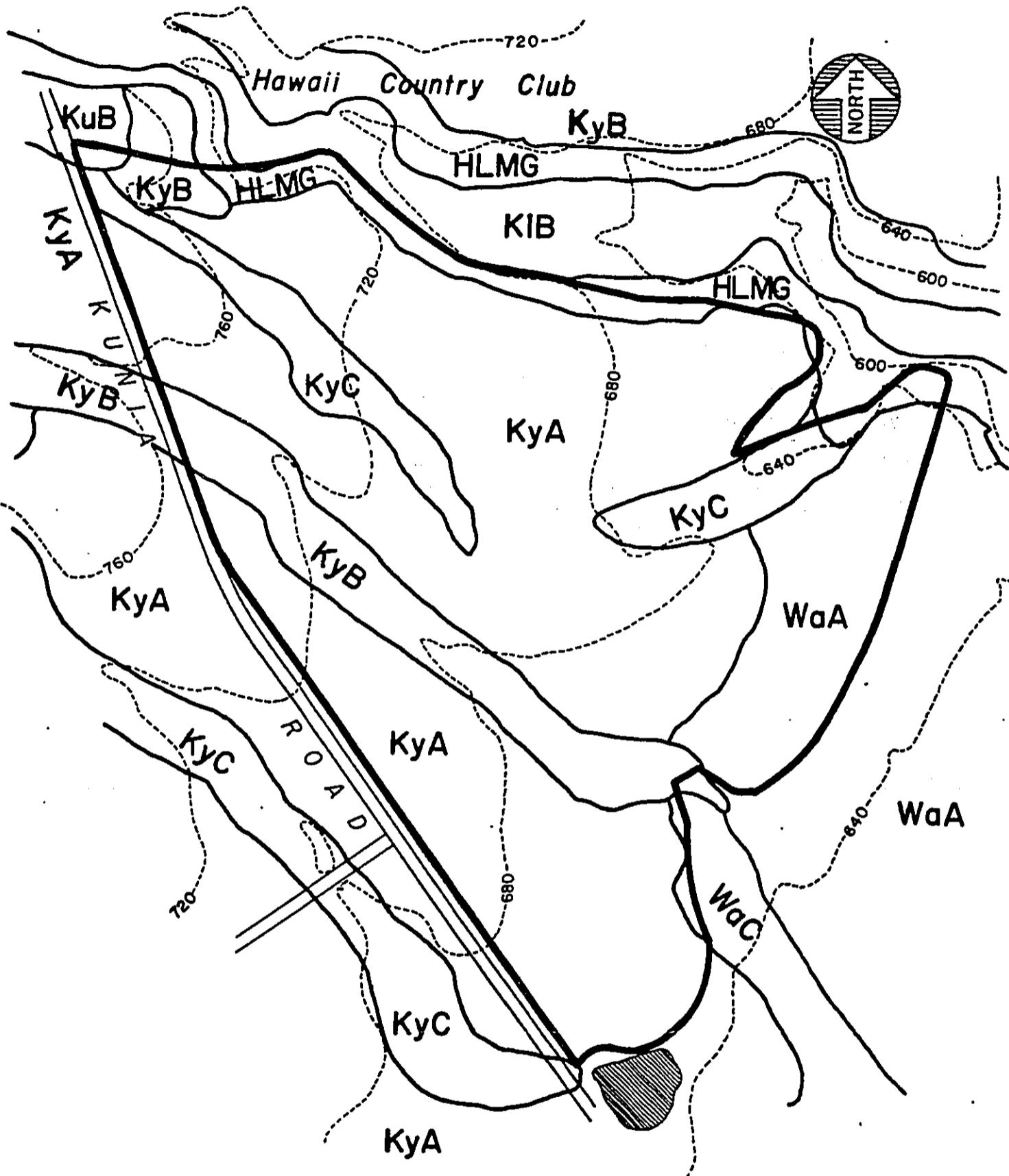
- Master Productivity Rating
 - Land Type, Number and Letter "i" If Irrigated.
- A11



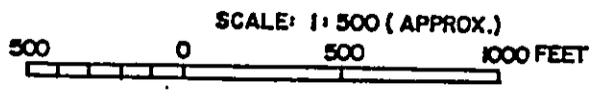
HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 7
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

LAND STUDY BUREAU
CLASSIFICATION



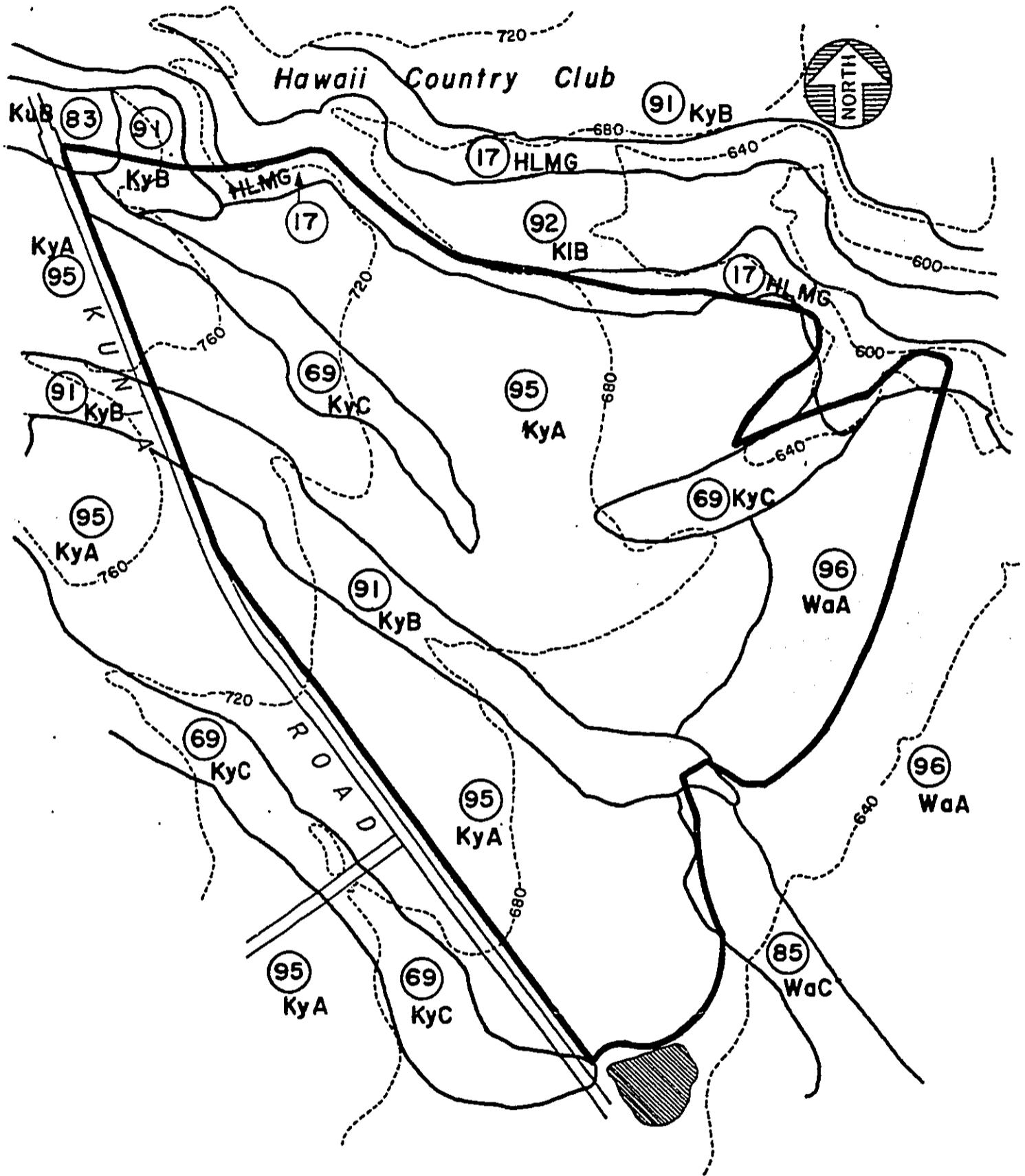
LEGEND ON REVERSE SIDE



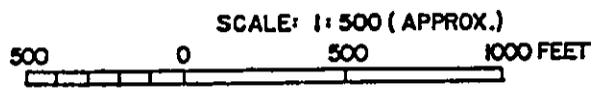
HIDA. OKAMOTO & ASSOCIATES, INC.
 CONSULTING ENGINEERS
 HONOLULU, HAWAII

EXHIBIT 8
 DEVELOPMENT PLAN AMENDMENT
 KUNIA GOLF COURSE
 GENERAL BOUNDARIES

SOIL CLASSIFICATION



LEGEND ON REVERSE SIDE



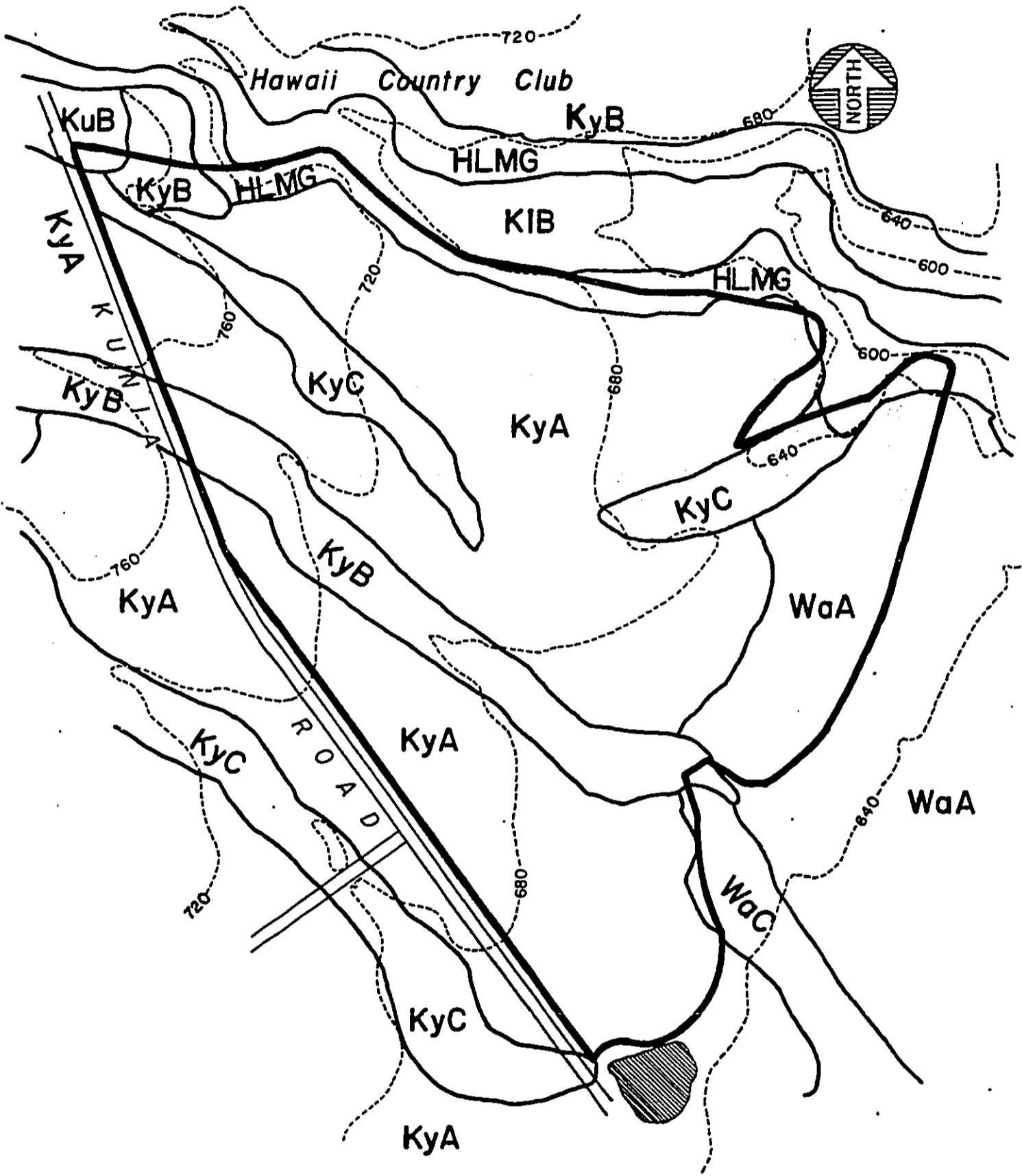
HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 9
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

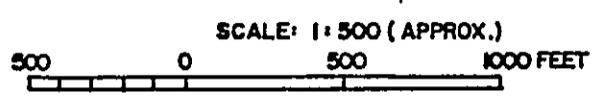
LESA PROPOSED L.E.
CLASSIFICATIONS

CORRECTION

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



LEGEND ON REVERSE SIDE



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 8
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

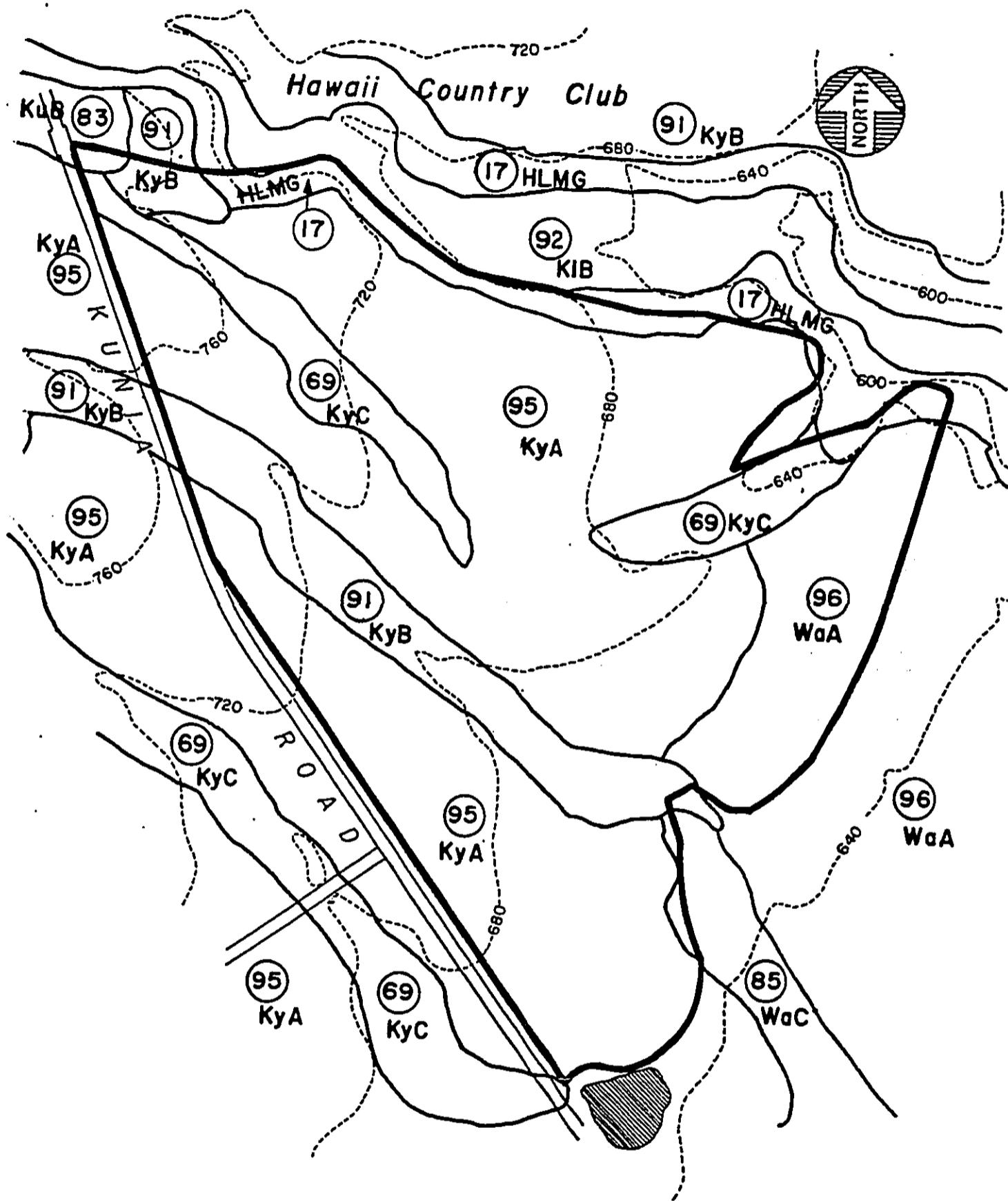
SOIL CLASSIFICATION

LEGEND:

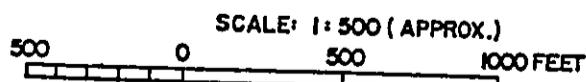
FOR

EXHIBIT 8, SOIL CLASSIFICATIONS:

HLMG	Helemano Silty Clay, 30 to 90 percent slopes
KyA	Kunia Silty Clay, 0 to 3 percent slopes
KyB	Kunia Silty Clay, 3 to 8 percent slopes
KyC	Kunia Silty Clay, 8 to 15 percent slopes
K1B	Kawaihapai Clay Loam, 2 to 6 percent slopes
KuB	Kolekole Silty Clay Loam, 1 to 6 percent slopes
WaA	Wahiawa Silty Clay, 0 to 3 percent slopes
WaC	Wahiawa Silty Clay, 8 to 15 percent slopes



LEGEND ON REVERSE SIDE



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 9
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

LESA PROPOSED L.E.
CLASSIFICATIONS

LEGEND:

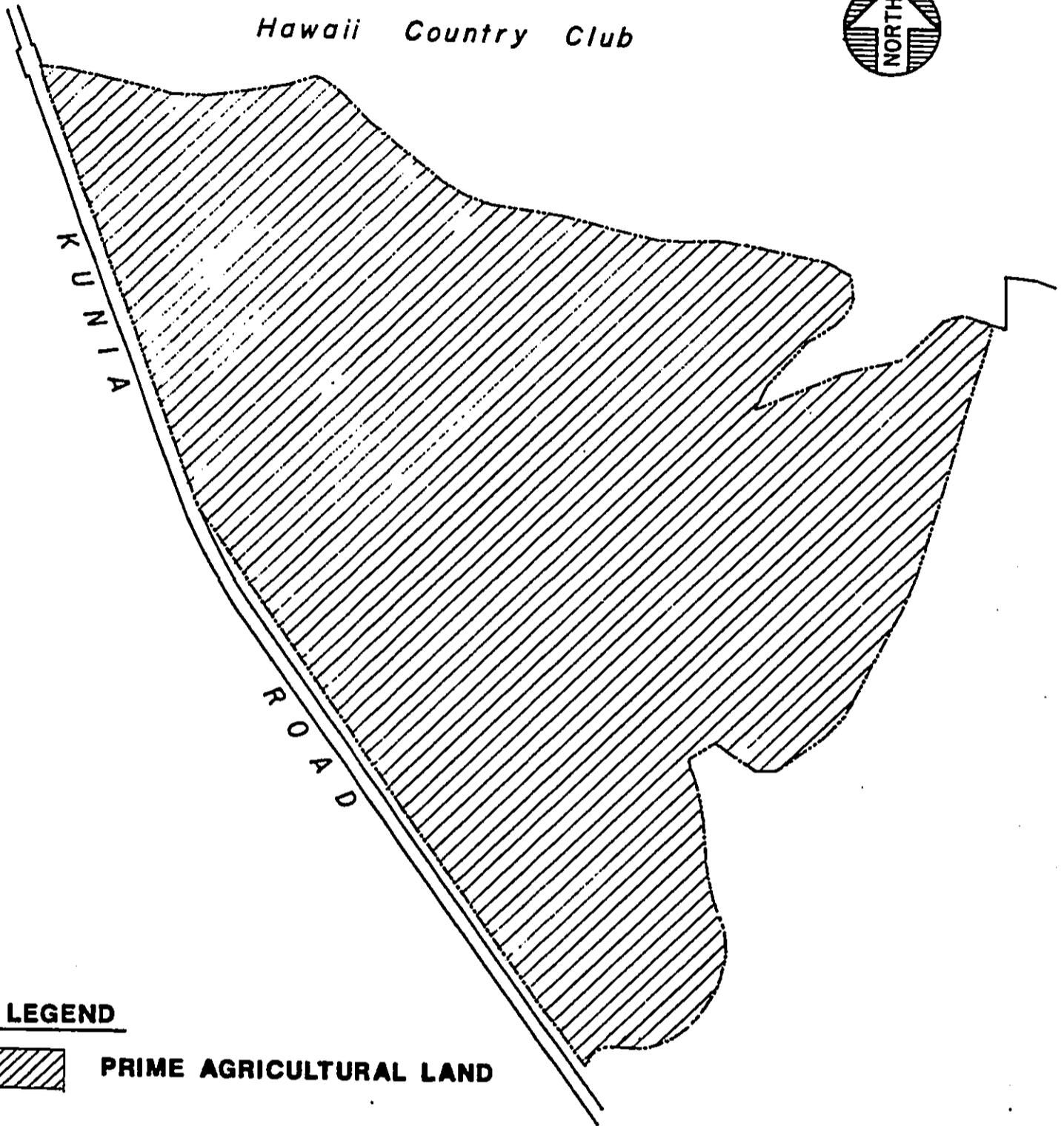
FOR

EXHIBIT 9, LESA PROPOSED L. E. CLASSIFICATIONS:

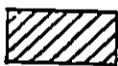
<u>MAP SYMBOL</u>	<u>L. E. RATING</u>
HLMG	17
KyA	95
KyB	91
KyC	69
KTB	92
KuB	83
WaA	96
WaC	85

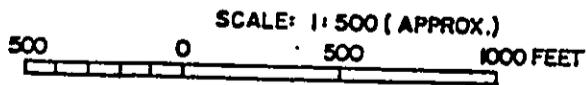
The application of the LESA system combines a value or rating for Land Evaluation with a value or score for Site Assessment to determine the total value or rating of a given site or area for agriculture. The higher the total value of a site, the higher the agricultural economic viability.

Hawaii Country Club



LEGEND

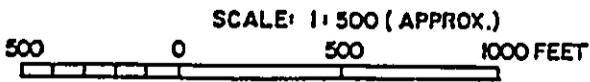
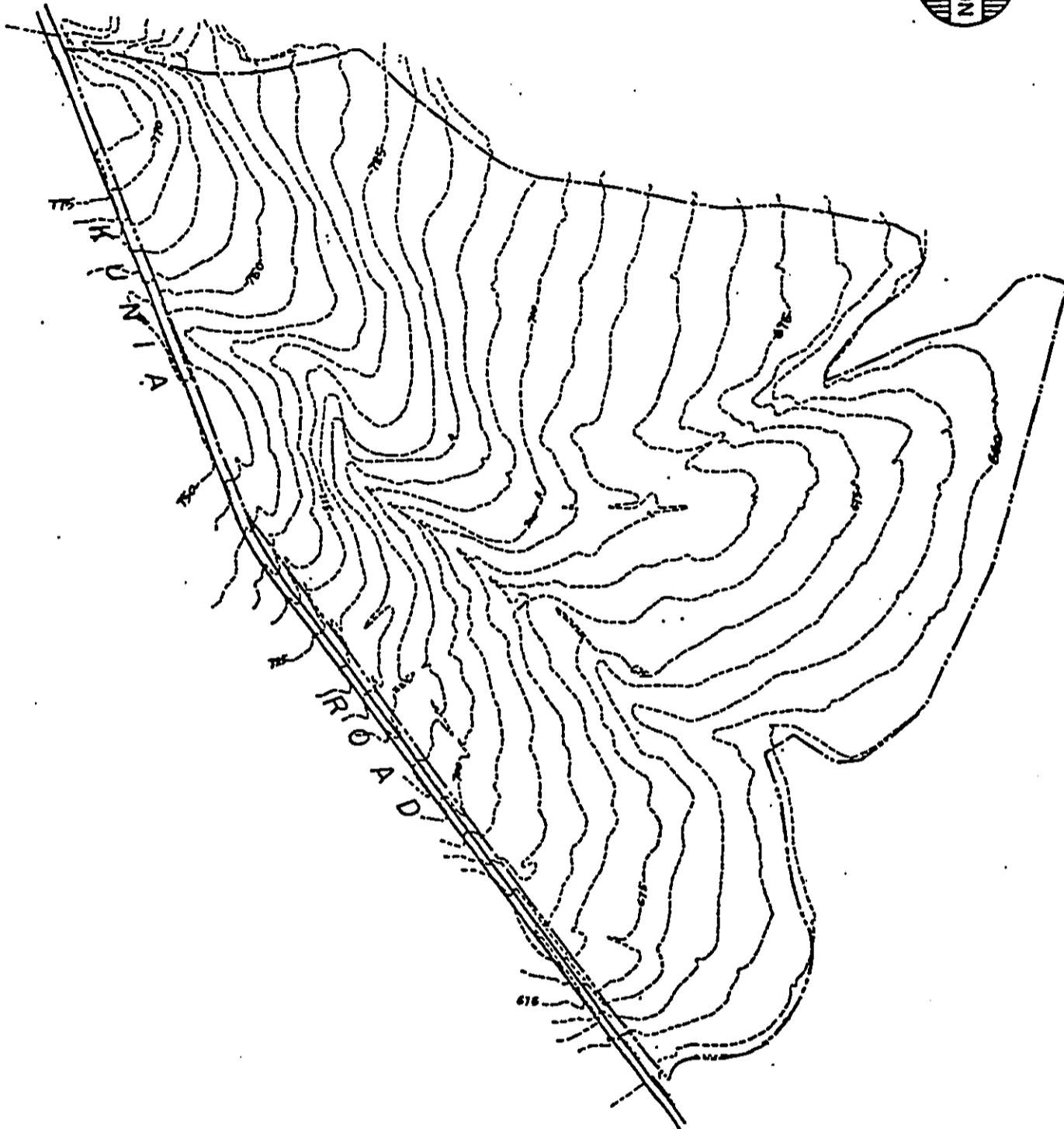
 **PRIME AGRICULTURAL LAND**



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 10
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

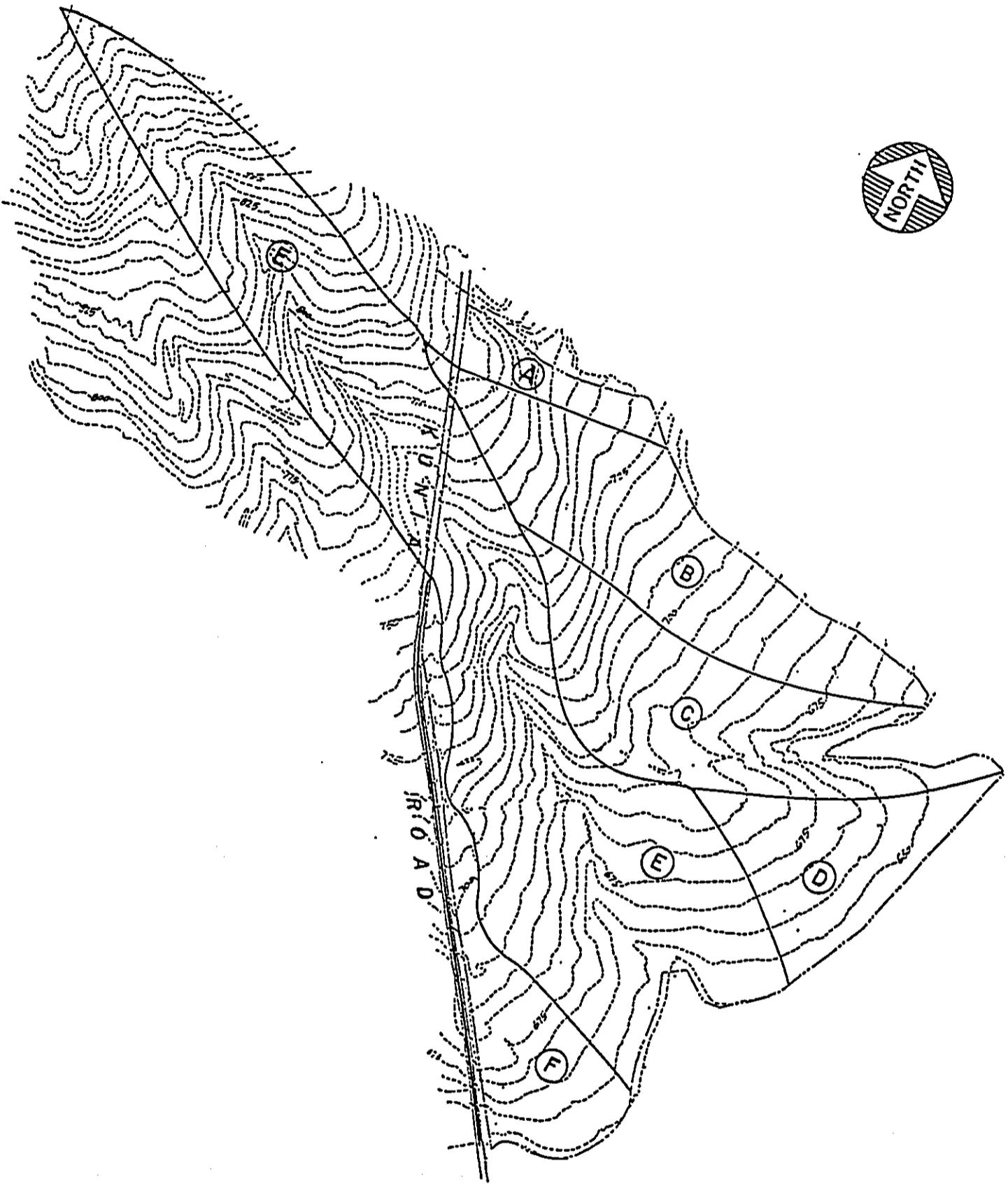
PROPOSED ILLUSTRATIVE
GENERALIZED LESA I.A.L. MAP



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT II
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

TOPOGRAPHIC MAP



SCALE: 1:500 (APPROX.)
500 0 500 1000 FEET

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 12
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES
DRAINAGE BASIN AREAS

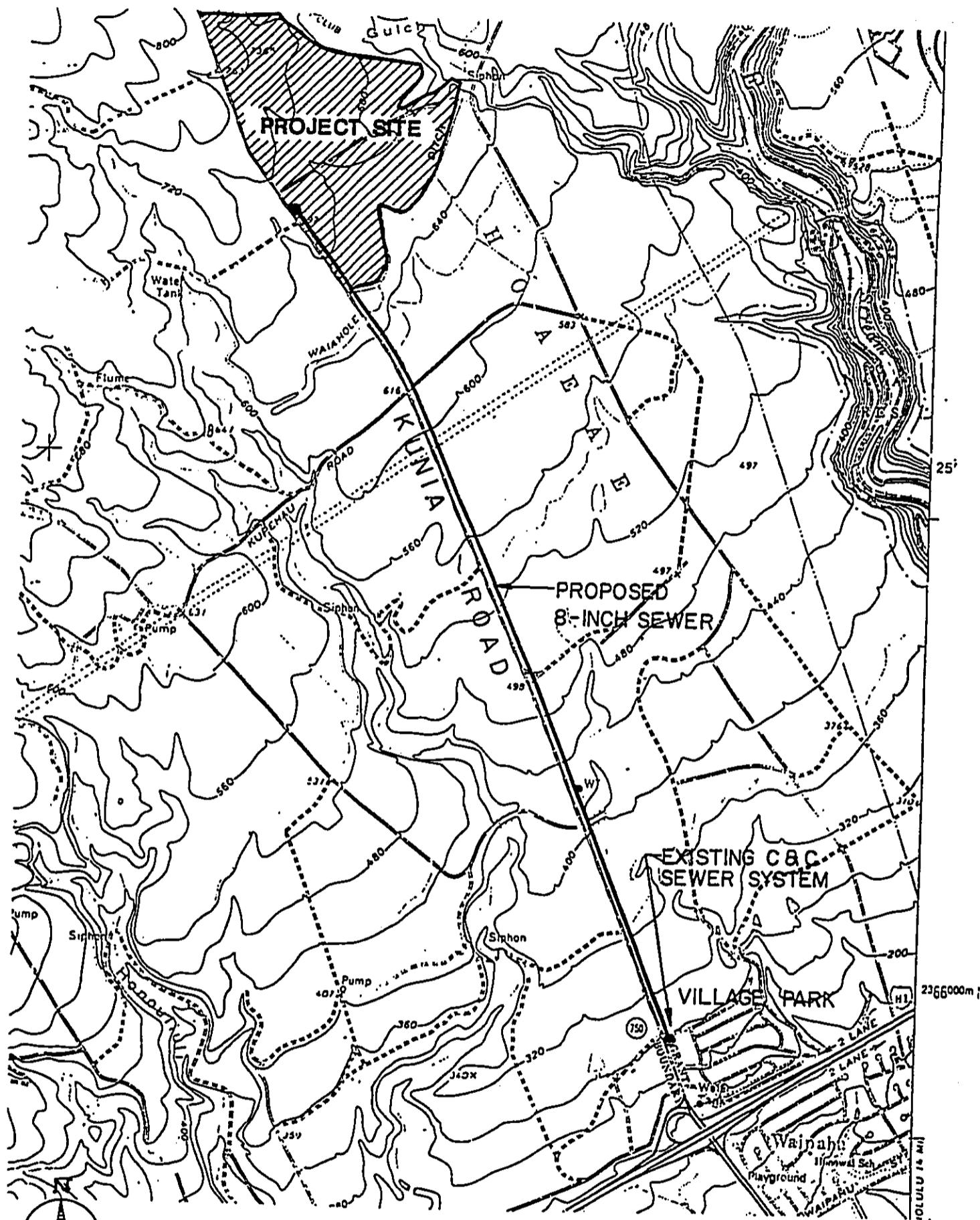
EXHIBIT 13

DESIGN STORM RUNOFF QUANTITIES

<u>DRAINAGE BASIN</u>	<u>AREA (ACRES)</u>	<u>RUNOFF (CFS) Q (10)</u>
A	6.6	20
B	41.2	115
C	37.1	104
D	23.4	68
E	121.6	700
F	21.8	59
TOTAL	251.7	1,066

NOTES:

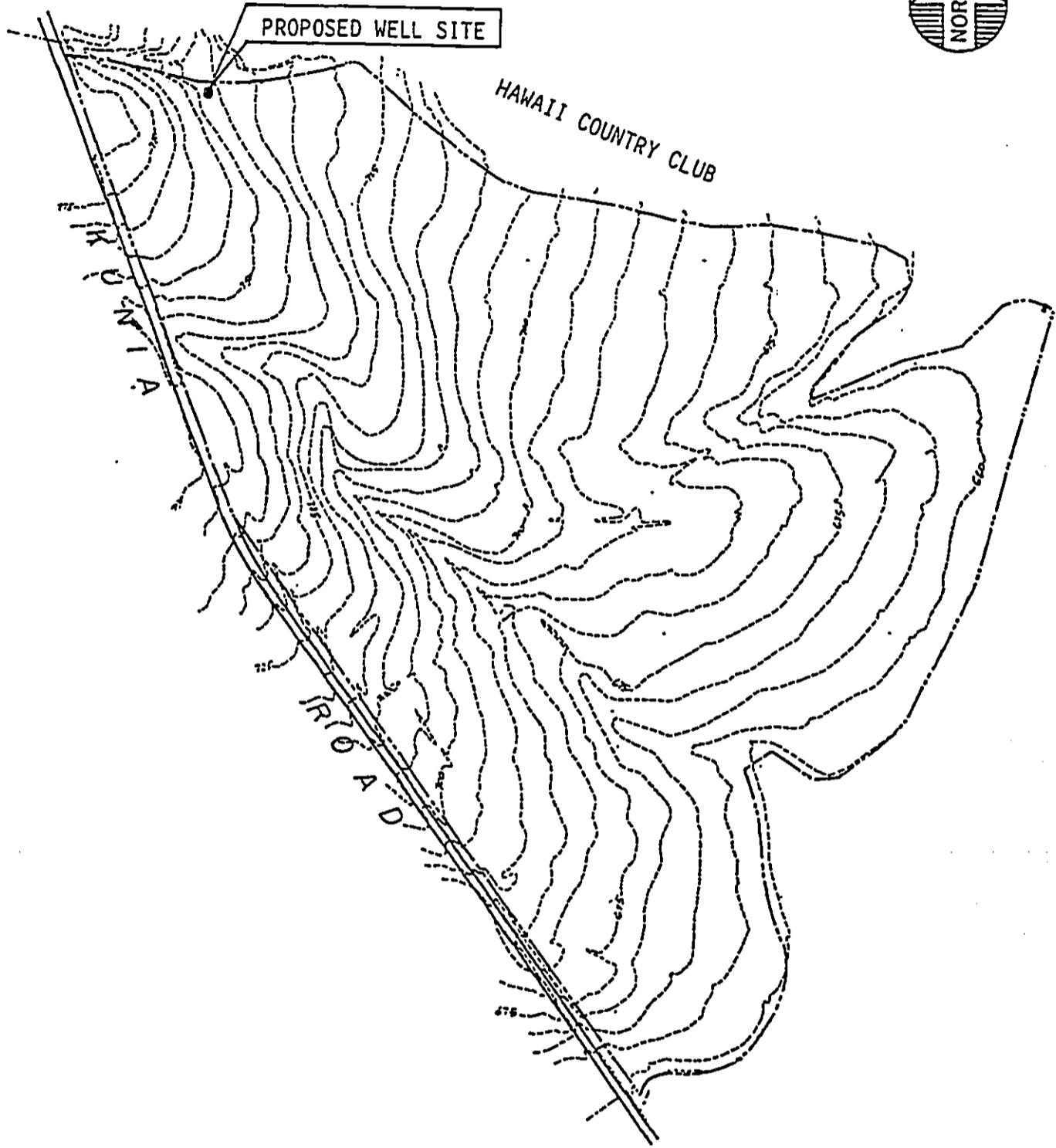
1. Reference: Storm Drainage Standards - Department of Public Works,
City & County of Honolulu, March 1986
2. Q (10): 10-year storm runoff



SCALE: 1:24000 (APPROX.)
 1000 0 2000 4000 FEET

HIDA, OKAMOTO & ASSOCIATES, INC.
 CONSULTING ENGINEERS
 HONOLULU, HAWAII

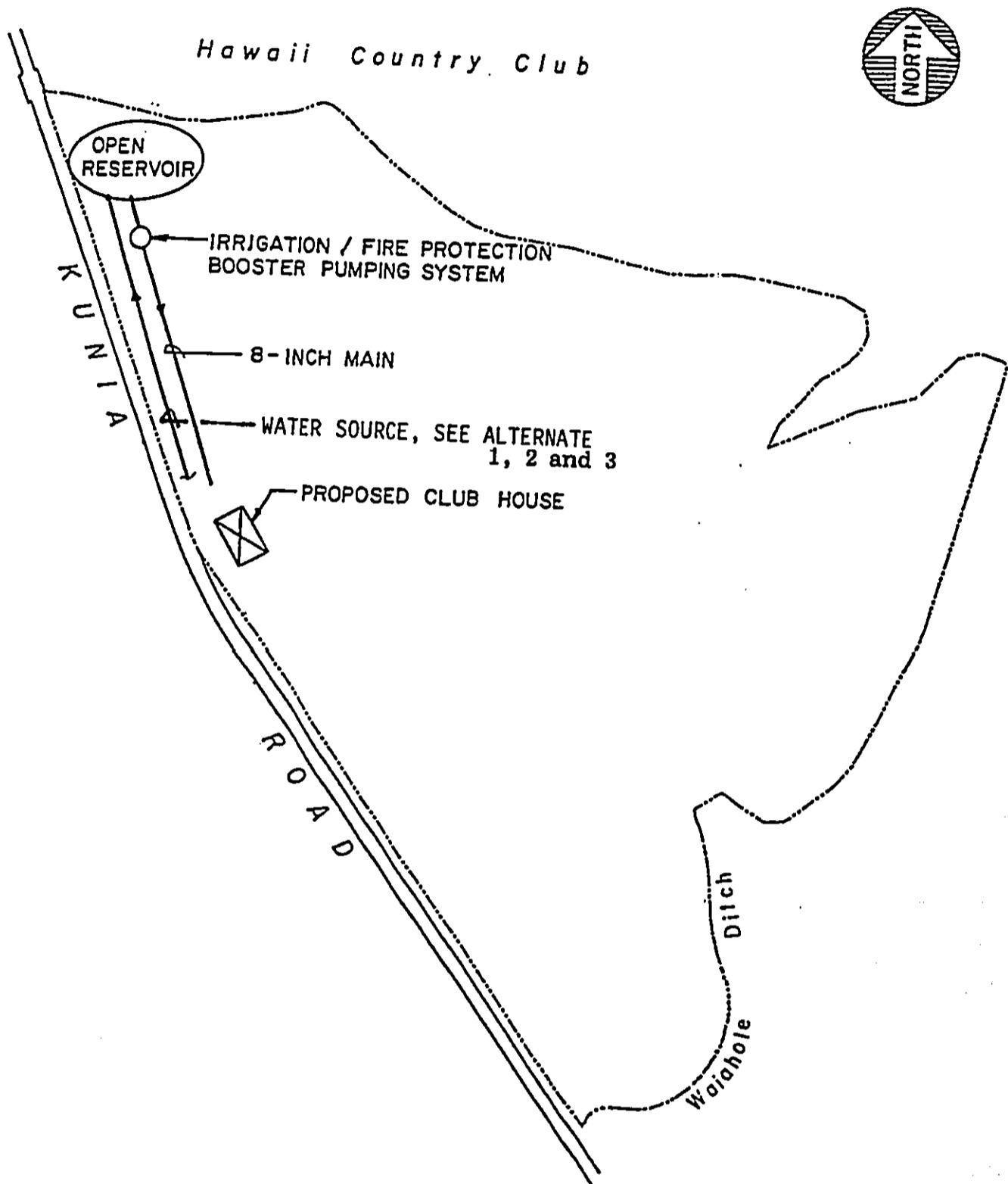
EXHIBIT 14
 DEVELOPMENT PLAN AMENDMENT
 KUNIA GOLF COURSE
 GENERAL BOUNDARIES
 WASTEWATER SYSTEM



SCALE: 1: 500 (APPROX.)
500 0 500 1000 FEET

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

EXHIBIT 16
KUNIA GOLF COURSE
GENERAL BOUNDARIES
POTABLE DOMESTIC WATER



SCALE: 1:500 (APPROX.)
 500 0 500 1000 FEET

HIDA, OKAMOTO & ASSOCIATES, INC.
 CONSULTING ENGINEERS
 HONOLULU, HAWAII

EXHIBIT 18
 KUNIA GOLF COURSE
 GENERAL BOUNDARIES
 GOLF COURSE IRRIGATION &
 FIRE PROTECTION WATER

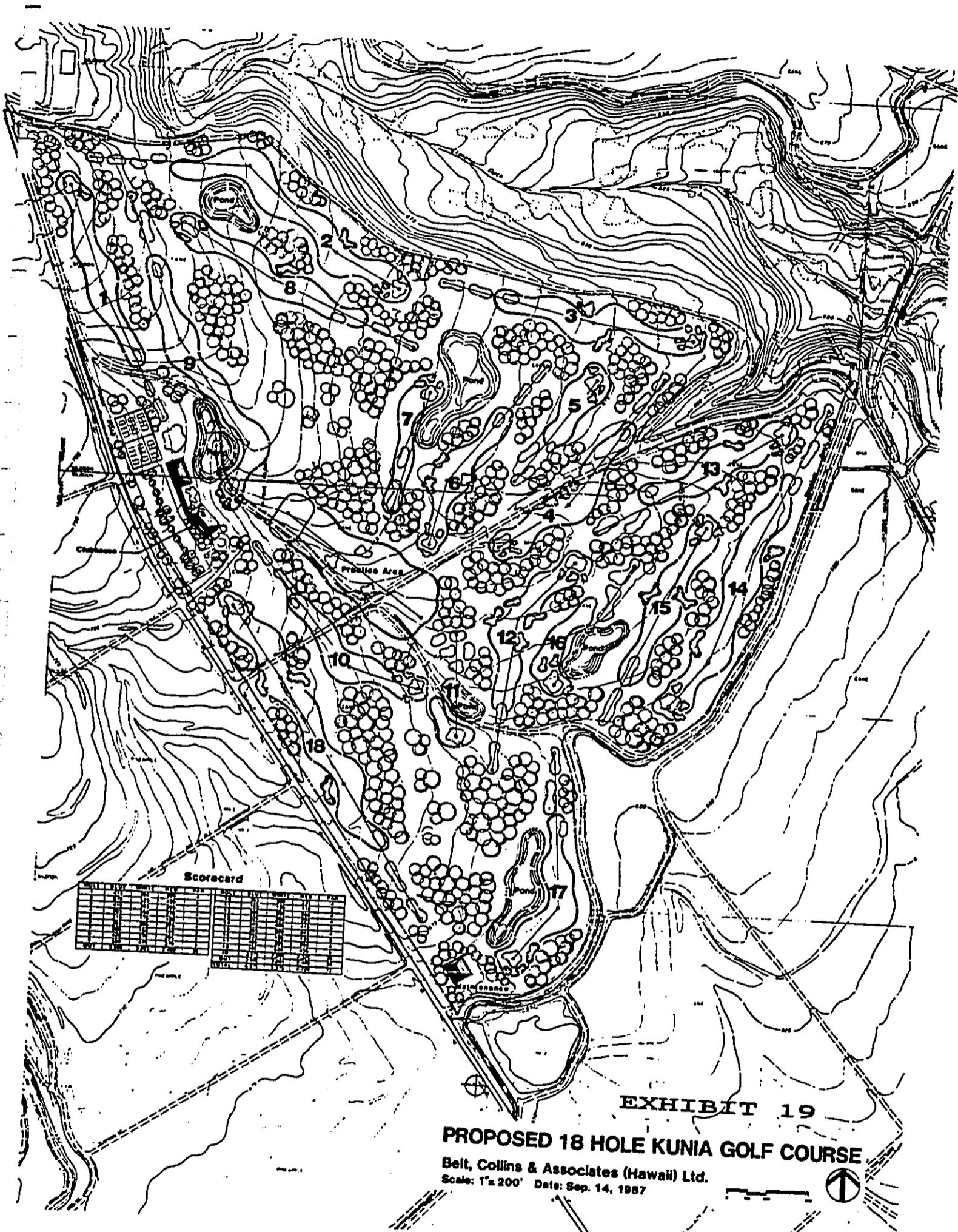


EXHIBIT 19

PROPOSED 18 HOLE KUNIA GOLF COURSE

Belt, Collins & Associates (Hawaii) Ltd.

Scale: 1" = 200' Date: Sep. 14, 1987



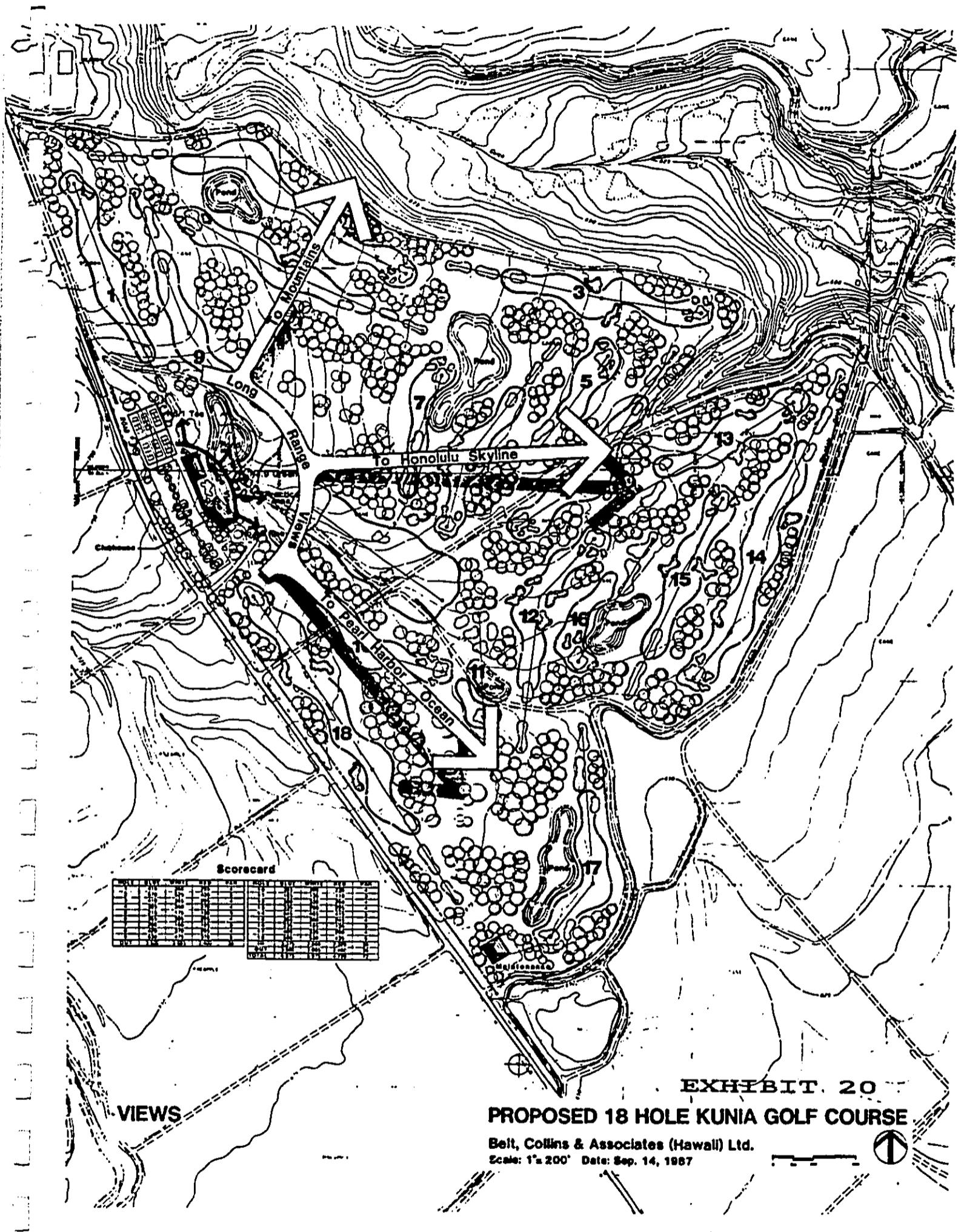


EXHIBIT 20

PROPOSED 18 HOLE KUNIA GOLF COURSE

Belt, Collins & Associates (Hawaii) Ltd.
 Scale: 1" = 200' Date: Sep. 14, 1967

VIEWS

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HAWAII
96850

December 10, 1987

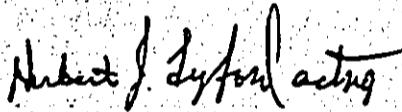
William E. Wanket, Inc.
William E. Wanket, President
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: Proposed Kunia Golf Course, EIS

We have no comments to offer at this time but appreciate the opportunity to review the draft EIS on this project.

Sincerely,



RICHARD N. DUNCAN
State Conversationist

NO RESPONSE REQUIRED.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P. O. BOX 50187
HONOLULU, HAWAII 96850

IN REPLY REFER TO:

ES
Room 6307

DEC 4 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Re: Environmental Impact Statement Preparation Notice,
Development Plan Application and Environmental Assessment
for a Proposed Golf Course, Kunia, Oahu

Dear Mr. Wanket:

We recommend that the impact statement for the proposed golf course address the potential for pesticide and herbicide poisoning of migratory birds and endangered Hawaiian waterbirds that may frequent the golf course greens, water hazards, and sand traps. Discussion of these concerns in the statement should include a description of the fertilizers and biocides which will be applied during normal maintenance, their normal application rates, and calculations of their concentrations in runoff waters from the site. Given the proximity of the proposed golf course to wetland waterbird habitats in Middle and West Loch, Pearl Harbor, and Lualualei, it seems likely that endangered Hawaiian stilt, ducks, and coots will be attracted to the six ponds on the new golf course.

The Service is concerned that these birds may be exposed to high levels of toxic chemicals while feeding and loafing on the proposed course. To the best of our knowledge, this potentially harmful impact can be reduced by careful application of selected biocides with reduced toxicity to aquatic organisms and waterbirds. We offer our assistance in the identification of suitable chemicals for use on the proposed course (phone 541-2749).

Please contact us if you have any questions about our comments or desire to meet with our professional staff.

We appreciate this opportunity to comment.

Sincerely yours,

Ernest Kosaka, Field Supervisor
Office of Environmental Services
Pacific Islands Office

cc: DLNR



Save Energy and You Serve America!

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. Ernest Kosaka
Field Supervisor
Office of Environmental Services
Fish and Wildlife Service
P.O. BOX 50167
Honolulu, Hawaii 96850

Re: Response to Comments on the EIS Preparation Notice (EISPN),
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Kosaka:

Thank you very much for your comments on the above-reference EISPN.

To address your concern over the potential of pesticide and herbicide poisoning of migratory birds and endangered Hawaiian waterbirds, I asked Charles L. Murdoch, Ph.D. from the University of Hawaii to look into this matter. Enclosed, as part of this response, is his report, "Potential for Poisoning of Migratory Birds and Endangered Hawaiian Waterbirds by Chemicals applied in Maintenance of the Proposed Kunia Golf Course". Dr. Murdoch's findings indicate that 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.

Also enclosed (to be made part of the Draft EIS) for your information and review is a report from Murdoch and Green on the "Environmental Impact of Fertilizer and Pesticide Use on the Proposed Kunia Golf Course".

Please be assured that we will continue to coordinate with your office on the construction of the golf course to ensure protection of our wildlife. Again, thank you for your comments.

Sincerely,


William E. Wanket

enclosures

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu HI 96813
Phone
1808-533-4937

**POTENTIAL FOR POISONING OF MIGRATORY BIRDS AND
ENDANGERED HAWAIIAN WATERBIRDS BY CHEMICALS
APPLIED IN MAINTENANCE OF THE PROPOSED KUNIA
GOLF COURSE**

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 (see Appendix Table 1 of the EIS report for the Kunia Golf Course, attached). The only chemicals used in golf course maintenance in Hawaii which are highly toxic to birds are the organic phosphate insecticides, especially diazinon and chlorpyrifos.

Diazinon in particular has come under close scrutiny by the Environmental Protection Agency (EPA) because of kill of migratory waterbirds on golf courses in the northeastern mainland United States. RPAR hearings are presently being held to show cause why all labeled uses of diazinon on turfgrasses should not be cancelled. To the best of our knowledge, the reported bird kills were all associated with very heavy applications of a granular formulation of diazinon, resulting in birds (Canadian geese) picking up granules. Application of proper rates of this pesticide and/or use of a liquid spray might have prevented bird injury in all cases. Diazinon has been used on Hawaii golf course for more than 20 years (both granular and liquid formulations). As far as we are aware, there have been no reports of bird injury from this pesticide on golf courses in Hawaii. From observations of birds using grassed areas and ponds of golf courses in Hawaii, it appears that golf courses are excellent habitats for birds.

Although both diazinon and chlorpyrifos are highly toxic to birds, they are strongly adsorbed on the thatch layer of turf and move little from the site of application. One reason for their weakness in controlling soil infesting insects is the inability to get the insecticides through the thatch layer to the depth needed to contact these insects. Recent studies (Sears and Chapman, 1980; Tashiro, 1980) have shown that diazinon and chlorpyrifos applied to turfgrasses do 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 they are rapidly degraded in the soil, both by hydrolysis and microbial action. Data on persistence of eight organic phosphate insecticides are given below.

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.

Half-life and time required for 95% disappearance of eight organic phosphate insecticides in non-sterile sandy loam soil (adapted from data of Miles, et al., 1979)

Insecticide	Half-life (wks.)	Wks. for 95% decomposition
Diazinon	<1	1
Chlorpyrifos	<1	1
Parathion	<1	3
Fensulfothion	<1	4
Chlorfenvinphos	<1	5
Trichloronat	1.5	20
Fonofos	20	20
Ethion	>24	>24

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. The attached table shows that carbaryl and trichlorfon are less toxic to birds than diazinon or chlorpyrifos. In most cases these insecticides may be substituted for diazinon or chlorpyrifos with little loss of effectiveness. For bermudagrass mite control, however, diazinon has been shown to be much more effective than other insecticides tested.

The labeling of pesticides for particular uses by EPA with strict laws (enforced by the Hawaii Department of Agriculture) for their use are perhaps the best assurance of protection of humans and wildlife. It is impossible to predict what pesticides will be developed in the future. However, all pesticides must be applied in compliance with federal and state laws regulating their use. Hazards to both humans and wild life 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.

REFERENCES

1. Miles, J. R. W., C. M. Tu, and C. R. Harris. 1979. Persistence of eight organophosphorus insecticides in sterile and non-sterile mineral and organic soils. Bull. Environm. Contam. Toxicol. 22:312-318.

2. Sears, M. K., and R. A. Chapman. 1980. Persistence and movement of four insecticides applied to turfgrass. In H. D. Niemczyk and B. G. Joyner (eds.) *Advances in Turfgrass Entomology*. p 57-59.

3. Tashiro, H. 1980. Distribution and persistence of chlorpyrifos and diazinon in soil when applied to turfgrass. In H. D. Niemczyk and B. G. Joyner (eds.) *Advances in Turfgrass Entomology*. p 53-56.

Appendix Table 1. Properties of pesticides used in turfgrasses in Hawaii.

Pesticide common name	Trade name(s)	Oral LD-50 (mg/kg body wt.)	Toxicity to fish & wildlife	Water solubility	Soil behavior
Herbicides:					
MSMA	WeedHoe etc.	1800	Low	Very soluble	Tightly sorbed
glyphosate	Roundup, Kleanup	150	Mod. to birds, none to fish	Very soluble	Inactivated on soil contact
metribuzin	Sencor	2200	Moderate	122 mg/l	Moves readily, Rapidly degraded
2,4-D	part of mixtures	370-700	High to fish	46 mg/l	Rapidly degraded
mecoprop	ditto	700-1500	Low	0.62 mg/l	Moderately residual
dicamba	ditto	1000-2000	Non toxic to fish	0.08 mg/l	Moderately residual
oryzalin	Surflan	10000	Mod. to birds, toxic to fish	2.5 mg/l	Moderately residual
oxadiazon	Ronstar	8000	Toxic to fish	0.7 mg/l	Half-life 1-6 months
propyzamide	Kerb	5620-8350	Low	15 mg/l	Half-life approx. 1 mo.
simazine	Princep	>5000	Low	5 mg/l	Half-life approx. 2-3 mo.
chlorthal-dimethyl	Dacthal	>3000	Low	0.5 mg/l	Residual activity approx. 3 mo.
bensulfide	Betasan, Betamec	770	Mod. to fish	25 mg/l	Tightly sorbed-long residual
paraquat dichloride	Ortho Paraquat CL	150	Mod. to birds, none to fish	Readily soluble	Immediate inactivation
bentfluralin	Balan	10000	Low to birds, high to fish	<1 ppm	Strongly sorbed
Insecticides					
diazinon	Spectricide	300-850	High	4 mg/l	Readily degraded
chloropyrifos	Dursban	135-163	High	2 mg/l	Slowly degraded, strongly sorbed
bendiocarb	Ficam	40-156	High	40 mg/l	Rapidly degraded
carbaryl	Sevin	400-850	Moderate	<1 ppm	No information
trichlorfon	Dylox	450-630	Moderate	154 g/l	No information
Fungicides					
amilazine	Dyrene	<5000	Low	8 mg/l	Half-life 12 hours
benomyl	Benlate	9590	Low	2 mg/l	Half-life 6-12 mo.
chlorothalonil	Daconil 2787	>10000	Low to birds, mod. to fish	0.6 mg/l	Half-life 1.5-3.0 mo.
iprodione	Chipco 26019 RP	3500	Low	13 mg/l	Rapidly metabolized
mancozeb	Dithane M-45	>8000	Low	practically insoluble	No information
quinotozone	PCNB, Terrachlor	12000	Non-toxic	0.44 mg/l	No information
thiram	Tersan	7500	Low	30 mg/l	Rapidly degraded
triadimefon	Bayleton	568	Low	260 mg/l	Rapidly degraded
metalaxyl	Subdue	669	Non-toxic	7.1 g/l	Rapidly degraded
thiophanate-methyl	Cleary 3336	7500	Low	3.5 mg/l	Rapidly degraded

JOHN WAIHEE
GOVERNOR



SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

DEPUTY TO THE CHAIRPERSON

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

December 8, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Subject: Environmental Impact Statement Preparation Notice
(EISPN) for Kunia Golf Course, Hoaeae, Ewa, Oahu
Nihonkai Lease Company, Ltd.
TMK: 9-4-04: 9
Area: 203.171 acres

Dear Mr. Wanket:

The Department of Agriculture has reviewed the subject document and offers the following comments.

According to the EISPN, the applicant will be seeking to amend the designation of the subject parcel on the Central Oahu Development Plan land use map and public facilities map from Agriculture to Recreation/Golf Course.

The project abuts the Waiahole Ditch to the south and Kunia Road to the west. About one-and-a-half miles south along the Kunia Road is the 691.5-acre Village Park expansion site (Waitec Development, Inc.).

References in the document to the Agricultural Lands of Importance to the State of Hawaii (ALISH) system, the Soil Conservation Service Soil Survey, and Land Evaluation (LE) ratings are correct. Exhibit 7, referring to the Land Study Bureau (LSB) Overall (Master) Productivity Rating, is incorrect and apparently based on an earlier version of the LSB study for Oahu. The correct ratings are A46i and B47i according to Land Study Bureau Bulletin No. 11 (December 1972).

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December 8, 1987
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ALTERNATIVE SITES FOR THE PROPOSED USE

The EISPN identifies the subject site as "...an ideal location to service the golf needs of the Ewa and Central Oahu development plan areas" (EISPN, page 8). Appendix G of the EISPN does not indicate alternative sites for the proposed use that consider lands of lesser agronomic suitability. It does state that there are nine other golf courses being proposed in the Ewa and Central Oahu areas.

RELATIONSHIP OF THE PROPOSED USE TO THE HAWAII STATE PLAN

Under the section titled Federal, State and City Plan/Programs (EISPN, pages 9 to 16), there should be reference to the following agriculturally-related objectives, policies and priority guidelines of the Hawaii State Plan (Chapter 226, HRS) and the State Agriculture Functional Plan (June, 1985).

- Section 226-7(b)(6) "Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs."

Comment: From the perspective of agronomic quality, the subject parcel is without a doubt, "agriculturally suitable lands". Water from the Waiahole Ditch is currently being used to irrigate the sugarcane growing on the subject parcel.

- Section 226-103(c)(1) "Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries."

Comment: This priority guideline places immediate attention on the need to maintain an adequate land supply for the sugar industry.

- Section 226-103(d)(2) "Assist in providing adequate, reasonably priced water for agricultural activities."

Comment: The Waiahole Ditch is a relatively inexpensive source of water for the subject parcel, which as described earlier, has excellent agronomic qualities. Furthermore, Oahu Sugar Company has stated that the irrigation water applied onto the subject parcel (Field 280) "...will lessen the withdrawal of water from the caprock aquifer system..." (letter to you from Mr. William D. Balfour, President and Manager of Oahu Sugar Company, dated November 16, 1987, page 2).

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December 8, 1987
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- Section 226-104(b)(2) "Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district"; and
- Section 226-103(d)(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."

Comment: While "agricultural lands of importance" have not yet been statutorily identified pursuant to Article XI, Section 3 of the State Constitution, the subject parcel is being put to economic agricultural use. This is further evidenced by Oahu Sugar Company's intention to cultivate the subject parcel (Field 280) until the lease with Robinson Estate expires in 1996 (Letter from Mr. William D. Balfour, page 1).

- State Agriculture Functional Plan, Implementing Action B(5)(c) "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."

Comment: The Land Evaluation and Site Assessment (LESA) Commission's working definition of "important agricultural lands" includes "...those lands in the State which, as a resource with certain physical properties and setting, are capable of producing sustained high agricultural yields when treated and managed according to modern farming methods and technology; [and] b) lands which contribute to the State's economic base and produce commodities for export and for local consumption..." ("A Report on the State of Hawaii Land Evaluation and Site Assessment System", February, 1986, page 7). The subject parcel clearly conforms to these two criteria. On the other hand, we see no evidence indicating that "injustice or inequity" or "overriding public interest" would result from non-acceptance of the proposed project.

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December 8, 1987
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IMPACT UPON OAHU SUGAR COMPANY

The EIS should address, in detail, the full economic impact on Oahu Sugar Company (OSC) that would result from the removal of the subject parcel from sugarcane cultivation. This would include the loss in tons of sugar per acre, lost revenues, location and cost of replacement field preparation (if any), and any other indicators of adverse impact.

The EISPN seeks to dilute and minimize the immediate and long-term adverse impacts on OSC by making the following generalizations:

- "...the Kunia golf course -- individually or in combination with other major projects planned and proposed for Ewa and Central Oahu -- would not adversely affect the economic viability of OSCo, nor would it require layoffs of sugar workers. This assumes the continuation of historic development rates for housing projects -- rates which would allow sufficient time to increase yields and thereby partially or completely compensate for the reduced acreage with little or no loss in production. Reductions in employment would occur through retirement and voluntary movement to other jobs. Over the long term, OSCo could accommodate a major reduction in acreage and maintain economies of scale by operating just one mill, rather than two in parallel" (EISPN, pages 34, 35 and Appendix F).

Comment: We question whether OSC can realistically maintain its profitability in the future if available acreage is reduced to the point where there is little or no leeway to alter the total area available for sugarcane cultivation, especially if high-yield lands continue to be removed from production. Increased sugar yields can generally only occur with additional production costs for capital, labor, management, energy, and/or research. Per acre yield (tons of sugar per acre) from Field 280 for 1987 is better than the average OSC yield for 1987. The EIS should show how lost yields from about 190 acres of very productive sugarcane land can be economically replaced by further improved yields in existing, possibly less productive, fields. According to the letter from OSC to you concerning the subject project, if all the pending projects on the drawing boards [affecting its lands] culminate

Mr. William E. Wanket
December 8, 1987
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collectively and out of a desirable sequence, they will adversely affect the economic viability of OSCo (emphasis added). Finally, regarding the reduction in OSC operations to a single mill, it should be explained why this would justify removal of a better-than-average field from production rather than less productive fields, especially if increased yields are supposed to be the key variable in allowing OSC to reduce cultivated acreage and still maintain profitability.

IMPACT UPON DIVERSIFIED AGRICULTURE

The EISPN asserts that "...it is extremely doubtful that this [the loss of agricultural use of the subject area] will adversely affect the growth of diversified agriculture in Hawaii." This assessment is based on: "(1) an extensive amount of prime-agricultural land and water has been freed from sugar and pineapple production because of past mill closings and reductions in operations; (2) a very real possibility exists that additional land and water will be freed from sugar production given the outlook for low sugar prices; (3) some - if not most or even all - of the sugar operations will make their lands available for profitable replacement crops to the extent that such crops are available; and, (4) compared to the available supply, a very small amount of land and water is required to grow proven and promising crops to achieve a realistic level of food and animal-feed self-sufficiency, and to increase exports." (EISPN, page 35 and Appendix F).

Comment: The third point is highly problematic. While there may be a reduction in sugarcane acreage, the fallowed lands do not necessarily become available for other agricultural uses if landowners wish to pursue other activities that promise higher returns, or hold their lands off the market. Our records show more than 270 individuals searching for suitable farm land to begin, expand or relocate their diversified farming activities. It would be useful if these "freed" lands could be identified in terms of their location and their specific availability for profitable replacement crops.

The Department of Agriculture is compelled by the State Constitution to "...conserve and protect agricultural lands, promote diversified agriculture, increase agricultural

Mr. William E. Wanket
December 8, 1987
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self-sufficiency and assure the availability of agriculturally suitable lands". On Oahu, it happens that the lands most suitable for agricultural use are situated in the areas (Ewa and Central Oahu) that are under the greatest pressure for urban expansion. We take the perspective that agriculturally suitable land is a resource in its own right rather than simply an economic commodity that may be used for the highest private return. Agriculturally suitable lands once developed for higher uses will remain unavailable for agricultural use. Thus, while there may be more important agricultural lands in total on Oahu than can be fully utilized over the next decade, we feel it should be the policy of the State and the City and County to allocate the best agricultural lands to agricultural use to the fullest extent possible. Alternative uses (such as the subject project) should be directed to lands of lesser value for agriculture wherever possible.

Thank you for the opportunity to comment.


SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: Mr. William Balfour, OSCo
OSP
OEQC
DGP

WILLIAM
E.
WANKET
INC.

Land Use Consultant

January 15, 1988

Ms. Suzanne D. Peterson
Chairperson, Board of Agriculture
Department of Agriculture
P.O. Box 22159
Honolulu, Hawaii 96822-0159

Re: Response to Comments on the EIS Preparation Notice (EISPN),
Development of a Golf Course, Kunia, Oahu.

Dear Ms. Peterson:

Thank you very much for your comments on the above-referenced EISPN. Your comments were reviewed by our agricultural consultant, Bruce Plasch of Decision Analysts Hawaii, Inc., and we respond as follows:

EXHIBITS

"Exhibit 7, referring to the Land Study Bureau (LSB) Overall (Master) Productivity Rating, is incorrect and apparently based on an earlier version of the LSB study for Oahu. The correct ratings are A46i and B47i according to Land Study Bureau Bulletin No. 11 (December 1972)".

Response:

Exhibit 7 will be corrected, as noted in your comment, in the Draft EIS.

ALTERNATIVE SITES FOR THE PROPOSED USE

"Appendix G of the EISPN does not indicate alternative sites for the proposed use that consider lands of lesser agronomic suitability. It does state that there are nine other golf courses being proposed in the Ewa and Central Oahu areas".

Response:

The market study (Appendix G) was limited in scope to determine whether a demand existed for the development of new facilities, and whether the proposed Kunia Golf Course could contribute to meeting these demands. The analysis

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January 15, 1988
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concluded that the proposed Kunia Golf Course will be one of a number of new facilities designed to meet the growing needs of the tourist and resident population. The analysis did not involve an agronomic assessment. Other sections of the EISPN clearly identified the agricultural suitability of the proposed Kunia Golf Course site, and Appendix F of the EISPN fully discussed the loss of this land to the agricultural industry.

RELATIONSHIP OF THE PROPOSED USE TO THE HAWAII STATE PLAN

Comment 1:

"Under the section titled Federal, State and City Plan/Programs (EISPN, pages 9 to 16), there should be reference to the following agriculturally-related objectives, policies and priority guidelines of the Hawaii State Plan (Chapter 226, HRS) and the State Agriculture Functional Plan (June 1985).

Section 226-7(b)(6): 'Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.'

"From the perspective of agronomic quality, the subject parcel is without a doubt, 'agriculturally suitable lands.' Water from the Waiahole Ditch is currently being used to irrigate the sugarcane growing on the subject parcel."

Response:

It is true that the subject parcel is "agriculturally suitable" and has "adequate water." The implication from your comment is assumed to be, then, that the State must assure the availability of this particular parcel for agricultural use. But when read in context, Section 226-7 of the Hawaii State Plan (Chapter 226, HRS) does not support this interpretation.

Section 226-7 lists the economic objectives and policies specific to agriculture. Subsection 226-7(b)(6) is one of twelve policies which are designed to contribute to achieving the two stated economic objectives dealing with agriculture:

- (1) Continued viability in Hawaii's sugar and pineapple industries.
- (2) Continued growth and development of diversified agriculture throughout the State.

The impact of the proposed development on these two objectives, including the availability of an adequate supply of agriculturally suitable land and water to achieve these objectives, is the relevant issue — an issue which is addressed in detail in Appendix F of the Environmental Assessment (EA).

Ms. Suzanne D. Peterson
January 15, 1988
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Comment 2:

Section 226-103(c)(1) 'Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.'

"This priority guideline places immediate attention on the need to maintain an adequate land supply for the sugar industry."

Response:

In context, Subsection 226-103(c)(1) is one of three priority guidelines under Section 226-103 Economic priority guidelines, Subsection (c) Priority guidelines to promote the continued viability of the sugar and pineapple industries. As mentioned above, this issue, including the availability of an adequate supply of agriculturally suitable land, is addressed in detail in Appendix F of the EA.

Comment 3:

Section 226-103(d)(2): 'Assist in providing adequate, reasonably priced water for agricultural activities.'

"The Waiahole Ditch is a relatively inexpensive source of water for the subject parcel, which as described earlier, has excellent agronomic qualities. Furthermore, Oahu Sugar Company has stated that the irrigation water applied onto the subject parcel (Field 280) '... will lessen the withdrawal of water from the caprock aquifer system ...' (letter to you from Mr. William D. Balfour, President and Manager of OSCo, dated November 16, 1987, page 2)."

Response:

We note that Mr. Balfour (OSCo) states that the Waiahole Ditch water now used on the subject property would be used by OSCo elsewhere for agricultural use. Thus, the project will have no effect on availability of this water to OSCo.

The Waiahole Ditch water is high-quality "sweet" water free of salts, which is not the case for groundwater from the Ewa Plain. Because of its high quality, the use of Waiahole Ditch water on the Ewa Plain would contribute to higher yields from the affected fields, and infiltration of this water down to the Ewa Plain groundwater would improve the quality of this supply. If, on the other hand, any of the released water is used on the higher elevation fields now irrigated with groundwater, then pumping costs would be reduced.

This information will be added to the final EIS.

Ms. Suzanne D. Peterson
January 15, 1988
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Comment 4:

Section 226-104(b)(2): 'Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district;' and

Section 226-103(d)(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.'

"While 'agricultural lands of importance' have not yet been statutorily identified pursuant to Article XI, Section 3 of the State Constitution, the subject parcel is being put to economic agricultural use. This is further evidenced by Oahu Sugar Company's intention to cultivate the subject parcel (Field 280) until the lease with Robinson Estate expires in 1996 (letter from William D. Balfour, page 1).

Response:

It is true that the subject land is being put to economic agricultural use. However, it should be noted that the above quoted Sections in the Hawaii State Plan are intended to serve as "guidelines." As such, deviations from them should occur where warranted. If this were not the case, and all urban development were forced to locate only on lands which are already zoned urban or which are regarded as "marginal or non-essential agricultural lands," then the impact on Oahu's economy and housing market would be disastrous. This is because the supply of lands that would be appropriate for urban development (based on location, slopes, access, etc.) would be insufficient to accommodate expected needs.

Furthermore, Subsection 226-103(d)(1) should be read in context. It is one of three priority guidelines under Section 226-103 Economic priority guidelines, Subsection (d) Priority guidelines to promote the growth and development of diversified agriculture. This issue, including the availability of an adequate supply of agriculturally suitable land, is addressed in detail in Appendix F of the Environmental Assessment (EA).

Comment 5:

"State Agriculture Functional Plan, Implementing Action B(5)(c): '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.'

Ms. Suzanne D. Peterson
January 15, 1988
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"The Land Evaluation and Site Assessment (LESA) Commission's working definition of 'important agricultural lands' includes [a] '... those lands in the State which, as a resource with certain physical properties and setting, are capable of producing sustained high agricultural yields when treated and managed according to modern farming methods and technology; [and] b) lands which contribute to the State's economic base and produce commodities for export and local consumption ...' ('A Report on the State of Hawaii Land Evaluation and Site Assessment System,' February 1986, page 7). The subject parcel clearly conforms to these two criteria. On the other hand, we see no evidence indicating that 'injustice or inequity' or 'overriding public interest' would result from non-acceptance of the proposed project."

Response:

It is true that the subject land is capable of sustained high yields and that it contributes to the State's economic base. Nevertheless, the "overriding public" interest that would justify the proposed project would be an increase in the economic base, and an increase in recreational opportunities. The Kunia Golf Course would generate far more economic benefits from the subject property than would cultivation of sugar; an estimated 50 jobs would be provided, or over 10 percent of the employment of OSCo on just 1.4 percent of OSCo's current acreage under cultivation. This would occur without jeopardizing the economic viability of OSCo, and without adversely affecting the growth of diversified agriculture.

IMPACT UPON OAHU SUGAR COMPANY

Comment 6:

"The EISPN seeks to dilute and minimize the immediate and long-term adverse impacts on OSC by making the following generalizations:

'... the Kunia golf course — individually or in combination with other major projects planned and proposed for Ewa and Central Oahu — would not adversely affect the economic viability of OSCo, nor would it require layoffs of sugar workers. This assumes the continuation of historic development rates for housing projects — rates which would allow sufficient time to increase yields and thereby partially or completely compensate for the reduced acreage with little or no loss in production. Reductions in employment would occur through retirement and voluntary movement to other jobs. Over the long term, OSCo could accommodate a major reduction in acreage and maintain economies of scale by operating just one mill, rather than two in parallel.' (EISPN, pages 34, 35 and Appendix F).

"We question whether OSC can realistically maintain its profitability in the future if available acreage is reduced to the point where there is little or no leeway to alter

Ms. Suzanne D. Peterson
January 15, 1988
Page 6

the total area available for sugarcane cultivation, especially if high-yield lands are removed from production. Increased sugar yields can generally only occur with additional production costs for capital, labor, management, energy, and/or research. Per acre yield (tons of sugar per acre) from Field 280 for 1987 is better than the average OSC yield for 1987. The EIS should show how lost yields from about 190 acres of very productive sugarcane land can be economically replaced by further improved yields in existing, possibly less productive fields. According to the letter from OSC to you concerning the subject project, if all the pending projects on the drawing boards [affecting its lands culminate collectively and out of a desirable sequence, they will adversely affect the economic viability of OSCo. (emphasis added). Finally, regarding the reduction in OSC operations to a single mill, it should be explained why this would justify removal of a better-than-average field from production rather than less productive fields, especially if increased yields are supposed to be the key variable in allowing OSC to reduce cultivated acreage and still maintain profitability."

Response:

The quotation from the report is not a generalization, but a summary of the analysis contained in Appendix F. Furthermore, the analysis was reviewed by OSCo before submission of the report. However, since its submission, OSCo expressed concerns over the pattern and sequence of development of certain proposed large projects. Problems could result for OSCo if all the large-scale developments planned and proposed for the Ewa Plain and Central Oahu were developed in a short time period, and developed in an undesirable pattern and sequence whereby inner fields were developed first and in such a way as to block access to the more distant fields. However, it is not at all clear that the planned and proposed large developments will, in fact, all receive approvals, and be developed fully according to the proposed plans and schedules. Also, at least one of the large developments that is of concern to OSCo (Hawaiian Housing Authority — Kapolei Village) is being designed with respect to its land-use pattern and development sequence so as to impose the least impact on OSCo. The development of the larger projects should take place gradually and generally from the outside in, and in coordination with representatives from OSCo, so as not to adversely affect the economic viability of OSCo. It should be noted, however, that the proposed Kunia Golf Course project is small when compared to the large housing developments planned and proposed for the area, and its development would not block access to other fields. Furthermore, the concerns of OSCo will be taken into consideration during the design process.

Regarding yields, the subject fields produced 15.4 tons of sugar in 1987, 13.1 tons in 1985, and 14.7 tons in 1983. These yields are slightly higher than the average for OSCo, which is about 14.5 to 15.5 tons per acre. Based on 1987 yields and 1986 prices (\$334.59 per ton for sugar, and \$45.80 per ton for molasses, with one-third of a ton of molasses produced for each ton of sugar), lost revenues would amount to about \$0.5 million per year, which represents a revenue loss of about 1.6 percent.

Ms. Suzanne D. Peterson
January 15, 1988
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Over the long term, yields are expected to continue their gradual increase as a result of improved farming practices (including better water management such as application of sweet water on Ewa fields as discussed above), and application of research results from the Hawaiian Sugar Planters' Association genetic engineering provides the greatest long-term promise for increased yields. As discussed in Appendix F, increasing yields totally or partially compensate for acreage reductions.

Regarding replacement lands, none are anticipated.

Regarding conversion from a two-mill to a single-mill operation, it is expected that this would allow OSCo to remain economically viable given the City and County policy of developing Ewa as a secondary urban center, and development of the large housing developments planned and proposed for Ewa and Central Oahu. In either case, whether a two- or a single-mill operation, the proposed project is not expected to adversely affect the economic viability of OSCo.

IMPACT UPON DIVERSIFIED AGRICULTURE

Comment 7:

"The third point [from the DEIS: '(3) some — if not most or even all — of the sugar operations will make their lands available for profitable replacement crops to the extent that such crops are available'] is highly problematic. While there may be a reduction in sugarcane acreage, the fallowed lands do not necessarily become available for other agricultural uses if landowners wish to pursue other activities that promise higher returns, or hold their lands off the market. Our records show more than 270 individuals searching for suitable farm land to begin, expand or relocate their diversified farming activities. It would be useful if these 'freed' lands could be identified in terms of location and their specific availability for profitable replacement crops."

Response:

Two compelling arguments support the position that the third point is not problematic: first, common sense argues that landowners would convert their lands to a more profitable use; and second, as Amfac testified on the Waikele project before the State Land Use Commission, one of the components of OSCo's "Survival Plan" is to find profitable replacement crops before OSCo is forced by outside economic factors to cease operations.

With regard to identifying the "freed" lands, we agree that it would be useful to the DOA to have these "freed" lands identified and the terms of obtaining use, and believe that this would be of great statewide benefit. However, this is a large project which is more appropriately within the purview of the State as an ongoing effort. Most of the "freed" lands would include but not be limited to those released by the

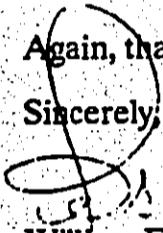
Ms. Suzanne D. Peterson
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closing of four sugar operations since 1970 (Kilauea on Kauai, Kahuku on Oahu, and Kohala and Puna on Hawaii), and pineapple operations on Molckai and Kauai.

As noted in Appendix F, "freed" lands may be available for profitable replacement crops but, because of expensive subdivision requirements and other concerns, such lands may not be available to small farmers.

Again, thank you very much for your comments.

Sincerely,


William E. Wanket

WEW : awp



**DEPARTMENT OF BUSINESS
AND ECONOMIC DEVELOPMENT**

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JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
MURRAY E. TOWILL
DEPUTY DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR

Ref. No. P-7754

December 8, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: Environmental Impact Statement Preparation Notice
Kunia Golf Course

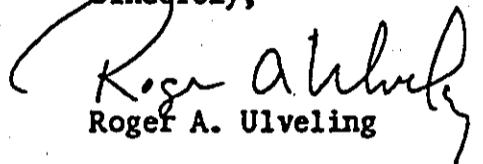
We have reviewed the subject EISPN and have the following comments.

The subject document states on page 31, that Coastal Zone Management is "N/A" (not applicable). For your information, under the Hawaii Coastal Zone Management (CZM) Law, Chapter 205A, Hawaii Revised Statutes, the CZM Administrative Area is comprised of all land except forest reserves and excluded Federal lands. Included within the CZM Administrative Area is the Special Management Area (SMA); development within the SMA requires a County administered permit. Therefore, although the proposed project does not lie within the SMA, the EIS should discuss the project's relevance to all CZM objectives and policies, as specified in Chapter 205A, Hawaii Revised Statutes.

The document states that a study will be done on the impact of fertilizers and pesticides. This study should consider the potential effects of these pollutants on endangered species in the Pearl Harbor National Wildlife Refuge, located in the lower reaches of the watershed for the proposed project.

We look forward to reviewing the EIS for the proposed project.

Sincerely,


Roger A. Ulveling

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. Roger A Ulveling
Director
State Department of
Business and Economic Development
P.O. BOX 2359
Honolulu, Hawaii 96804

Re: Response to Comments on the EIS Preparation Notice (EISPN),
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Ulveling:

Thank you very much for your comments on the above-reference EISPN.
We respond as follows:

Coastal Zone Management

We recognize the project lies within the broader framework of Part I of the Coastal Zone Management (CZM) program and as such relationships should be identified between the proposed project and the CZM objectives and policies.

The essence of the CZM objectives and policies are embodied within various portions of the EISPN and especially the State and City and County policy documents which are referenced. However, for purposes of clarity the seven CZM program objectives and their related policies are reviewed below:

Recreation Resources

The proposed golf course while not coastal related provided an additional recreational facility in an area which has a deficiency in convenient golf courses. The proposed course will expand the golfing opportunities for both residents and visitors.

Historic Resources

Field observations were conducted on the site and no above-ground archaeological features were found and it was concluded the site offers little chance of subsurface recovery.

Scenic and Open Space Resources

The proposed project will not materially alter the existing natural landform. The golf course represents an open space resource which retains the open

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scenic qualities of the area. Buildings will not infringe into any scenic viewing corridors and the placement of the clubhouse will be oriented to take advantage of the viewing opportunities offered by the central plateau and the bracketing mountain ranges.

Coastal Ecosystems

The golf course will incorporate retention and sediment basins as well as earthen berms to control runoff into the nearby gulches and ditches. The environmental impact of chemicals which will be used on the golf course will be studied (Green and Murdoch).

The construction of the golf course will alter the habitat for some birds currently using the site. However, as the Avifaunal and Feral Mammal Survey indicated the conversion of the property "to a more diversified habit of trees and grass should be a positive change with a resultant increase in the populations of most bird species."

Economic Uses

The economic impact of the proposed golf course is reviewed in detailed in the Market Analysis. The course will in brief provide new employment opportunities while promoting Hawaii's geographic and environmental advantages in attracting new economic activities to meet visitor and resident demands. The course is located and will be designed and constructed to minimize adverse social, visual, and environmental impacts in the CZM area.

Coastal Hazards

As noted earlier, the course will be designed to minimize runoff into adjacent gulches. A special study will be conducted on the impact of chemicals used on the course. The site is well drained and not prone to flooding.

Managing Development

The proposed project is in its initial stage of development. The Environmental Impact Statement being prepared will offer the general public an opportunity to participate in the early stages of project review. The proposed golf course requires the processing of a Development Plan Amendment, a State Special Permit or Land Use Boundary Change and a Zoning Amendment. These application procedures will offer the general public ample opportunity to participate in the planning process for the proposed golf course.

In summary the proposed Kunia Golf Course will not adversely impact the Objectives and Policies of the CZM program. The proposed project will be managed in a manner to comply with the spirit and intent of the CZM program.

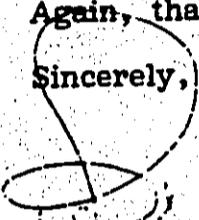
Page 3

Impact of Fertilizers and Pesticides

As indicated earlier, a chemical impact study will be done and included as part of the Draft EIS. Your concern regarding endangered species will be addressed.

Again, thank you very much for your comment.

Sincerely,


William E. Wanket

JOHN WAIHEE
GOVERNOR OF HAWAII



JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EPHSD

December 8, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop St.
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: Development Plan Application and Environmental Assessment for
the Proposed Golf Course - Kunia, Oahu

Thank you for allowing us to review and comment on the subject EISPN. We provide the following comments for your review.

Drinking Water

The location of this proposed golf course makes the issues of water availability and water quality critical. The environmental assessment discussed two schemes for supplying potable water to the golf course. Scheme A involves upgrading the Hawaii Country Club Water System. Scheme B proposes to drill a new well.

It is a well publicized fact that groundwater contamination has been found in several wells in the Kunia area. Finding a groundwater source free of contaminants may be difficult. Dibromochloropropane (DBCP) and tetrachloroethylene (PCE) have been reported in the Hawaii Country Club well. Trace concentrations of DBCP, trichloropropane (TCP), and atrazine have been detected in the Kunia I wells. Levels in the Kunia II well were high enough for the Board of Water Supply to install a Granulated Activated Carbon (GAC) treatment plant. Mililani and Waipahu wells also have GAC filter plants. One of the wells formerly serving Del Monte Kunia was closed due to the concentrations of ethylene dibromide (EDB) and DBCP found in the well water. The developer should consider the possibility that a new well at the Clubhouse site may contain contaminants found in other central Oahu wells.

The Safe Drinking Water Act was revised in June, 1986. Rules for additional compounds are being developed. Beginning in January, the Drinking Water Program will begin monitoring for eight regulated volatile organic compounds and 51 unregulated compounds. This increases the potential that contaminants may be found in a new well. The environmental impact statement should fully address the issues of water quality and assess the possibility of treatment.

Please be advised that any new source of potable water developed to serve the golf course would be subject to approval by the Director of Health prior to its use required under the terms of Section 11-20-29 of Chapter 20, Title 11, Administrative Rules. Such

Mr. William E. Wanket
December 8, 1987
Page 2

approval is based primarily upon the satisfactory submission of an engineering report which adequately addresses all concerns as set down in Section 11-20-29. The engineering report must be prepared by a registered professional engineer and bear his or her seal upon submittal.

Section 11-29-30 requires that new or substantially modified distribution systems for public water systems be approved by the Director of Health. Such approval depends upon the submission of plans and specifications for the project prior to construction and the demonstration that the new or modified portions of the system are capable of delivering potable water in compliance to all maximum contaminant levels as set down in Chapter 20 once the distribution system or modification is completed.

Because Kunia is located in the Pearl Harbor Basin Groundwater Control Area, there is a question of water availability. The Department of Land and Natural Resources determined that the Pearl Harbor Basal Aquifer was being used beyond its maximum sustainable yield of 225 million gallons per day. Pumpage limits have been identified and set. Oahu Sugar would have to release its current water allocation for the proposed site to the developer. The applicant has indicated that water use for the golf course will be less than water used for sugar production by about 1.1 MGD. However, the water used at the site is nonpotable. Both proposed schemes for supplying potable water described in the environmental assessment involve withdrawing additional potable water in an aquifer which has experienced droughts and groundwater contamination. Approval by the Department of Land and Natural Resources will be necessary.

Should there be any questions regarding Chapter 20, Title 11, Administrative Rules, please contact the Drinking Water Program at 548-2235.

Wastewater Disposal

Of the two proposed alternatives for handling the 68,000 gpd wastewater flow, it is recommended that Scheme "A" be followed. This scheme calls for the construction of 13,000 feet of 8-inch gravity line along Kunia Road to the municipal system. The rationale for this is that Scheme "B" calls for treatment of 68,000 gpd flow by aerated lagoons and the disposal of the effluent by irrigation on the golf course. Under the current requirements for Underground Injection Control (UIC) and treatment works, this proposal would be acceptable; however, since the project is located above the Board of Water Supply's (BWS) no-pass line and in the vicinity of their wells, the proposed scheme of disposing the treated effluent by irrigation may not be allowed by BWS.

Vector Control

1. This is cane land and our rule on clearing of sites (Title 11, Chapter 26, Section 11-26-35) must be strictly adhered to.
2. There are reservations regarding Scheme "B" for wastewater disposal. We have had serious midge problems with holding ponds used for wastewater disposal.

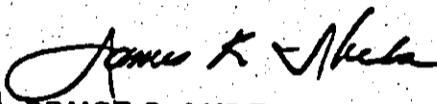
Mr. William E. Wanket
December 8, 1987
Page 3

Examples are Queens Gate in Kalama Valley and Makaha Golf Course where the midge problems have been severe and caused nearby residents much discomfort.

Noise

1. The proposed project clubhouse must be designed to comply with the provisions of Title 11, Administrative Rules, Chapter 43, Community Noise Control for Oahu. Noise from equipment, such as air conditioning/ventilation units and exhaust units, must be attenuated to meet the allowable noise levels of the rules.
2. Activities associated with the construction phase must comply with the provisions of Title 11, Administrative Rules, Chapter 43, Community Noise Control for Oahu.
 - a. The contractor must obtain a noise permit if the noise levels from the construction activities are expected to exceed the allowable levels of the rules.
 - b. Construction equipment and onsite vehicles or devices requiring an exhaust of gas or air must be equipped with a muffler.
 - c. The contractor must comply with the conditional use of the permit specified by the conditions issued with the permit.
3. Traffic noise from heavy vehicles travelling to and from the construction site must be minimized near residential areas and must comply with Title 11, Administrative Rules, Chapter 42, Vehicular Noise Control for Oahu.

Sincerely,


BRUCE S. ANDERSON, Ph.D.
Deputy Director for
Environmental Health

WILLIAM
E.
WANKET
INC.

Land Use Consultant

January 15, 1988

Mr. Bruce S. Anderson
Deputy Director for Environmental Health
State Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Re: Response to Comments on the EIS Preparation Notice
(EISPN), Development of a Golf Course, Kunia, Oahu

Dear Mr. Anderson:

Thank you very much for your comments on the above
referenced EISPN. We respond as follows:

Drinking Water

The Department of Health has indicated that any new source or substantially modified source of potable water developed to serve the proposed golf course would be subject to approval of the Director of Health (DOH) prior to its use under the terms of Section 11-20-29 and or Section 11-29-30 of Chapter 20, Title 11, Administrative Rules. Further the DOH advises that groundwater contamination has been found in several wells in the Kunia area and that due to this finding the DOH has increased the scope of its testing program for contaminants. Detection of contaminants in new or existing sources may prohibit their use as potable water sources without treatment. Information supplied by the DOH drinking water section indicates a number of treatments including, carbon filtration, pack tower aeration, reverse osmosis and deionization could be employed to rid water of various contaminants. To date the DOH has not encountered any contamination problems which could not be treated with available technology, although some treatment alternatives have been considered uneconomic by some water system operators. The applicant intends to minimize costs by treating only that water to be used as potable water.

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu HI 96813
Phone
(808) 533-4937

Mr. Bruce S. Anderson
January 15, 1988
Page 2

The applicant will comply with all laws and regulations relating to safe drinking water and will work with Health Department personnel in order to determine the proper treatment techniques should they be determined to be necessary to insure water quality.

The applicant also recognizes the need to obtain approval for all new wells from the State Department of Land and Natural Resources.

Wastewater Disposal

The applicant is proposing to follow Scheme "A", the construction of 13,000 feet of 8-inch gravity line along Kunia Road to the existing municipal system at Village Park.

Vector Control

As stated above, Wastewater Scheme "A" will be followed. Regarding clearing of the site, we will strictly comply with the requirements of Title 11, Chapter 26, Section 11-26-35.

Noise

Thank you for specifying the various regulations controlling noise. The Draft EIS will contain these references and all requirements will be met.

Again, thank you very much for your comments.

Sincerely,


William E. Wanket

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

DEC 18 1987

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LIBERT K. LANDGRAF
DEPUTY

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

DOC. NO.: 2233E
FILE NO.: 88-234

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

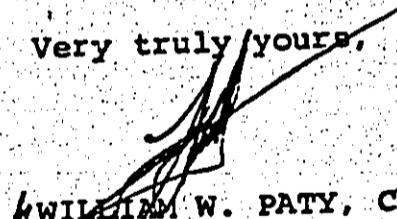
Dear Mr. Wanket:

SUBJECT: Kunia Golf Course, TMK: 9-4-04: 09

Thank you for the opportunity to review the Environmental
Assessment for the subject project.

We have no comments to offer at this time.

Very truly yours,


WILLIAM W. PATY, Chairman
Board of Land and Natural Resources

NO RESPONSE REQUIRED.

JOHN WAIHEE
GOVERNOR



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

DIRECTOR
EDWARD Y. HIRATA

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI

IN REPLY REFER TO:

STP 8.2537

December 9, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Development Plan Application
and Environmental Assessment
Proposed Golf Course
Kunia, Oahu

We are recommending that separate lanes for left and right turns exiting the site be provided. In addition, a left-turn storage lane for southbound Kunia Road traffic wishing to enter the site should also be provided.

Any plans for work within the State road right-of-way must be submitted to and approved by our Highways Division. The cost of all intersection improvements shall be borne by the developer.

Thank you for this opportunity to provide comments.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Edward Y. Hirata".

Edward Y. Hirata
Director of Transportation

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. Edward Y. Hirata
Director
State Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Re: Response to Comments on the EIS Preparation Notice (EISPN),
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Hirata:

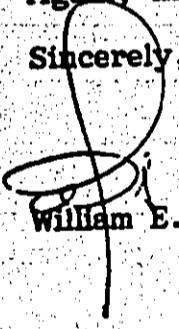
Thank you very much for your comments on the above-reference EISPN.

Our traffic consultant, Parson Brinckerhoff, has recommended as well that separate lanes for left and right turns exiting the site be provided. With reference to a left-turn storage lane for southbound Kunia Road traffic wishing to enter the site, this was also suggested but with the recommendation that it be implemented at such time as similar improvements are made along Kunia Road.

Regarding plans for work within the State road right-of-way, we will submit such plans for your review and approval. We acknowledge that the cost of all intersection improvements shall be borne by the developer.

Again, thank you very much for your comments.

Sincerely,


William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937



STATE OF HAWAII
DEPARTMENT OF BUSINESS
AND ECONOMIC DEVELOPMENT

LAND USE COMMISSION

Room 104, Old Federal Bldg. 335 Merchant Street
Honolulu, Hawaii 96813 Telephone: 548-4611

JOHN WAIHEE
Governor
TEOFILO PHIL TACBIAN
Chairman
FREDERICK P. WHITTEMORE
Vice Chairman

COMMISSION MEMBERS:

Richard B.F. Choy
Lawrence F. Chun
Everett L. Cuskaden
Sharon A. Himeno
Toru Suzuki
Robert S. Tanaya
Ranton L.K. Nip

ESTHER UEDA
Executive Officer

November 19, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: EISPN - Kunia Golf Course

Thank you for providing us a copy of the EISPN for the proposed Kunia Golf Course.

Inasmuch as the proposed site is within the State Land Use Agricultural District and has a Land Study Bureau Master Productivity Rating of "A", a State Special Permit or Land Use District Boundary Amendment will be required for the proposed use.

Thank you for this opportunity to comment.

Sincerely,

ESTHER UEDA
Executive Officer

EU:to

WILLIAM
E.
WANKET
INC.

January 15, 1988

Ms. Esther Ueda
Executive Office
State Land Use Commission
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

Re: Response to Comments on the EIS Preparation Notice (EISPN)
Development of a Golf Course, Kunia, Oahu.

Dear Ms. Ueda:

Thank you very much for your comments on the above-referenced EISPN.

The Draft EIS will include a statement on the need for a State Special Permit or Land Use District Boundary Amendment for the proposed development.

Sincerely,


William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937



University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

December 4, 1987
PN:0057

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Preparation Notice
Environmental Impact Statement
Kunia Golf Course
Kunia, Oahu

This document proposes building an 18-hole championship-style golf course, a club house and restaurant, tennis courts, a swimming pool and other recreational amenities. This brief review was prepared with the assistance of Henry Gee, Water Resources Research Center; and Steven Armann, Environmental Center. An indepth review will be conducted upon receiving the Draft Environmental Impact Statement (EIS).

The water supply schemes presented on page 22 for potable water may not be viable alternatives for drinking water. Scheme A will tap into the private water system of Hawaii Country Club. We believe this well is used for irrigation of their golf course and, although low in salinity, traces of organic solvents have been found. An analysis of the well in June 1985 showed concentrations of 16ppt DBCP and 130ppt TCP. Scheme B, drilling a new well at the Kunia Golf Course clubhouse site may also encounter these same contaminants and would not satisfy BWS drinking water standards. We note that since the source will come from a private well, the Department of Health will be responsible for requiring compliance with the state water quality standards. We believe water from Waiahole ditch, with proper treatment, can provide an alternative source of potable drinking water.

Thank you for the opportunity to comment on this EIS Preparation Notice. We hope our comments will assist in the preparation of the Draft EIS.

Yours truly,

Jacquelin N. Miller
Associate Environmental Coordinator

cc: OEQC
L. Stephen Lau
Henry Gee
Steven Armann

A portion of this document is classified as confidential.

AN EQUAL OPPORTUNITY EMPLOYER

WILLIAM
E.
WANKET
INC.

January 15, 1988

Ms. Jacquelin N. Miller
Associate Environmental Coordinator
Environmental Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Re: Response to Comments on the EIS Preparation Notice
(EISPN), Development of a Golf Course, Kunia, Oahu

Dear Ms. Miller:

Thank you very much for your comments on the above-
referenced EISPN.

Water Contaminants

Please refer to the Draft EIS for a revised list of options
for providing water to the proposed project.

The Department of Health has indicated that any new source
or substantially modified source of potable water developed
to serve the proposed golf course would be subject to
approval of the Director of Health (DOH) prior to its use
under the terms of Section 11-20-29 and or Section 11-29-30
of Chapter 20, Title 11, Administrative Rules. Further the
DOH advises that groundwater contamination has been found in
several wells in the Kunia area and that due to this finding
the DOH has increased the scope of its testing program for
contaminants. Detection of contaminants in new or existing
sources may prohibit their use as potable water sources
without treatment. Information supplied by the DOH drinking
water section indicates a number of treatments including,
carbon filtration, pack tower aeration, reverse osmosis and
deionization could be employed to rid water of various

Pacific Tower
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1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

Ms. Jacquelin N. Miller
January 15, 1988
Page 2

contaminants. To date the DOH has not encountered any contamination problems which could not be treated with available technology, although some treatment alternatives have been considered uneconomic by some water system operators. The applicant intends to minimize costs by treating only that water to be used as potable water.

The applicant will comply with all laws and regulations relating to safe drinking water and will work with Health Department personnel in order to determine the proper treatment techniques should they be determined to be necessary to insure water quality.

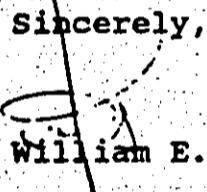
The applicant also recognizes the need to obtain approval for all new wells from the State Department of Land and Natural Resources.

Waiahole Ditch Water

Oahu Sugar Company has stated that they will not permit water withdrawal from the Waiahole Ditch.

Again, thank you very much for your comments.

Sincerely,


William E. Wanket

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

630 SOUTH BERETANIA STREET

HONOLULU, HAWAII 96843



December 21, 1987

FRANK F. FASI, Mayor

DONNA B. GOTH, Chairman
ERNEST A. WATARI, Vice Chairman
MILTON J. AGADER
SISTER M. DAVILYN AH CHICK, O.S.F.
EDWARD Y. HIRATA
ALFRED J. THIEDE
JOHN K. TSUI

KAZU HAYASHIDA
Manager and Chief Engineer

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: Your Letter of November 8, 1987 on the
Environmental Preparation Notice for a Proposed
Golf Course at Kunia, TMK: 9-4-04: 9

Thank you for the opportunity to comment on the environmental assessment for the proposed golf course.

We have the following comments:

1. We have no water system in the area of the proposed project.
2. We have no objections to either Schematic A or B to provide potable water for the golf course domestic water requirement. Under Scheme B, the developer will be required to obtain a permitted use and approval to drill a new well from the State. The program is currently administered by the Board of Land and Natural Resources, but will be turned over to the new Water Commission.
3. The fire protection requirements should be coordinated with the Fire Department.
4. The use of secondary treated sewage effluent for irrigation should be approved by the Department of Health.

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: George Uyema

WILLIAM
E.
WANKET
INC.

Land Use Consultants

January 15, 1988

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Re: Response to Comments on the EIS Preparation Notice
(EISPN), Development of a Golf Course, Kunia, Oahu.

Dear Mr. Hayashida:

Thank you very much for your comments on the above-referenced EISPN. We respond as follows:

Item 1

No response necessary.

Item 2

The applicant has revised the proposed alternatives for supplying the golf course development with water in order to broaden the applicant's opportunities. We ask that you review the revised water section.

The applicant is aware of the requirement to obtain approval to develop water within the Pearl Harbor Ground Water Control Area from the Department of Land and Natural Resources, currently, and at some future date from the State Water Commission.

The applicant will comply with all applicable state and county requirements.

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu HI 96813
Phone
(808) 533-4937

Mr. Kazu Hayashida
January 15, 1988
Page 2

Item 3

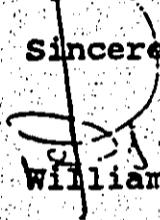
We will coordinate with Fire Department to ensure that the fire flow and access requirements meets the applicable fire codes.

Item 4

A wastewater treatment plant is no longer being proposed. The applicant is proposing to follow Scheme "A", the construction of 13,000 feet of 8-inch gravity line along Kunia Road to the existing municipal system at Village Park.

Again, thank you for your comments.

Sincerely,


William E. Wanket

Mr. William E. Wanket, Inc.
William E. Wanket, President
Page 2
December 8, 1987

Regarding Appendix G, Market Analysis for the Proposed Kunia Golf Facility, September 1987, the apparent discrepancy between the number of golf holes on Oahu (less military courses) as indicated on Exhibit IV-2 and V-1 should be clarified. On Exhibit V-4, population projections were developed by the former State Department of Planning and Economic Development and not the Department of General Planning. Is the 1987 population estimate made for the end of 1987? Should the military population be included in these calculations?

If you have any questions, please call Randy Hara at 523-4483.

Sincerely,

Donald A. Clegg
DONALD A. CLEGG
Chief Planning Officer

CORRECTION

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

Mr. Kazu Hayashida
January 15, 1988
Page 2

Item 3

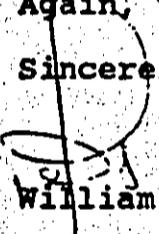
We will coordinate with Fire Department to ensure that the fire flow and access requirements meets the applicable fire codes.

Item 4

A wastewater treatment plant is no longer being proposed. The applicant is proposing to follow Scheme "A", the construction of 13,000 feet of 8-inch gravity line along Kunia Road to the existing municipal system at Village Park.

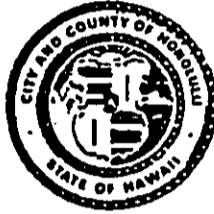
Again, thank you for your comments.

Sincerely,


William E. Wanket

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

RH/DGP 11/87-3828

December 8, 1987

Mr. William E. Wanket, Inc.
William E. Wanket, President
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Environmental Assessment on the Kunia Golf Course

Thank you for the opportunity to review the subject project. The following comments are submitted for the preparation of the Environmental Impact Statement:

Paragraph B, Development Timetable, on page 5 indicates that golf course completion will depend on the status of the current lease with Oahu Sugar Company. What are the conditions of the lease agreement and are there plans for negotiations with Oahu Sugar that would affect the golf course development timetable?

The last paragraph of Section A, Public Problem or Need, on page 8 indicates that Nihonkai Lease Company is an experienced country club owner and operator. Can you briefly describe the business of Nihonkai Lease Company and its past experience in golf course development and operation.

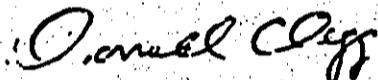
The discussion of the City's General Plan should include the impacts of this proposal on the General Plan's objective and policies to provide sufficient agricultural land in Central Oahu to encourage the continuation of sugar and pineapple as viable industries including a review of the needs of Oahu Sugar for sugar production. The review should include Oahu sugar lands in Ewa and Central Oahu and the proposed use of those lands for urban uses.

Mr. William E. Wanket, Inc.
William E. Wanket, President
Page 2
December 8, 1987

Regarding Appendix G, Market Analysis for the Proposed Kunia Golf Facility, September 1987, the apparent discrepancy between the number of golf holes on Oahu (less military courses) as indicated on Exhibit IV-2 and V-1 should be clarified. On Exhibit V-4, population projections were developed by the former State Department of Planning and Economic Development and not the Department of General Planning. Is the 1987 population estimate made for the end of 1987? Should the military population be included in these calculations?

If you have any questions, please call Randy Hara at 523-4483.

Sincerely,


DONALD A. CLEGG
Chief Planning Officer

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
Municipal Office Building, 8th Floor
650 South King Street
Honolulu, Hawaii 96813

Re: Response to Comments on the EIS Preparation Notice (EISPN),
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Clegg:

Thank you very much for your comments on the above-reference EISPN.
We respond as follows:

Paragraph B, Development Timetable

Oahu Sugar Company has a lease on the property that expires in December 1996. Oahu Sugar Company has advised us that "...at this juncture we intend to cultivate the area till that time..." (letter from OSCo dated November 16, 1987). In an earlier letter (November 2, 1987), OSCo indicated that they would be willing to engage in discussions regarding a possible purchase of the leasehold interest under certain conditions.

Section A, Public Problem or Need

Nihonkai Lease Company, Ltd. is the Land Division of Tottori F-One Ltd, a men's apparel industry in Japan with offices in the United States as well. Nihonkai is responsible for developing two golf courses in Japan, one at Nishi-Mikado, Kohge-cho, Yasu-gun, Tottori Prefecture (18-holes, par 71) and the other at Karakawa, Iwami-cho, Iwami-gun, Tottori Prefecture (18-holes, par 72).

City's General Plan Agricultural Objectives and Policies

Regarding pineapple operations, the proposed project will have no impact on this activity inasmuch as pineapple lands would not be affected.

Regarding sugar operations, the impact of the proposed development on the viability of OSCo is discussed in detail in Appendix F, pages 2 through 9.

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

Market Analysis

With reference to the number of golf holes, there is a discrepancy of 18 holes between Exhibits IV-2 and V-1. In both cases the source of the information was the State Data Book. The number of golf holes cited in Exhibit IV-2 was for 1980 and the number of golf holes cited in Exhibit V-1 was for 1984. If the number of golf holes shown on Exhibit V-1 is increased to 324 then the ratio of persons to golf holes decreases from 1 to 2,000 to 1 to 1,888. This 6% change would rank the County of Honolulu 46th out of 50 states with Maryland, California, Louisiana and Alaska with a lower ratio. On the other hand use of the higher ratio results in a more conservative estimate of demand in the remainder of the report. Based on the above, it appears that the discrepancy does not have a material impact on the conclusions or recommendations contained in the report. It should also be noted that if the analysis had been conducted using the State Data Book information for 1984 and the 1984 population figures the results would have been very close to the results shown in Exhibit V-1.

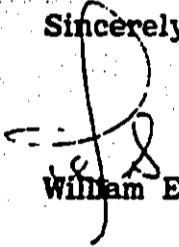
Regarding population, the source of the population estimate is the former State Department of Planning and Economic Development, however, in its report titled "Residential Development Implications of the Development Plans" the Department of General Planning adopted these projections and projected the population by development plan areas which have been used in the Market Analysis.

Regarding the question of whether the 1987 population estimate was made for the end of 1987, we answer yes (note: this led to an understatement of approximately 2 golf holes in the projection of demand).

With reference to the military, we do not feel they should be included in the calculations. The market analysis assumes that the military population throughout the island of Oahu remains constant. It also assumes that the military population within DP areas remains constant. Note: the DPED forecast which was the basis for the population projection projected no change in the number of military jobs between 1980 and 2005.

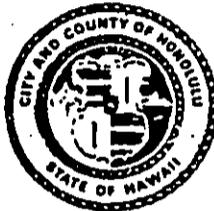
Again, thank you very much for your comments.

Sincerely,


William E. Wanket

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 ☎ (808) 523-4432

FRANK F. FASI
MAYOR



JOHN P. WHALEN
DIRECTOR

LU11/87-6044(mstm)

December 8, 1987

Mr. William E. Wanket
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Environmental Assessment for
Proposed Kunia Golf Course
Waipahu, Oahu; Tax Map Key 9-4-04: 09

The Department of Land Utilization has had the opportunity to review the environmental assessment for the proposed Kunia Golf Course.

Based on our review, we offer the following comments:

1. Is the proposed golf course site located over an aquifer recharge area? You state that little or no impact on water recharge is expected due to the proposed development. Will there be a deficit on water recharge, and if so, how much? Please provide a mathematical analysis to justify your statement.
2. The proposed Green and Murdock Study concerning the environmental impact of chemicals to be used should be made a part of the EIS.

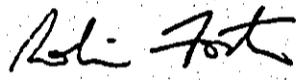
Specifically, what are the projected long-term impacts on ground water from the use of the recommended chemicals? A comparison of the effects of the chemicals currently being used in the cane fields to the proposed chemicals for the golf course should be made.

Mr. William E. Wanket
Page 2

3. The slope of the parcel is approximately four percent. Storm-water runoff from the site drains into Waiahole Ditch and Ekahanui Gulch. What effect will the chemicals have on receiving waters?

Thank you for the opportunity to comment. If you have any questions, please contact Maureen St. Michel of our staff at 527-5349.

Very truly yours,


/s/ JOHN P. WHALEN
Director of Land Utilization

JPW:s1
14958

WILLIAM
E.
WANKET
INC.

January 15, 1988

Land Use Consultant

Mr. John P. Whalen
Director
Department of Land Utilization
Municipal Office Building, 7th Floor
650 South King Street
Honolulu, Hawaii 96813

Re: Response to Comments on the EIS Preparation Notice (EISPN),
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Whalen:

Thank you very much for your comments on the above-reference EISPN.
We respond as follows:

Water Recharge

The proposed golf course is situated over an aquifer recharge area of Pearl Harbor GWCA.

The withdrawal of sugar operations from the subject site would reduce irrigation water use by about 1.7 MGD. However, this reduction would be offset by increased golf course irrigation water requirement of about 0.6 MGD, resulting in a net decrease in water use of about 1.1 MGD.

Water currently used for agricultural purposes on the subject property is provided by Waiahole Ditch. The Department of Land and Natural Resources (DLNR) estimates approximately 27 MGD of irrigation water is imported by Waiahole Ditch, of which a 15 MGD contributes to the recharge of the Pearl Harbor GWCA or 56% of transported water. A net decrease in irrigation water return from golf course operation within the GWCA is therefore estimated at 0.61 MGD or 0.23% of total recharge of 271 MGD to the Pearl Harbor basal aquifer estimated by DLNR.

The reduced amount of irrigation water by golf course operation will increase the available water for agricultural activities which will allow the potential use of this irrigation water on lands nearby the project site.

In view of these assumptions, we have concluded that little or no impact on water recharge is expected due to the development as proposed.

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

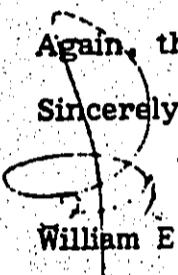
Page 2

Impact of Chemicals (comments 2 and 3)

The "Environmental Impact of Fertilizer and Pesticide Use On The Proposed Kunia Golf Course", a report by Green and Murdoch, will be part of the Draft EIS. This report addresses your concerns and concludes "... that it is unlikely that development of the proposed Kunia golf course would pose environmental risks associated with the use of chemicals fertilizers and pesticides..." (page 7).

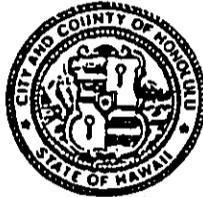
Again, thank you very much for your comments.

Sincerely,


William E. Wanket

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

HIRAM K. KAMAKA
DIRECTOR
WALTER M. OZAWA
DEPUTY DIRECTOR

November 23, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

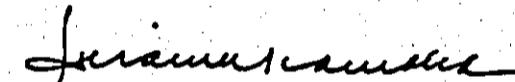
Dear Mr. Wanket:

Subject: Environmental Impact Statement Preparation Notice (EISPN)
Kunia Golf Course
Tax Map Key 9-4-04:9

We have no comments to the Environmental Impact Statement Preparation Notice
for the proposed Kunia Golf Course in Central Oahu.

Thank you for the opportunity to review the EISPN report.

Sincerely,


HIRAM K. KAMAKA, Director

HKK:ei NO RESPONSE REQUIRED.

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER
ENV 87-230

FRANK F. PASI
MAYOR

November 24, 1987

Mr. William E. Wanket
President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: EISPN for The Proposed Golf Course, Kunia, Oahu
(Tax Map Key: 9-4-04: 9)

We have reviewed the environmental assessment for the proposed project and have the following comments:

1. Part of the drainage area of Basin E is across Kunia Road and has not been included in the Design Storm Runoff Quantities in Exhibit 13. Both Exhibits 12 and 13 should be revised.
2. The construction of a proposed 8-inch sewer along Kunia Road to the existing municipal system at Village Park, Waipahu, under Scheme A would require an expansion of the existing capacity of Kunia wastewater pump station. If there are any areas makai of the golf course which may be developed, oversizing of the proposed sewer should be considered.
3. We have no objection to the construction of a private WTP under Scheme B. The private plant will be constructed by the applicant and be operated and maintained by the applicant. The applicant, not the City and County, will be responsible to insure that effluent meets all applicable discharge limitations.

The reuse of the effluent for golf course irrigation should be reviewed by the Board of Water Supply and the Department of Health, since the site is located in the "no-pass" zone.

Very truly yours,


ALFRED J. THIEDE
Director and Chief Engineer

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
Municipal Office Building, 11th Floor
Honolulu, Hawaii 96813

Re: Response to Comments on the EIS Preparation Notice (EISPN)
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Thiede:

Thank you very much for your comments on the above-referenced EISPN.
We respond as follows:

1. Drainage

The revised drainage area of Basin E and Design Storm Runoff Quantities in Exhibit 13 will be included in the Draft EIS.

2. Municipal Sewer System.

The Draft EIS will recognize the need to expand the existing capacity of the Kunia wastewater pump station. The proposed 8-inch line will connect with an existing 8-inch line along Kunia Road. Any further development makai is likely to use an alternate route.

3. Private WWTP.

The applicant will be responsible to insure that effluent meets all applicable discharge limitations. The reuse of the treated wastewater effluent for golf course irrigation will be reviewed by the Board of Water Supply and the Department of Health.

Again, thank you for your comments.

Sincerely,

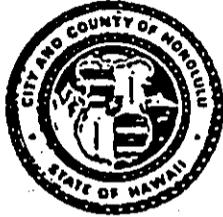

William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

ARTMENT OF TRANSPORTATION S. . 25
CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR



JOHN E. HIRTEN
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

PL1.0881
TE-9386

December 16, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

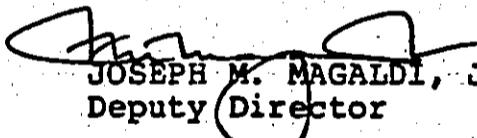
Dear Mr. Wanket:

Subject: Environmental Assessment for Proposed
Golf Course
Kunia, Hawaii
TMK: 9-4-04: 9

This is in response to your letter of November 8, 1987 requesting our review and comments concerning the subject assessment.

We appreciate the opportunity to comment. However, since Kunia Road which fronts the proposed project is under the jurisdiction of the State Department of Transportation, they should be the agency to review and comment on the assessment.

Sincerely,


JOSEPH M. MAGALDI, JR.
Deputy Director

cc: State Department of
Transportation

NO RESPONSE REQUIRED.

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU

1455 S. BERETANIA STREET, ROOM 305
HONOLULU, HAWAII 96814

FRANK F. FASI
MAYOR



FRANK K. KAHOOHANOHANO
FIRE CHIEF

LIONEL E. CAMARA
DEPUTY FIRE CHIEF

November 13, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, Hawaii 96813

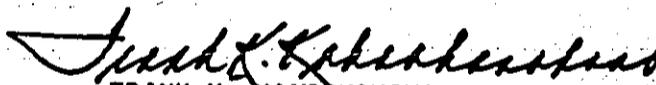
Dear Mr. Wanket:

SUBJECT: PROPOSED KUNIA GOLF COURSE DEVELOPMENT

We have reviewed the Development Plan Application and Environmental Assessment for the above proposed development. Fire protection would be from the Waipahu Fire Station housing an engine and a ladder company and 11 on-duty personnel. Secondary protection would be from the Wahiawa Fire Station. Both stations are an estimated five to eight minutes from the proposed development.

We have no objections to the proposed development. However, our concern would be that the fire flow and access meets the applicable fire codes.

Should you have any questions, please contact Battalion Chief Kenneth Word of our Administrative Services Bureau at 943-3638.


FRANK K. KAHOOHANOHANO
Fire Chief

FKK/CAM:sb

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. Frank K. Kahoochanohano
Fire Chief
Fire Department
1455 South Beretania, Room 305
Honolulu, Hawaii 96814

Re: Response to Comments on the EIS Preparation Notice (EISPN)
Development of a Golf Course, Kunia, Oahu.

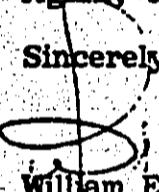
Dear Mr. Kahoochanohano:

Thank you very much for your comments on the above-reference EISPN.

The information you have provided will be included in the Draft EIS. We will coordinate with your office to ensure that the fire flow and access meets the applicable fire codes.

Again, thank you for your comments.

Sincerely,


William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu HI 96813
Phone
(808) 533-4937

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU

1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 - AREA CODE (808) 943-3111

FRANK F. FASI
MAYOR



DOUGLAS G. GIBB
CHIEF

WARREN FERREIRA
DEPUTY CHIEF

OUR REFERENCE SS-LK

November 23, 1987

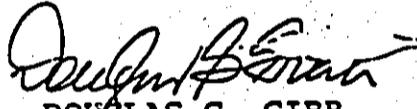
Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: Environmental Impact Statement Preparation Notice
(EISPN) for a proposed Kunia Golf Course development
along Kunia Road, Central Oahu.

We have reviewed the EISPN for the proposed Kunia Golf Course development and do not foresee the project having a major impact on calls for police service in the area.

Sincerely,


DOUGLAS G. GIBB
Chief of Police

NO RESPONSE REQUIRED.



Brenner Munger, Ph.D., P.E.
Manager
Environmental Department
(808) 548-6880

December 7, 1987

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: Environmental Impact Statement Preparation Notice
(EISPN) for the Proposed Kunia Golf Course, Kunia, Oahu,
Hawaii

We have reviewed the subject EISPN and have the following comments regarding the "Utility" section presented on page 28".

1. In the second sentence of the first paragraph, the 12KV power lines are fed from HECO's Waipio Substation and not the upper Kipapa substation.
2. We do not feel that the load will warrant the installation of a substation as mentioned in the third paragraph. The existing 12KV circuit on Kunia Road will be adequate to serve the Golf Course.
3. The intent of the fifth paragraph is not clear. The utility lines within the development would most likely be constructed by HECO in accordance with State laws. The City and County standards would only be applicable to the secondary wiring after the meter.

Sincerely,

Brenner Munger

10. Utilities

Existing electrical and telephone service to the site is currently supplied by overhead lines along Kunia Road. Electrical service to these 12kv power lines is supplied by the Upper Kipapa Substation.
WAIPIE

Electrical and telephone infrastructure may have to be upgraded to serve the development.

The developer will work closely with HECO in order to find an appropriate on-site location for a substation as well as to ensure that timely service can be provided.

No other mitigating measures are necessary since the Electric Company has indicated that adequate service can be provided.

The electrical system within the development will be built to County standard. Utility lines will be underground to mitigate any visual impacts. UTILITY BY WHO?

The developer will maintain contact with Hawaiian Telephone Co. to assure necessary service levels.

11. Other

N/A

12. List of Agencies Consulted

State Department of Land and Natural Resources

State Department of Health

Board of Water Supply

City and County of Honolulu Public Works Department

City and County of Honolulu Department of General Planning

City and County of Honolulu Department of Land Utilization

State Land Use Commission Office

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. Brenner Munger
Manager, Environmental Department
Hawaiian Electric Company
P.O. BOX 2750
Honolulu, Hawaii 96840-0001

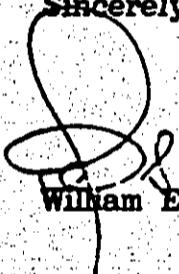
Re: Response to Comments on the EIS Preparation Notice (EISPN)
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Munger:

Thank you very much for your comments on the above-referenced EISPN.

The Utility section of the Draft EIS will incorporate your comments. We appreciate your time in reviewing the EISPN.

Sincerely,


William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu HI 96813
Phone
(808) 533-4937

HAWAIIAN TEL GTE

Hawaiian Telephone Company
P.O. Box 2200
Honolulu, Hawaii 96841

Telephone (808) 546-4511

December 2, 1987

William E. Wanket, Inc.
William E. Wanket, President
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

ATTENTION: William Wanket

Dear Sir:

Environmental Impact Statement Preparation Notice
for a Proposed Kunia Golf Course Development
Along Kunia Road in Central Oahu

We have reviewed the Environmental Impact Statement Preparation Notice for the proposed Kunia Golf Course and our findings show that telecommunication service can be provided aerially on existing polelines along Kunia Road to serve the proposed development. We do not foresee any adverse environmental effect of providing service to the proposed project.

Should you have any questions, please call Nelson Yrizarry at 834-6222.

Sincerely,

W. Matsumoto
for Walter M. Matsumoto
Oahu Engineering and
Construction Manager

NO RESPONSE REQUIRED.

OAHU SUGAR

P.O. Box "O"
Waipahu, Hawaii 96797
(808) 677-3577

Aumfac

November 16, 1987

Mr. William E. Wanket
William E. Wanket, Inc.
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, HI 96813

Dear Mr. Wanket:

Subject: Proposed Kunia Golf Course by Nihonkai Leasing Company, Ltd., October 1987 Development Plan Application and Environmental Assessment

In response to your request for a review and comments on the subject property, we have the following comments:

The October 1987 report on page 3, first paragraph, states that storm water runoff flows into nearby Waiahole Ditch. Please be advised that Oahu Sugar Company (OSCo) makes every effort to transport storm waters over the Waiahole Ditch and has various structures in place to accommodate the storm waters. Sugarcane is a tremendous "sponge" during storm periods and any change of use will drastically increase the amount of storm water runoff into the cane fields below the project area. OSCo will insist that NO storm water from the project area be allowed to enter the Waiahole Ditch or the adjacent OSCo sugarcane fields.

Page 5 of the report states a three (3) year permit approval process and several additional years for Golf Course completion, dependent on the status of the current lease with OSCo. Please be advised that our lease with the Robinson Estate expires in December 1996 and that at this juncture we intend to cultivate the area till that time.

Page 9 of the report states that "the proposed golf facility will provide an estimated 50 jobs, or 10 percent of the employment of OSCo, on just 1.4 percent of OSCo's current acreage under cultivation." We are confused by this comparison; is the applicant promising OSCo personnel all of these 50 jobs or anticipating the closure of the plantation in response to this project and stating that the effects of the closure will be softened by the increase in employment opportunities for the displaced workers?

Mr. William E. Wanket
November 16, 1987
Page 2

Page 16 mentions the "agricultural activities" which border the boundary areas. Is the applicant aware of the problems associated with being situated adjacent to cane fields and all the inherent dangers and liabilities involved? Please be advised that a 6-foot chain link fence should be erected to restrict access to the cane field area and the Waiahole Ditch. Golfers searching for errant balls must not be allowed outside of the golf course--the liabilities are too great.

Page 21 mentions an increase in traffic on Kunia Road in response to the project. Please be advised that OSCo has a major cane haul crossing in close proximity to the site and several others south of the site which cross Kunia Road.

Page 23 mentions using Waiahole Ditch water for irrigation and fire safety. Under no circumstances will OSCo allow that to occur.

Please be advised that the water used to irrigate the sugarcane at the site comes from the windward side of Oahu and is collected and transferred by various tunnels and ditches within the Waiahole Irrigation Company, Limited's system. The irrigation water presently used at the site does not come from either the Pearl Harbor Ground Water Control area or the adjacent Waianae aquifer. Waiahole water released from use on the site would be used to irrigate our caprock fields in Ewa. Thus the removal of Field 280 from sugar cultivation will lessen the withdrawal of water from the caprock aquifer system and would not affect our withdrawal rate from the Pearl Harbor Ground Water Control Area.

Pages 31 and 32 discuss clearing and grubbing. Please be advised that OSCo is a cooperator with the West Oahu Soil and Water Conservation District and they should be listed as a consulted party. In addition, OSCo would expect strict adherence by the applicant to any guidelines, ordinances and regulations in this regard.

Pages 32 and 33 mention botanical and animal surveys. OSCo maintains strict right of entry procedures and has no record of either survey taking place. Either these are generalized studies which were done without entering the property or the surveyors were trespassing during their studies.

Page 34 mentions a "pond at the SW corner." Please provide a clearer description of this "pond," as we construe this "pond" to be in actuality an OSCo reservoir. Be advised that the U.S. Fish and Wildlife Service has no jurisdiction over OSCo's reservoirs.

Mr. William E. Wanket
November 16, 1987
Page 3

Finally, while the impact of this project alone may not adversely affect the economic viability of OSCo today, a harder look must be taken at all the pending projects presently on the drawing boards, some of which will culminate in the future. Taken collectively and out of a desirable sequence, these projects will adversely affect the economic viability of OSCo.

Oahu Sugar Company thanks you for the opportunity to respond to the Proposed Golf Course.

Very truly yours,

W. D. Balfour, Jr.
W. D. Balfour, Jr.
President and Manager

WRD:yk

cc: Suzanne D. Peterson, Board of Agriculture
Bert Hatton

WILLIAM
E.
WANKET
INC.

January 15, 1988

Mr. W. D. Balfour
President and Manager
Oahu Sugar Company
P.O. BOX "O"
Waipahu, Hawaii 96797

Re: Response to Comments on the EIS Preparation Notice (NOP),
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Balfour:

Thank you very much for your comments on the above-reference NOP.
We respond as follows:

Storm Water Runoff Flows.

The applicant is proposing to construct earthen berms along the periphery of the site. These berms will create retention basins in which runoff from the site will be held. The berms will be designed for maximum precipitation conditions. These earthen berms will prevent storm water runoff from the project area from entering the Waiahole Ditch or the adjacent OSCo. sugarcane fields.

Permit Approval Process.

We recognize and acknowledge that the lease to OSCo runs to December 1996. We also understand that OSCo "...at this juncture...intends to cultivate the area till that time". Your intentions will be noted in the Draft EIS.

Golf Course Employment.

The statement on page 9 of the NOP is simply an observation that the proposed Kunia Golf Course would involve a relatively small amount of land, and would provide far more jobs per acre than is the case for sugar. No other implications are intended.

Bordering Agricultural Activities.

The applicant is aware of the agricultural activities bordering the property, which is not necessarily a unique situation with respect to other golf course in the State of Hawaii, including the adjoining Hawaii Country Club. All necessary and proper measures will be taken in the design and operation of

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

the golf course to prevent interference with ongoing agricultural activities, including placement of holes, setbacks, landscape barriers, as well as fencing, if necessary. It is our full intent to establish a close relationship with the operators of agricultural activity in the area to minimize operational conflicts. Furthermore, we recognize that the Hawaii Right-to-Farm Act (Chapter 165, Hawaii Revised Statutes) limits the circumstances under which existing farming operations may be deemed a nuisance. In essence, responsibility for taking mitigating measures would rest with the golf course development.

Cane Haul Crossing.

The major cane haul crossing are intersections which may affect traffic on the highway. However, most crossings occur at non-peak hours when there would be minimal impacts to highway flow. Nevertheless, with the project, the maximum one-way hourly volume is estimated to be approximately 850 vehicles, which indicates that cane haul crossing could be accommodated. As an indicator of project impact to traffic, please note that the projected maximum increase in peak hour traffic due to the project is approximately 6 percent, compared to an expected increase (due to other factors) in highway traffic of 48 percent (four percent/year compounded for ten years).

Waiahole Ditch Water.

Engineer, Hida, Okamoto & Associates, Inc. has been retained as the water and engineering consultant for the development. They are currently investigating the development of a new water source to serve the proposed development. Waiahole Ditch water, in light of your comment, will no longer be considered. Any new source will comply with Section 11-20-29 and 11-20-30 of Chapter 20, Title 11, Administrative Rules.

Clearing and Grubbing.

At your suggestion, we included West Oahu Soil and Water Conservation District as a consulting party. A copy of the NOP has been sent to them. With regards to guidelines, ordinances and regulations, the applicant fully expects to meet all requirements.

Botanical and Animal Surveys.

Both surveys were the result of on-site inspections. According to the applicant, permission was asked and given by a representative of Oahu Sugar Company for consultants to visit the site.

"Pond" at the SW Corner.

The Draft EIS will correct this statment to read "OSCo reservoir". It will also note your comment that U.S. Fish and Wildlife Service has no jurisdiction over OSCo's reservoirs.

Economic Viability of OSCo

It is true that problems could result for OSCo if all the large-scale developments planned and proposed for the Ewa Plain and Central Oahu were developed in a short time period, and developed in an undesirable pattern and sequence whereby inner fields were developed first and in such a manner as to block access to the more distant fields. However, it is not clear that all the planned and proposed large developments will in fact receive all approvals, and be developed fully according to the proposed plans. Also, at least one of the large developments that is of concern to OSCo (Hawaiian Housing Authority - Kapolei Village) is being designed with respect to its land-use patterns and development sequence so as to impose the least impact on OSCo.

We agree that the development of the larger projects should take place gradually and generally from the outside in, and in coordination with representatives from OSCo, so as not to adversely affect the economic viability of OSCo. It should also be noted that the proposed Kunia Golf Course is small relative to the large housing developments proposed for the area, and its development would not block access to other fields.

We really appreciate the time spent in reviewing the NOP. Thank you very much for your comments.

Sincerely,



William E. Wanket



HAWAII RESEARCH CENTER
P.O. Box 8
Kunja, Hawaii 96759
RESEARCH CENTER

P.O. Box 101, Kunia, HI 96156-0101
Phone 677-1477

December 07, 1987

William E. Wanket, Inc.
Pacific Tower
1001 Bishop St., Suite 1010
Honolulu, HI 96813
Attn: Mr. William E. Wanket, President

Dear Mr. Wanket:

The Garst Seed Company would like to thank you for providing us with the opportunity to comment on the proposed Kunia Golf Course as described in the Development Plan Application and Environmental Assessment of October, 1987.

As described in the proposal, the site will be directly across Kunia Road from our present operations. As such we will be very concerned regarding this relatively close proximity so that the two operations do not interfere with one another. The major concerns that we have regarding this proposal are as follows:

Water - Under the terms of our lease with Oahu Sugar Co. (OSCo), we are allowed to draw water out of the Waiahole Ditch to satisfy our irrigation requirements. Anything that would interfere with this free withdrawal will not be tolerated. We are very concerned that every conceivable means are taken to avoid blocking or in any way reducing the free flow of this water. This includes the complete elimination of any, and all sediment runoff, both during and after construction, into the ditch system so that the sediment load does not foul our water and cause undue problems with our normal irrigation.

Waste Water Treatment Plant (WWTP) - In the proposal it is stated that this scheme will have little social impact "because the facility will be located in an area without any nearby residences". While there may not be any residences nearby, there is our operation which lies directly downwind from the proposed site as is indicated in Exhibit 15. We strongly encourage you to insure that the odor which would be generated does not in any way interfere with our year-round crop breeding operation.

Dust - As pointed out in the previous section concerning a WWTP, our operation is downwind from the proposed site. Again, every possible means must be taken to control the dust during the construction and operation of the golf course. The nature of our work requires that we work outdoors and will not tolerate having to be exposed to dusty, fouled air.

Impact of Fertilizers and Pesticides - Since this portion of the proposal has yet to be completed by Doctors Green and Murdock from the Utl., we cannot as yet comment. However; being "downstream" from the site, we are very concerned that our water is not fouled in any way from these materials. Please forward to me the analysis when it is complete.

Maintenance Shed Location - As is indicated in Exhibit 20, this building will be directly adjacent to the Waiahole Ditch. We are very concerned as to the potential introduction into the Waiahole Ditch of spilled or rinsed containers that may contain materials that would foul the water with petroleum products, fertilizers, or pesticides. As mentioned previously, we are directly downstream from the proposed site and would be the first affected by this contamination.

These, then, are our major concerns at this time. Thank you again for the opportunity to comment.

Sincerely,

THE GARST SEED COMPANY

Paul H. Koehler/ccf

Paul H. Koehler
Manager

PHK/ccf

cc: Mr. Bill Balfour, Oahu Sugar Co.
Dr. Ted Crosbie, Garst Seed Co.

WILLIAM
E.
WANKET
INC.

LAND USE CONSULTANTS

January 15, 1988

Mr. Paul H. Koehler
Manager
The Garst Seed Company
P.O. BOX 8
Kunia, Hawaii 96759

Re: Response to Comments on the EIS Preparation Notice (EISPN),
Development of a Golf Course, Kunia, Oahu.

Dear Mr. Koehler:

Thank you very much for your comments on the above-reference EISPN.
We respond as follows:

Water

The applicant is proposing to construct earthen berms along the periphery of the site. These berms will create retention basins in which runoff from the site will be held. The berms will be designed for maximum precipitation conditions. These earthen berms will prevent storm water runoff from the project area from entering Waiahole Ditch.

The sediment runoff during construction will be eliminated by the appropriate erosion control measures. Such measures include the construction of temporary berms, dikes, dams, sediment basins, slope drain, and the use of temporary mulches, mats and grassing.

Wastewater Treatment Plant (WWTP)

After additional study, the applicant will be proposing to construct an 8-inch gravity sewage transmission main along Kunia Road to the existing municipal sewer system at Village Park. Therefore, odors should not be an issue.

Dust

For the duration of the construction, the contractor will maintain the area free from dust which would cause a hazard to persons or property. Industry-accepted methods of soil stabilization suitable for the area involved, such as sprinkling and/or screening, will be implemented. All City and State requirements will be followed.

After construction is completed and the golf course is in operation, the dust will be controlled by grassed ground cover and extensive landscaping.

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

Impact of Fertilizers and Pesticides

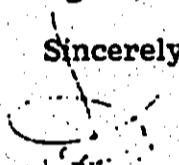
Per your request, please find enclosed a copy of a report, "Environmental Impact Of Fertilizer And Pesticide Use On The Proposed Kunia Golf Course", prepared by Charles L. Murdock and Richard E. Green. This report will be included in the Draft EIS. We will welcome your review and comment.

Maintenance Shed Location

The golf course layout, including the location of the maintenance shed, is a preliminary design concept. Actually the maintenance shed can be located in a variety of areas on the site. If the preliminary location proves to represent an environmental hazard, it will be relocated.

Please be assured that we do not intend to interfere with your operations and that we will do our utmost to cooperate with you on these matters. Again, thank you very much for your comments.

Sincerely,


William E. Wanket

enclosure: Environmental Impact Of Fertilizer
And Pesticide Use On The Propose
Kunia Golf Course

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HAWAII
96850

March 3, 1988

Mr. Donald A. Clegg
Chief Planning Officer
C & C of Honolulu, Dept. of General Planning
650 S. King Street
Honolulu, HI 96813

Dear Mr. ^{DC}Clegg:

Subject: Environmental Impact Statement (EIS) -
Proposed Golf Course at Kunia, Oahu

We have no comments to offer at this time regarding the above-subject matter. Thank you for the opportunity in allowing us to review the above EIS.

Sincerely,


RICHARD N. DUNCAN
State Conservationist

cc: Mr. William E. Wanket, William E. Wanket, Inc. Pacific Tower, Suite 1010,
1001 Bishop Street, Honolulu, HI 96813

NO RESPONSE NEEDED

Rec'd. 3-7-88



United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU HAWAII 96850

IN REPLY REFER TO:

ES
Room 6307

4 FEB 1988

Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Re: Environmental Impact Statement, Proposed Golf Course, Kunia,
Oahu

Dear Mr. Clegg:

We have reviewed the referenced material and find that due to its nature, the proposed project will have no significant deleterious impact on fish and wildlife resources.

We thank you for addressing our concerns regarding the potential impacts of pesticides on migratory birds and endangered species.

Please do not hesitate to call on us if we may be of further assistance.

Sincerely yours,

Ernest Kosaka, Field Supervisor
Office of Environmental Services
Pacific Islands Office

cc: ✓ William E. Wanket, Inc.
DLNR



NO RESPONSE NEEDED

Save Energy and You Save America!

Rec'd 2-8-88



DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

March 3, 1988

REPLY TO
ATTENTION OF:
Planning Branch

Mr. Donald A. Clegg
Chief Planning Officer
City and County of Honolulu
Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for the Proposed Golf Course at Kunia, Oahu. The following comments are offered.

a. A Department of the Army permit will not be required for the project since no construction will take place in waters of the United States or adjacent wetlands.

b. Paragraph 5.b. on page 30 of the DEIS should state that, according to the Flood Insurance Study for the City and County of Honolulu, the project site is located in Zone D, an unstudied area with possible flood hazards.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Copy Furnished:

Mr. William E. Wanket
William E. Wanket, Inc.
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Rec'd 3-8-88

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
FT. Shafter, Hawaii 96858-5440

ATTN: PLANNING BRANCH

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

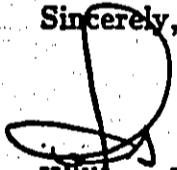
Dear Mr. Cheung:

Thank you very much for your comments on the above-referenced DEIS.

Paragraph 5.b. on page 30 of the DEIS will be changed in the Final EIS to include your statement that "...according to the Flood Insurance Study for the City and County of Honolulu, the project site is located in Zone D, an unstudied area with possible flood hazards".

Again, thank you for your comments.

Sincerely,



William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937



DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO.

5090 (24B)
Ser N5B/308

REPRODUCED AT GOVERNMENT'S EXPENSE

Mr. Donald A. Clegg, Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 S King Street
Honolulu, HI 96813

Dear Mr. Clegg:

DRAFT ENVIRONMENTAL IMPACT STATEMENT
PROPOSED GOLF COURSE, KUNIA, OAHU

The Draft Environmental Impact Statement for the Proposed Golf Course has been reviewed and we have no comments to offer. Since we have no further use for the EIS, it is being returned to the Office of Environmental Quality Control.

Thank you for the opportunity to review the Draft.

Sincerely,

W. A. ...
App to ... Civil ...
by direction of
the Commander

Enclosure

Copy to:
Mr. William E. Wanket
William E. Wanket, Inc.
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, HI 96813

Office of Environmental Quality Control

NO RESPONSE NEEDED

Rec'd 2-5-88

JOHN WAIHEE
GOVERNOR



SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

ROBERT Y. TSUYEMURA
ACTING DEPUTY
TO THE CHAIRPERSON

COPY

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

March 8, 1988

MEMORANDUM

To: Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu

Subject: Draft Environmental Impact Statement (DEIS) for
Proposed Golf Course
Nihonkai Lease Company, Ltd.
TMK: 9-4-04: 9 Hoaeae, Ewa, Oahu
Area: 203.171 acres

The Department of Agriculture has reviewed the subject DEIS and offers the following comments.

We appreciate the effort made by the applicant to assess the cumulative impact on Oahu Sugar Company and diversified agriculture resulting from the proposed use and all other proposed land uses in the Ewa/Central Oahu area. But as our response to the EIS Preparation Notice indicates (letter to Mr. William E. Wanket, dated December 8, 1987, pages 4-5), we remain unconvinced that the assumptions made in the DEIS in support of the conclusions are reasonably plausible.

The DEIS does not specifically indicate the impacts of the proposed golf course on the Oahu Sugar Company, in terms of loss in tons of sugar produced, lost revenues and other indicators of adverse impact specific to the subject location.



Mr. Donald A. Clegg
March 8, 1988
Page -2-

We hope our remaining concerns can be addressed in the
Final EIS.

We hereby request a copy of the Final EIS.

Ry Peterson

for SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: Mr. William E. Wanket
Mr. William Balfour, OSCo
OSP (attn: LUD)
OEQC

Rec'd 3-9-88

March 21, 1988

WILLIAM
E.
WANKET
INC.

Land Use Consultant

Ms. Suzanne D. Peterson
Chairperson, Board of Agriculture
P. O. Box 22159
Honolulu, Hawaii 96822-0159

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

Dear Ms. Peterson:

Thank you very much for your comments on the above-referenced DEIS.

The Agriculture Impact Report, prepared by Decision Analysts Hawaii, Inc., will be updated in the Final EIS to address more fully the issues raised in your comment letter. The updated report has been reviewed by Oahu Sugar Company, who offered no changes to the draft.

The Executive Summary of the updated report is attached to this response letter. The complete report will be included as Appendix F in the Final EIS (color coded Green).

Again, thank you for your comments.

Sincerely,



William E. Wanket

attachment

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

EXECUTIVE SUMMARY
Updated Agricultural Impact Analysis

The development of the proposed Kunia Golf Course would result in the urbanization of approximately 190 acres of sugarcane lands which are currently under cultivation by Oahu Sugar Company, Ltd. (OSCo). Assuming that U.S. sugar prices will continue to be high enough to justify continued sugar operations in Hawaii, an important question is whether Kunia Golf Course—combined with other planned and proposed projects—would eventually cause the closing of OSCo, either by reducing sugarcane acreage sufficiently to reduce economies of scale, and/or by contributing to a scattered and therefore inefficient plantation rather than a more compact and efficient one. Water is not an issue to the future viability of OSCo because water now used on fields proposed for the Kunia Golf Course as well as other proposed developments will remain with OSCo for use on other fields, unless the water is not needed by OSCo.

Assuming that all proposed projects will be approved, and that it would take about 20 years to realize the full development of all projects, OSCo would retain about 11,760 acres under cultivation in 1995 when its major lease expires. If yields increase from their current average of about 15 tons of raw sugar to 16 tons per acre by the end of 1995 (which is a conservative projection), then 11,760 acres would be sufficient land to maintain the current production of about 90,000 to 95,000 tons of raw sugar per year, without any loss in economies of scale. No layoffs of sugar workers would be expected, since OSCo has a practice of reducing its employment by attrition.

However, if the sequence of urbanization results in a scattered plantation that is too inefficient to operate at the current level of production, or if urbanization and loss of sugarcane acreage proceeds at too rapid a rate to be compensated by increasing yields, then a switch from a two- to one-mill operation would be required to maintain an efficient and economically viable operation. For this case, land requirements would be about 8,440 acres, assuming a yield of 16 tons per acre and production of about 67,500 tons per year. This would provide a buffer of 3,320 acres from

EXECUTIVE SUMMARY

which to assemble an efficient plantation; this figure is based on 11,760 acres remaining after projected urbanization (assuming approval of all planned and proposed projects), minus the estimated 8,440 acres required for a one-mill operation. It is uncertain whether or not attrition would be sufficient to accommodate a reduction in employment associated with a switch to a one-mill operation.

At full development of all the planned and proposed projects (assuming approval of all projects), the amount of land under cultivation by OSCo would be about 8,520 acres. If development proceeds gradually, and if yields increase sufficiently (as a result of genetic engineering and other advances), then it is conceivable that OSCo could maintain production near its current level. In order for this to occur, the average yield would have to increase by about 45 percent, from 15 to 21.7 tons per acre.

It is more likely, however, that a switch to a one-mill operation would be required to maintain economic viability. Assuming an average yield of 18 tons per acre by the time the various projects reach full development (which is a conservative projection), a one-mill operation would require about 7,500 acres. This would provide a buffer of about 1,020 acres from which to assemble an efficient plantation; this figure is based on 8,520 acres remaining after urbanization (assuming approval and full development of all planned and proposed projects), minus the estimated 7,500 acres needed for a one-mill operation.

To summarize the above, Kunia Golf Course, in combination with other approved and proposed projects, is not expected to threaten the economic viability of OSCo; economies of scale and a compact efficient plantation would be possible by (1) switching to a single-mill operation, or (2) retaining a two-mill operation provided that urbanization proceeds gradually and yields can be increased rapidly to compensate for the loss of acreage.

If OSCo were to cease operations for whatever reason (most likely because of low sugar prices), the loss of jobs would be less than 450 direct jobs and 510 indirect jobs. This would be equivalent to the loss of a hotel about half the size of the Hyatt Regency in Waikiki. Immediately following the mill closing, significant economic loss and social disruption would occur. But over the long term, the economic loss would be absorbed easily by expanding economic opportunities in the Ewa/Central-Oahu area.

Assuming that OSCo does close, revenues to Waialua Sugar Company, Inc. (WSCo) would be decreased slightly because OSCo's contribution to shared terminal facilities and services would be lost. At worst, the economic effect would correspond to an increase in production cost of less than 2 percent. But rather than absorb

EXECUTIVE SUMMARY

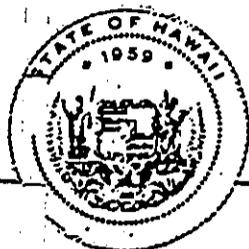
increased terminal charges, a more profitable alternative would be to increase the refining capacity of C&H in Aiea to process all of the WSCo production. Refined sugar in excess of the Hawaii requirements would be shipped at favorable backhaul rates to Los Angeles and Seattle. Currently, Hawaiian sugar is delivered to these markets by rail from the C&H refinery in Crockett, California near San Francisco. Consequently, the net economic effect of the closing of OSCo on WSCo would be small, and would be unlikely to force the closing of WSCo—like OSCo, the future economic health of WSCo will be determined primarily by the price of sugar in the U.S. market.

The development of Kunia Golf Course on sugarcane acreage would eliminate the possibility of using these lands for diversified agriculture (including aquaculture). However, it is extremely doubtful that this would adversely affect the growth of diversified agriculture in Hawaii. There are four reasons for this assessment: (1) an extensive amount of prime-agricultural land and water has been freed from sugar and pineapple production because of past mill closings and reductions in operations; (2) a very real possibility exists that additional land and water will be freed from sugar production given the outlook for low sugar prices; (3) some—if not most or even all—of the sugar operations will make their lands available for profitable replacement crops to the extent that such crops are available; and (4) compared to the available supply, a very small amount of land and water is required to grow proven and promising crops to achieve a realistic level of food and animal-feed self-sufficiency, and to increase exports. The increasing availability of prime agricultural land in Hawaii is part of very long-term and accelerating trends occurring throughout most developed and developing market economies. Productivity and yields have been increasing faster than population growth, and genetic engineering and other advances, combined with slower population growth, indicate an acceleration of these trends. Rapid productivity and yield increases require that labor, land, and other resources be withdrawn from agriculture in order to restore balanced markets and to increase farm income for those who remain.

Since the Kunia Golf Course is not expected to adversely affect the economic viability of OSCo, and would not limit the growth of diversified agriculture, the project is consistent with the major thrust of the agricultural portion of the Hawaii State Plan, the State Agriculture Functional Plan, and the General Plan of the City and County of Honolulu. This thrust is to preserve the economic viability of plantation agriculture and to promote the growth of diversified agriculture. Also, the project would provide a public benefit (i.e., increased employment) which would over-

EXECUTIVE SUMMARY

ride the proposed "important agricultural lands" designation of the Land and Evaluation Site Assessment (LESA) Commission. Furthermore, the project would not adversely affect cultivation of adjacent sugarcane acreage and, therefore, complies with the Hawaii Right-to-Farm Act.



DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

KAMAMALU BUILDING, 230 SOUTH KING ST., HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2159, HONOLULU, HAWAII 96804 TELEX: 7430250 HDPED

JOHN WAIHEE
GOVERNOR

ROGER A. ULVELING
DIRECTOR

BARBARA KIM STANTON
DEPUTY DIRECTOR

LESLIE S. MATSUBARA
DEPUTY DIRECTOR

Ref. No. P-8084

February 17, 1988

Mr. William E. Wanket, President
William E. Wanket, Inc.
Pacific Tower 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Subject: Draft Environmental Impact Statement (DEIS) for Kunia Golf Course, Kunia, Oahu

The applicant, Nihonkai Lease Company, Ltd., is requesting an amendment to the Central Oahu Development Plan Land Use Map to designate a 203.171 acre site along Kunia Road as Recreation. The property would be developed into an 18-hole golf course with club house, restaurant, recreation facilities for tennis, swimming, and other amenities. It is situated in the State Land Use Agricultural District along Kunia Road, immediately to the north of Waiahole ditch. The property is identified as tax map key: 9-4-04:9. According to the Draft Environmental Impact Statement (DEIS), the soils are rated by the Land Study Bureau as "A" lands, and by the LESA Commission as Important Agricultural Lands.

We have reviewed the subject DEIS and offer the following comments:

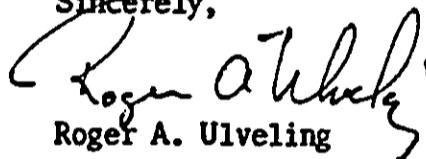
1. The final EIS should address the phasing of project development relative to the remaining eight-year term of Oahu Sugar Company's current lease. The DEIS has projected that golf course demand for the year 2000 will require an additional 16 courses. In light of the 19 golf courses already being considered, sufficient golf courses may be in existence by the time the Oahu Sugar Company lease expires in 1996.
2. The final EIS should address, a) why it is unlikely that other proposed golf courses will not be built as planned before the year 2000 and, b) how this golf course is unique from those courses which will not be built. If other golf courses require the "support" of a residential component to be viable, what advantage does the proposed project have over other golf courses which are integrated into a larger development?

Mr. William E. Wanket
Page 2
February 17, 1988

3. The final EIS should address whether the reclassification from agriculture to urban would pressure Oahu Sugar Company into removing these lands from agricultural production prior to the lease expiration date. This analysis should also describe whether reclassification of this parcel to urban would increase speculative pressures on other agricultural lands generally accelerating the overall price appreciation of agricultural land.
4. The final EIS should describe if alternate, non-essential agricultural lands were considered for golf course development and why they were not selected. Since the subject property encompasses some of the highest rated agricultural lands on Oahu, it should be assumed that they are essential for agricultural production and are therefore subject to the constitutional mandate to preserve important agricultural lands. Development of lands with less agricultural qualities and which are considered non-essential for agriculture should be considered whenever possible. The petitioner should also describe why it is necessary to satisfy all of the demand for golf courses at the expense of the agricultural resource.
5. The final EIS should describe in greater detail how the recharge of groundwater would be influenced by the conversion of drip irrigated sugar cane land into a golf course. A study conducted by the Water Resources Research Center of the University of Hawaii entitled, Land Use Effects on the Water Balance of a Tropical Island by Thomas W. Giambelluca, 1986, indicates that drip irrigated sugar cane land can recharge groundwater in quantities approximately three times greater than urban irrigated park land.

Thank you for the opportunity to review and comment on this proposal.

Sincerely,


Roger A. Ulveling

Rec'd 2-23-88

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. Roger A. Ulveling
Director
Department of Business
and Economic Development
P. O. Box 2359
Honolulu, Hawaii 96804

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

Dear Mr. Ulveling:

Thank you very much for your comments on the above-referenced DEIS.
We respond as follows:

1. Development Phasing:

As discussed in the DEIS the applicant has no intention of attempting to develop the proposed golf course prior to expiration of the lease with Oahu Sugar Company in 1996. The applicant has not requested any amendment of lease terms and has not responded to an Oahu Sugar Company letter setting down terms for negotiation for early termination of the lease.

On the other hand the applicant is not unaware of problems in the sugar industry in Hawaii in general and on Oahu in particular. A bill currently before the state legislature asks a \$10,000,000 uncollateralized loan be granted to Hamakua Sugar on the Big Island as financial problems may force its closing. On Oahu the future of Oahu Sugar was significantly in doubt during the last quarter of 1987 to the extent that Hawaii's governor felt compelled to go public with his concerns and take a number of steps including a reconsideration of parent company's Waikele development. Early in 1987, Castle and Cooke, Inc. parent company of Oahu's only other sugar company, Waialua Sugar, announced the decision to cease sugar operations. A concerted effort by government, business and labor has temporarily averted this crisis.

Given the time consuming nature of the approval process and the design development for a golf facility, it seems prudent for the applicant to pursue these activities as protection against a request for early termination of the lease by the lessee.

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu HI 96813
Phone
(808) 533-4937

The demand projections outlined in the DEIS were based on the M-F series Long Range Economic and Population Projections prepared by DPED. The preliminary M-K series projections released in January of 1988 by DBED indicate significantly higher expectations by the year 2000, including: an increased visitor count 9.0 million vs. 7.8 million (+15%); increase in visitor rooms 105,100 vs. 101,400 (+3.6%); increase in visitor expenditures \$8.3 billion vs. \$6.7 billion (+31%); and the percent of visitors from Japan 24% vs. 20% (+20). These projections of long range growth of the state's tourist industry indicate that the demand for golf courses could be substantially higher if the M-K assumptions were used in the demand analysis. Estimated demand could easily be 10% to 25% greater than the 16 courses projected in the DEIS.

2. Likelihood of All Proposed Golf Courses Being Built and Unique Characteristics of the Proposed Course

- a. The market analysis included in the DEIS as appendix G contains a discussion of some of the reasons that proposed courses would not ultimately be built on page VI-4. Among the reasons cited were failure to obtain government approvals and financing problems.

This characteristic is not unique to golf course development but can be seen in other aspects of development. A previous study undertaken by the golf course marketing consultant indicated that over a 20 year period (1960-1980) the increase of residential inventory on Oahu was only 86% of the construction authorizations (building permits) for the same period. The cause of this discrepancy was tracked to financing problems and changes in market conditions.

- b. The proposed Nikonkai Golf Course is unique from other courses in that the entity proposing the development is an experienced golf course operator. The site has an excellent location in relation to population and resort centers and provides unique views.

The proposed golf development is similar to other golf developments in that it will undergo examination during the approval process and must be approved by a number of government approval bodies.

Golf courses which are part of master planned resorts or residential communities are the beneficiaries of potential markets within the developments being proposed. However, the golf courses are generally provided as a recreational and open space amenity to the resort or residential project being proposed with the bulk of the revenues and profits generated by the residential and resort development not from the recreational amenities. This is one advantage that a stand alone golf facility has over one being incorporated into a planned residential or resort community. Design of the golf course and facilities are the primary consideration and need not be compromised in order to provide enhanced residential or resort values.

3. (a) OSCo Lease

(b) Price Appreciation

(a) The reclassification would not affect the lease rights which OSCo has to these lands. Also, any increase in property taxes would be assumed by the land owners. Therefore, the reclassification would not pressure OSCo into removing these lands from agriculture production prior to the lease expiration date.

Although not expected, it is theoretically possible for the land owner to buy back the lease rights from OSCo. Such an action would be consistent with the "survival plan" for OSCo: a portion of the revenues from urbanization may be used to support OSCo in order to buy time to find replacement activities for sugar (Amfac's Waialele petition to the State Land Use Commission).

(b) The essence of this question is whether or not the State, through the actions of the Land Use Commission, is in a monopolistic position to manipulate the price of land, so that perceived changes in policy would affect agricultural land values. The simple answer to this question is "yes."

The market value of agricultural land consist of two components: the agricultural component, which is the present discount value (PDV) of the agricultural lease rents; and the "speculative" component, which is the PDV of the anticipated urban value of the land when the conversion from agricultural to urban use occurs. For Oahu, the speculative component dominates; its presence is normal and proper, and its large value is a strong market signal that the residents of Oahu would be better

off if more land were to be converted from agricultural to urban use.

By manipulating the supply of urban land, the Land Use Commission can manipulate the value of agricultural land. If the Land Use Commission takes a hard position on preserving prime agricultural land, this will extend — possibly indefinitely — the date at which agricultural land is converted to urban use which, in turn, will decrease the "speculative" component of agricultural land values. The problem with this, of course, is that a restricted supply of urban land will greatly increase urban land and housing prices, and slow economic growth which is dependent on the supply of urban land.

It should also be noted that the price of agricultural land does not affect its agricultural use. Generally, agricultural land will be used in whatever manner generates the highest least rents, regardless of the price of the land. (For example, if agricultural land has a high market value because it is anticipated that it will be converted to urban use 20 years hence, the highest and best use until that conversion occurs may very well be the cultivation of suagar cane. Even if the land value doubles, this will not affect the fact that the highest and best use is cultivation of sugarcane until that conversion takes place.)

4. Non-Essential Agricultural Lands

The subject property is not essential for agriculture production. As explained in Appendix F of the Environmental Assessment in which the impact of the proposed project on agriculture was discussed, the proposed golf course would not adversely affect the economic viability of OSCo, nor would it adversely affect the growth of diversified agriculture. Supporting documentation is provided in Appendix F.

The reason that golf courses are being proposed in areas that involve agricultural land is because large parcels of non-agricultural land near large population centers, having adequate access, and being suitable for development are not available. If such parcels were available, they would immediately be proposed for development. Because of this lack of non-agricultural lands, the State, the City and County, and private developers are proposing major developments on agricultural land.

Mr. Roger A. Ulveling
Page 5

5. Water Recharge

The study Land Use Effects on the Water Balance of a Tropical Island by Thomas W. Giambelluca, 1986 does indeed indicate that drip irrigated sugarcane land can recharge groundwater in quantities approximately three times greater than urban irrigated park land. In fact, Table 2. Monthly and Annual Water Balances (mm) on page 138 indicates that for areas of 1,000 mm precipitation recharge rates for urban park land are 261 mm per year as compared with 829 mm per year for drip irrigated sugarcane.

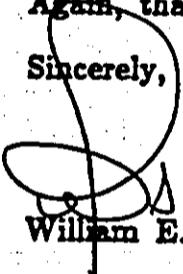
The study continues, however, to discuss the ultimate impact on the water supply is dependent not solely on recharge but on the net effect of water usage vs. water recharge. Table 4. Groundwater Recharge and Groundwater Use for Different Land Uses in Southern Oahu (1,000 mm precipitation) demonstrates this relationship as follows:

<u>Land Use</u>	<u>Groundwater Recharge (mm)</u>	<u>Groundwater Use (mm)</u>	<u>Net Effect (mm)</u>
Drip-irrigated Sugarcane	829	1,331	-502
Urban park/golf	261	318	-57

Thus the net effect of Urban Park/Golf Course is -57 vs. Irrigated Sugarcane net effect of -502. It appears that the negative impact of a golf course use is only 11% of that of drip irrigated sugarcane.

Again, thank you for your comments.

Sincerely,


William E. Wanket

JOHN WAIHEE
GOVERNOR



Joseph K. Conant
Executive Director

STATE OF HAWAII
Department of Business and Economic Development
Housing Finance and Development Corporation

P. O. BOX 17907
HONOLULU, HAWAII 96817

IN REPLY REFER

TO:

88:PLNG/579JT

February 9, 1988

Mr. Donald A. Clegg, Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement (EIS) for
the Proposed Golf Course, Kunia, Oahu

We have reviewed the subject draft EIS and have no comments
to offer.

Thank you for the opportunity to comment.

Sincerely,

A handwritten signature in black ink, appearing to read "Joe K. Conant".

JOSEPH K. CONANT
Executive Director

cc: William E. Wanket

NO RESPONSE NEEDED

Rec'd 2-11-88

FEB 11 1988

Engineering Office

Mr. Donald A. Clegg, Chief Planning Officer
Department of General Planning
City & County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Proposed Golf Course
Kunia, Oahu

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Sincerely,

Jerry H. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

Enclosure

cc:
Mr. William E. Wanket

NO RESPONSE NEEDED

Rec'd 2-11-88

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

FEB 23 1988

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LIBERT K. LANDGRAF
DEPUTY

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

DOC. NO.: 2746E
FILE NO.: 88-347

Honorable Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

SUBJECT: Kunia Golf Course, Draft EIS
TMK: 7-4-4: 9

In response to your request, we have reviewed the document cited above and have the following comments to offer:

As acknowledged in the Draft EIS, the developer is aware that any contemplated withdrawals of ground water from the Pearl Harbor Ground Water Control Area would have to be approved by the Board of Land and Natural Resources. He is also aware that the Board is currently evaluating the sustainable yield limits of the aquifer in the Ground Water Control Area and that the Board will subsequently act on his application for project water use, which amounts to about 650,000 gpd.

Thank you for the opportunity to comment on this project.

Very truly yours,

A handwritten signature in black ink, appearing to read "W. Paty", written over the typed name of the signatory.

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

cc: Mr. William E. Wanket

NO RESPONSE NEEDED

2-23-88

(P)1073.8

JAN 25 1988

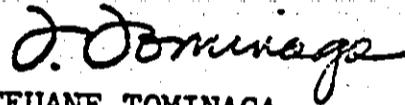
Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street, 8th Floor
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Proposed Golf Course, Kunia, Oahu
Draft Environmental Impact Statement

We have reviewed the subject document and have no
comments to offer.

Very truly yours,



TEUANE TOMINAGA
State Public Works Engineer

SS:jk
✓cc: Mr. William E. Wanket

NO RESPONSE NEEDED

Rec'd 1-27-88

John Waihee
GOVERNOR



JAN 25 1988

DIRECTOR
TELEPHONE NO
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
485 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

January 21, 1988

Dear Reviewer:

Attached for your review is an Environmental Impact Statement (EIS) that was prepared pursuant to Chapter 343, Hawaii Revised Statutes and Chapter 11-200, Administrative Rules, EIS Rules:

TITLE: Proposed Golf Course

LOCATION: Kunia, Oahu

CLASSIFICATION: Applicant Action

Your comments or acknowledgments of no comments on the EIS are welcomed. Please submit your reply to the accepting authority or approving agency:

Mr. Donald A. Clegg, Chief Planning Officer

C & C of Honolulu Dept. of General Planning

650 S. King St.

Honolulu, HI 96813

Please send a copy of your reply to the proposing party:

Mr. William E. Wanket

William E. Wanket, Inc.

Pacific Tower, Suite 1010

1001 Bishop St.

Honolulu, HI 96813

Your comments must be received or postmarked by: March 8, 1988

If you have no further use for this EIS, please return it to the Office of Environmental Quality Control.

NO RESPONSE NEEDED

Thank you for your participation in the EIS process.

Rec'd 1-28-88

*1/25/88
No comments.
Energy Division*



STATE OF HAWAII
DEPARTMENT OF BUSINESS
AND ECONOMIC DEVELOPMENT

• • •
LAND USE COMMISSION

Room 104, Old Federal Bldg. 335 Merchant Street
Honolulu, Hawaii 96813 Telephone: 5-484611

JOHN WAIHEE
Governor

TEOFILO PHIL TACBIAN
Chairman

FREDERICK P. WHITTEMORE
Vice Chairman

COMMISSION MEMBERS:

Richard B.F. Choy
Lawrence F. Chun
Everett L. Cuskaden
Sharon R. Himeno
Toru Suzuki
Robert S. Tamaya
Anton L.K. Nip

ESTHER UEDA
Executive Officer

January 27, 1988

Mr. Donald A. Clegg
Chief Planning Officer
City & County of Honolulu
Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Draft EIS for the Proposed Kunia Golf Course

Thank you for this opportunity to comment.

We have no comments to offer at this time.

Sincerely,

ESTHER UEDA
Executive Officer

EU:to

cc: William E. Wanket

NO RESPONSE NEEDED

Rec'd 1-29-88



University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

March 8, 1988
RE:0488

Mr. Donald Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Draft Environmental Impact Statement
Kunia Golf Course
Kunia, Oahu

The above referenced document involves construction of an 18-hole golf course, club house and restaurant, and other recreational facilities. The Environmental Center has conducted a review of this Draft Environmental Impact Statement (EIS) with the assistance of Bertell Davis, Anthropology; Yu-Si Fok, Henry Gee, and Edwin Murabayashi, Water Resources Research Center; and Jennifer Crummer, Environmental Center.

Drainage

The description of the storm drainage is inadequate. Estimates of expected total increases of runoff compared to total retention capacity should be given.

Pesticides

There is no quantitative information given regarding the application of pesticides, specifically, what types of pesticides will be utilized, how often, and in what quantities. Some of these data could be incorporated from the Appendix. The Appendix Table 1, by Murdoch and Green, contains pertinent information regarding toxicity levels, water solubility, and soil behavior. The pesticides that will be utilized should be indicated, and their qualities should be outlined in the text.

A Unit of Water Resources Research Center

AN EQUAL OPPORTUNITY EMPLOYER

Mr. Donald Clegg

-2-

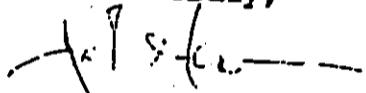
March 8, 1988

Without listing specific pesticides, it is difficult to ascertain potential impacts to wildlife. Diazinon is the only pesticide fully mentioned in the text. This biocide is listed on Appendix Table 1 as highly toxic to fish and wildlife and has been reportedly responsible for the death of Canadian Geese in the Continental United States.

Table 2 of the appendix gives a typical golf course pesticide profile. How closely will this be followed? The break down rates of pesticides should be included for all types to be used. Page 39 contains a list of the half-lives for eight insecticides, however, only two of these are discussed elsewhere in the text. The rate of application should be indicated as well. The accumulation of chemicals of varying toxicity, is of concern since many migratory and native waterbirds are likely to utilize the numerous ponds planned for this course.

We thank you for the opportunity to review this document. We look forward to your response and consideration of our comments.

Yours truly,



John T. Harrison
Environmental Coordinator

cc: OEQC

William Wanket

L. Stephen Lau

Bertell Davis

Yu-Si Fok

Henry Gee

Edwin Murabayashi

Jennifer Crummer

Rec'd 3-9-88

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. John T. Harrison
Environmental Coordinator
Environmental Center
University of Hawaii
Crawford 317 - 2550 Campus Road
Honolulu, Hawaii 96822

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

Dear Mr. Harrison:

Thank you very much for your comments on the above-referenced DEIS. The following responses were prepared by Hida, Okamoto & Associates (drainage) and Charles L. Murdoch, Ph.D. and Richard E. Green, Ph.D. of the university of Hawaii (pesticides).

Drainage

The proposed development is estimated to increase runoff by approximately 2.5% over the existing condition. Total increase is expected to be 26.7 cubic feet per second. Total retention capacity is approximately 40,000 cubic feet. Detailed computations are attached as Exhibit A. In the opinion of Hida, Okamoto & Associates, Inc., the retention to be provided is adequate.

Pesticides

We cannot specify the exact chemicals which will be used in management of the golf course. The amounts and frequency of application are controlled by EPA and are given on the labels of the pesticides. Turfgrass managers are required to strictly comply with these instructions for use. Course Superintendents may choose among several pesticides which are labeled for the particular pest present. Pesticides which are available today may not be available next year. New pesticides will undoubtedly be developed in the next few years. Perhaps by the time the golf course is constructed there will be more effective, less toxic pesticides than those given in our lists.

Based on our knowledge of golf course maintenance in Hawaii, Appendix Table 2 of our report was given as a typical golf course fertilizer and pesticide program. We believe that the pesticides given in this table are the ones which are used most frequently. The rates of application are those given on the labels of the pesticides. The frequency of application are fairly representative of average requirements in the State. There are certainly golf

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu HI 96813
Phone
(808) 533-4937

Letter to HARRISON

courses which apply more pesticide and ones which apply less. It would not be desirable to specify that this program be followed religiously. Pesticides are applied to golf courses in response to outbreak of pests. In many cases there is no need to apply them. In a good pest management program, pesticides represent only one tool in controlling pests, usually the tool of last resort. Because of the high cost of pesticides and the labor to apply them, there is no economic justification for indiscriminate pesticide application.

Appendix Table 1 was given to show the properties of most of the pesticides used on turfgrass in Hawaii. Information on break down rates of all pesticides in this table was not available. We did give the half-life of diazinon and chlorpyrifos on page 39 because there two insecticides are known to be highly toxic to birds. The other 6 insecticides in the table on page 39 are not used on golf courses in Hawaii and were, therefore, not discussed in the text but were given to show a range of break down rates for organic phosphate insecticides.

It should be reiterated that, under penalty of law, only EPA approved pesticides are used on golf courses. Compliance with EPA's labeled conditions of use is strictly enforced by the Hawaii Department of Agriculture. Data given in our report were intended to show that, with proper management, the present range of pesticides available and the relatively small amounts used on golf courses pose little threat to people or wildlife.

Tables 1 and 2 of Appendix I will be inserted in the EIS text.

Again, thank you for your comments.

Sincerely,


William E. Wanket

JOHN WAIHEE
GOVERNOR OF HAWAII



JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

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

March 8, 1988

In reply, please refer to:
EPHSD

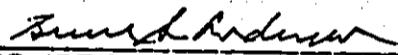
MEMORANDUM

To: Mr. Donald A. Clegg, Chief Planning Officer
Department of General Planning, City & County of Honolulu

From: Deputy Director for Environmental Health

Subject: Draft Environmental Impact Statement (DEIS) for Proposed Golf
Course, Kunia, Oahu, Tax Map Key 9-4-04: 9

Thank you for allowing us to review and comment on the subject DEIS. The applicant has addressed our previous comments to the environmental assessment. We do not have any additional comments at this time.


BRUCE S. ANDERSON, Ph.D.

cc: Mr. William E. Wanket ✓

NO RESPONSE NEEDED



STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS

1600 KAPIOLANI BLVD., SUITE 1500
HONOLULU, HAWAII 96814
(808) 548-8960
(808) 946-2642

March 17, 1988

Mr. Donald A. Clegg, Chief
Dept. of General Planning
City and County of Honolulu
650 S. King St.
Honolulu, HI. 96813

Dear Mr. Clegg:

SUBJECT: Draft EIS: Proposed Golf Course, Kunia, Hoaeae, Oahu.
TMK: 9-4-04: 9

This project is yet another which will convert agricultural lands to urban commercial use and will use water that might be put to agricultural and residential uses. Such actions have an adverse impact on a substantial number of Hawaiians who would like to see our rural heritage and lifestyle maintained. The urbanization of Oahu is neither inevitable nor is it the only alternative. Hawaiians rely on the State and Counties to have a plan that incorporates the needs of Hawaiians and provides for the wise use of our natural resources. Planned growth is like skilled craftsmanship. Uncontrolled growth is like cancer. This project will contribute to land speculation, which will also have an adverse effect on many poor Hawaiians who have no opportunity to own or deal in real estate.

Sincerely,

A handwritten signature in cursive script that reads "Kamaki A. Kanahele III".

Kamaki A. Kanahele III
Administrator

cc: Mr. William E. Wanket
Office of Hawaiian Affairs, Chairman
Office of Hawaiian Affairs, Board of Trustees
Malcolm Naea Chun, Cultural Affairs Officer

LATE COMMENT

Rec'd March 21, 1988

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. Kamaki A. Kanahele III
Administrator
Office of Hawaiian Affairs
1600 Kapiolani Blvd.
Suite 1500
Honolulu, Hawaii 96814

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

Dear Mr. Kanahele III:

We received your comment letter March 21, 1988. Thank you very much for your comments on the above-referenced DEIS.

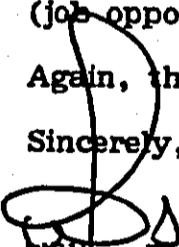
We agree that growth should be planned and controlled to meet the aspirations, goals and objectives of Hawaiians and all other residents, and that our natural resources must be wisely used. Regarding the urbanization of Oahu, over 70 percent of Oahu is presently planned for agriculture and conservation, and many areas under the City and County of Honolulu General Plan are designated Rural, where growth is controlled to maintain rural lifestyles.

Regarding this project, it is true that it proposes to convert agricultural lands to commercial open space/recreational uses. An Agricultural Impact Analysis was performed that concluded the project would not adversely affect the economic viability of Oahu Sugar Company, and it would not limit the growth of diversified agriculture. Also, the project would provide a public benefit by allowing increased employment in the area.

On the issue of speculation, the Land Use Commission, by manipulating the supply of urban land, could manipulate the value of agricultural land. If the Land Use Commission were to take a firm position on preserving prime agricultural land, this would extend-possibly indefinitely- the date to when agricultural land is converted to urban use, which, in turn, would decrease the "speculative" component of agricultural land values. The problem with this, of course, is that a restricted supply of urban land would greatly increase urban land and housing prices, and would slow economic growth (job opportunities) that is dependent on the supply of urban land.

Again, thank you for your comments.

Sincerely,


William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

January 29, 1988

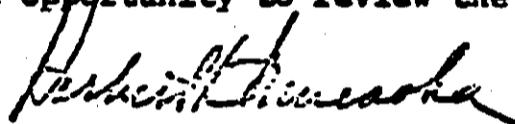
MEMO TO: MR. DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: DRAFT EIS FOR NIHONKAI LEASE COMPANY, LIMITED
PROPOSED GOLF COURSE

We have reviewed the subject draft EIS and have no
comments.

Thank you for the opportunity to review the document.



HERBERT K. MURAOKA
Director and Building Superintendent

TH:ly
cc: J. Harada
William E. Wanket,
William E. Wanket, Inc.

NO RESPONSE NEEDED

Rec'd 2-1-88

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 © (808) 523-4432



FRANK F. FASI
MAYOR

JOHN P. WHALEN
DIRECTOR

March 1, 1988

LU1/88-444 (mstm)

MEMORANDUM

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

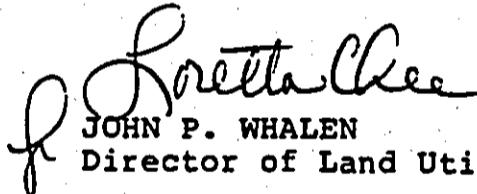
FROM: JOHN P. WHALEN, DIRECTOR

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
FOR THE PROPOSED KUNIA GOLF COURSE
WAIPAHAU, OAHU; TAX MAP KEY 9-4-04: 09

Our concerns and questions from the EIS Preparation Notice (EISPN) have been satisfactorily addressed in the DEIS. Thank You.

The Department of Land Utilization has had the opportunity to review the DEIS, and we have no further comments at this time.

Thank you for the opportunity to comment. If you have any questions, please contact Maureen St. Michel of our staff at 527-5349.


JOHN P. WHALEN
Director of Land Utilization

JPW:sl
1660B

cc: ✓ William E. Wanket, Inc.

NO RESPONSE NEEDED

Rec'd 3-2-88

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU

1455 S. BERETANIA STREET, ROOM 305
HONOLULU, HAWAII 96814



FRANK F. FASI
MAYOR

FRANK K. KAHOOHANOHANO
FIRE CHIEF

LIONEL E. CAMARA
DEPUTY FIRE CHIEF

February 9, 1988

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: FRANK K. KAHOOHANOHANO, FIRE CHIEF

SUBJECT: PROPOSED KUNIA GOLF COURSE, KUNIA, OAHU

Reviewing the materials provided, we foresee no adverse impact on Fire Department facilities or services.

We have no further comments at this time.

Should you have any questions, please contact Battalion Chief Kenneth Word at 943-3838.


FRANK K. KAHOOHANOHANO
Fire Chief

FKK/LD:sb

cc: Mr. William Wanket ✓
William E. Wanket, Inc.

NO RESPONSE NEEDED

Rec'd 2-11-88

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 523-4161



FRANK F. FASI
MAYOR

MIKE MOON
DIRECTOR
ROBERT MIYABATO
DEPUTY DIRECTOR

February 16, 1988

MEMORANDUM

TO: Donald Clegg, Chief Planning Officer
Department of General Planning

FROM: Mike Moon

SUBJECT: Draft Environmental Impact Statement
for the Proposed Golf Course, Kunia, Oahu

We have reviewed the subject draft Environmental Impact Statement and have no comments.

Robert Miyabato
for MIKE MOON
Director

cc: William E. Wanket

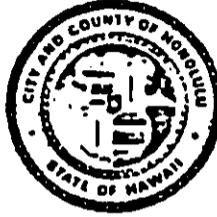
NO RESPONSE NEEDED

Rec'd 2-17-88

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU

1485 SOUTH MERETANIA STREET
HONOLULU, HAWAII 96814 - AREA CODE (808) 943-3111

FRANK F. PABE
MAYOR



DOUGLAS G. GIBB
CHIEF
WARREN FERREIRA
DEPUTY CHIEF

OUR REFERENCE SS-LK

February 9, 1988

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR A PROPOSED
GOLF COURSE, KUNIA, OAHU

We have reviewed the EIS for the above proposed golf course and have no comments to offer at this time.

Warren Ferreira
for DOUGLAS G. GIBB
Chief of Police

cc: Mr. William E. Wanket.

NO RESPONSE NEEDED

Rec'd 2-11-88

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

RH/DGP 2/88-185

March 3, 1988

Mr. William E. Wanket
William E. Wanket, Inc.
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Wanket:

Draft Environmental Impact Statement (EIS)
Kunia Golf Course, Tax Map Key 9-4-04: 09

The Department of General Planning offers the following comments on the above subject.

The Draft EIS on page 25 and 41 indicated that the Department of Land and Natural Resources (DLNR) is expected to complete a study to determine the sustainable yield of the Pearl Harbor Ground Water Control Area. Since water supply Alternatives 1, 2, and 3 involve the DLNR's approval and the results of the study may have a significant impact on future water development in the area, please provide the findings of this study if it is available and indicate how it may affect the availability of water for the project. In the absence of this study, please describe the current water situation, i.e., the availability of water, the needs of existing users, and the needs of other proposed uses.

Oahu Sugar Company, in its letter dated November 16, 1987, indicated that it would not allow the use of Waiahole Ditch water for irrigation and fire safety. In response, the Draft EIS commented that the project engineers are investigating new water sources. Exhibit 18, Golf Course Irrigation and Fire Protection Water, should reflect these new sources as it appears to depict water intake from Waiahole Ditch.

The Draft EIS included a study on the impact on Agriculture (Appendix F).

Mr. William E. Wanket
William E. Wanket, Inc.
Page 2
March 3, 1988

Please include a map or maps indicating Oahu Sugar Company's acreages, the property owners of these lands and the lease expiration date, their current and planned uses, the sugar yields, and the major developments referred to on page 7 of the study.

The Draft EIS on page 17-18 discusses the consistency of this project with the General Plan objectives and policies. This section should also include a discussion on General Plan Economic Activity Objective C, to maintain the viability of agriculture on Oahu, and 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.

Thank you for the opportunity to comment.

Sincerely,

Donald A. Clegg
DONALD A. CLEGG
Chief Planning Officer

Rec'd 3-7-88

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 19, 1988

Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
Municipal Office Building, 8th Floor
650 South King Street
Honolulu, Hawaii 96813

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

Dear Mr. Clegg:

Thank you very much for your comments on the above referenced DEIS. We respond as follows:

Sustainable Yield

A draft of the sustainable yield study (Entitled "Review and Reevaluation of the Ground Water Conditions within the Pearl Harbor Ground Water Control Area" by George Yuen and Asso.) has been completed and submitted by the consultant to the Department of Land and Natural Resources. This draft is at the beginning of an extensive internal DLNR review process which will be coordinated with other governmental agencies as well as the existing water users. According to Dan Lum, the DLNR staff person responsible for the review process, the review will be time consuming in order to give all parties an opportunity to have input before the final report is issued. It is possible that this process may involve six months or longer. The draft study will not be available to the public.

It should be noted that the State Water Commission (which was created by the 1987 Legislature) is responsible for administering public policy on water related matters including the determination of safe sustainable yields for various aquifers in the state. It is expected that the

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

Mr. Donald A. Clegg
March 19, 1988
Page 2

Water Commission will rely heavily on the final report when it is issued.

In fact, the DLNR response to the subject DEIS contains the following statement: "The applicant is...aware that the Board is currently evaluating the sustainable yield limits of the aquifer in the Ground Water Control Area and that the Board will subsequently act on his application for project water use, which amounts to 650,000 gpd."

Current Water Situation (Note: The following information was provided by Ed Sakota of the DLNR staff)

The Pearl Harbor Ground Water Control Area is the largest aquifer on the Island of Oahu. Total sustainable yield of the aquifer has been estimated at approximately 225,000,000 gallons per day. This total is split between the Koolau sub-area and the Waianae sub-area which are estimated at 200,000,000 and 25,000,000 gallons respectively.

Under its authority as the administrator of the Pearl Harbor Ground Water Control Area (PHGWCA), DLNR has allocated water to various users. As of the beginning of 1988 the following allocations were in place: Board of Water Supply 92.01 mgd; Oahu Sugar Company 91.85 mgd; Military 28.125 mgd; and Private users 7.549 mgd. (mgd = million gallons per day) Thus a total of 219.5 mgd of the 225 mgd available has been allocated. The unallocated water amounts to 5.5 mgd essentially all of which is in the Waianae sub-area.

DLNR monitors water usage within the PHGWCA by requiring water users to provide pumpage figures on an annual basis. DLNR records indicate that for the period 1983-1986 average use totaled only 161 mgd annually or 73% of allocated usage. Actual usage in the Koolau and Waianae sub-areas was 147 mgd and 14 mgd respectively or 74% and 72% of allocation respectively.

In summary, essentially all of the water within the PHGWCA has been allocated except for 5.5 mgd all of which is located within the Waianae sub-area. Based on 1983 - 1986 usage data approximately 64 mgd (225 mgd - 161 mgd) or 27% of the average estimated sustainable yield in the PHGWCA goes unused on the average.

To put the applicant's proposed request for water usage in perspective, the applicant is requesting an allocation of

Mr. Donald A. Clegg
March 19, 1988
Page 3

.65 mgd or .3% of the estimated sustainable yield of the PHGWCA, or 1% of the estimated unused allocated water in the PHGWCA, or 12% of the unallocated water in the PHGWCA. The applicant's impact on the PHGWCA should be minimal.

DLNR does not estimate future water needs of potential uses.

Exhibit 18

A new Exhibit 18 will be in the Final EIS. Exhibit 18 in the DEIS was taken from the EISPN in error. Thank you for bringing this to our attention.

Maps

A detailed map was requested from Oahu Sugar Company but they declined to provide one. Property owners, however, include Campbell Estate (lease expires at the end of 1995); Robinson Estate (lease expires at the end of 1996); and the U.S. Navy (lease expires at the end of 1995). Ownership maps are given on page 178 of the Plasch Report entitled, "Hawaii's Sugar Industry: Problems, Outlook and Urban Growth Issues," prepared for DPED, April 1981.

The current use of the land is cultivation of sugarcane; with regard to planned use, the two estates have plans to develop a portion of their lands, with the remainder of their lands to remain in sugarcane. Maps of planned and proposed developments have been provided to the City & County by the various land owners and developers.

Information on sugar yields was requested but not provided by OSCO; we understand that they have since provided this information to the City & County.

As mentioned above, detailed maps of each of the major development projects have been provided to the City & County.

GP Economic Activity Objective C

This will be addressed in the Final EIS.

Again, thank you for your comments.

Mr. Donald A. Clegg
March 19, 1988
Page 4

Sincerely,



William E. Wanket

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

ENV 88-34

February 5, 1988

MEMORANDUM:

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER

SUBJECT: DRAFT EIS FOR PROPOSED GOLF COURSE, KUNIA, OAHU
(TAX MAP KEY: 9-4-04: 9)

We have reviewed the Draft EIS for the proposed Kunia Golf Course and have the following comments:

1. A drainage report should be prepared at the appropriate time and submitted to the Drainage Section, Division of Engineering, for review and approval.
2. Connection of the proposed golf course will not be allowed until the Kunia Wastewater Pump Station is expanded at the developer's cost.

A handwritten signature in black ink, appearing to read "Alfred J. Thiede", is written over the typed name and title.

ALFRED J. THIEDE
Director and Chief Engineer

Rec'd 3-11-88

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
Municipal Office Building, 11th Floor
650 South King Street
Honolulu, Hawaii 96813

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

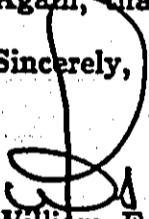
Dear Mr. Thiede:

Thank you very much for your comments on the above-referenced DEIS.

A detailed drainage report will be prepared at the appropriate time and submitted to your office for review and approval. Normally such studies are included in applications for a zone change or subdivision. We are aware, and the DEIS had acknowledged, that the Kunia Wastewater Pump Station will require expansion at the developer's cost. We also understand that connection will not be allowed until the pump station is expanded.

Again, thank you for your comments.

Sincerely,


William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937



COPY

March 8, 1988

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR GOLF
COURSE AT KUNIA TMK: 9-4-04: 9

Thank you for the opportunity to review and comment on the proposed golf course project.

We have the following comments:

1. We have no water system in the area.
2. Fire protection requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.
3. The developer should use water from a non-potable source for landscape irrigation. We oppose the drilling of potable water wells for irrigation use.
4. The statement that "There will, therefore, be no recharge of groundwater from rainfall ..." (page 36) is not valid. During periods of heavy rainfall, recharge will occur which could cause groundwater contamination with heavy and frequent use of fertilizers and pesticides. The permeability of the soil found in the area is described as moderate to moderately rapid by the Soil Conservation Service in "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii (Foote, 1972)."



COPY

Mr. Donald A. Clegg
March 8, 1988
Page 2

5. The statement that "water available for agricultural use will not be impacted" (page 41) contradicts the statements made on page iv of the Executive Summary and pages 35 and 30 as follows:
 - a. "With regard to water, the withdrawal of sugar operations from the petition area would reduce water requirements by about 1.7 MGD. However, the water released from sugar operations will remain with OSCo for agricultural use elsewhere" (page iv of Executive Summary).
 - b. "With regards to water, the withdrawal of sugar operations from the petition area would reduce water requirements by about 1.7 MGD. However, this savings would be offset by increased water requirements for the project of about 0.6 MGD, resulting in a net decrease in water use of about 1.1 MGD" (page 35).
 - c. "Water currently used for agricultural purposes on the property proposed for development will be used for the irrigation of the golf course" (page 30).

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: William E. Wanket, Inc.

LATE COMMENT

Rec'd 3-10-88

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 S. Beretania Street
Honolulu, Hawaii 96843

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

Dear Mr. Hayashida:

Thank you very much for your comments on the above-referenced DEIS.
We respond as follows:

1. No response Required.
2. Fire protection requirements will be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department at the appropriate time.
3. The applicant will consider the use of non-potable water for irrigation purposes. However, at the present time no source of non-potable water is available to the applicant for this purpose. Drilling of wells in any location on the subject property would result in potable water. Regarding this issue, Lawrence Whang of your staff was consulted and he referred us to Mr. George Hiu, also of your staff. Mr. Hiu indicated that as a matter of policy the Board is opposed to the use of potable water for irrigation purposes and that comment 3 is a standard comment for golf courses within the Pearl Harbor Water Control area.

Mr. Hiu indicated that while the Board of Water Supply would entertain requests for potable water (for clubhouse usage) from the proposed development any requests for the use of potable water for irrigation purposes would have to be made to the State of Hawaii, Department of Land and Natural Resources.

The applicant recognizes that there are competing interests for the available water resources within the Pearl Harbor Ground Water Control Area, including agriculture, housing and other urban uses and other uses including golf course uses. Allocation of water among the competing uses is made by the Department of Land and Natural Resources which has commented on the DEIS as follows:

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

Letter to Hayashida

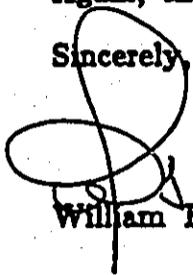
"As acknowledged in the Draft EIS, the developer is aware that any contemplated withdrawals of ground water from the Pearl Harbor Ground Water Control Area would have to be approved by the Board of Land and Natural Resources. He is also aware that the Board is currently evaluating the sustainable yield limits of the aquifer in the Ground Water Control Area and that the Board will subsequently act on his application for project water use, which amounts to 650,000 gpd."

4. Our Summary and Conclusions (para. 1, lines 7-9) should have read "there will be little recharge from rainfall in this area except during unusually high rainfall periods. Since such events will occur at infrequent intervals, the leaching of significant quantities of fertilizer nutrients and pesticides is not expected. There is no historical evidence of the leaching of herbicides used in sugar cane production in this area to the Pearl Harbor aquifer, even though irrigation of sugarcane provided much more recharge than will result from irrigation of turf on the golf course. Proper irrigation practices will contribute little recharge, so leaching of chemicals should not be a problem."
5. Thank you for pointing out our inconsistencies in statements relating to water usage. We believe that with the exception of 5.c. all statements are correct and consistent with clarification. The initial statement "water available for agricultural use will not be impacted" remains true in that Waihole Ditch water which is currently used to irrigate cane on the site will be used elsewhere in the Oahu Sugar Company operations.
 - a. The statement is correct. Agricultural usage on the site will be decreased by 1.7 million gallons but the water freed would be used elsewhere in the Oahu Sugar Company operations.
 - b. The statement is correct. Agricultural usage will decrease by 1.7 million gallons but golf course usage will increase by .6 million gallons leaving a net decrease in usage (on the specific site) of 1.1 million gallons. (Note: the water available for agricultural usage has not changed as the golf course must obtain water from a new source with DLNR permission).
 - c. The statement is incorrect. This statement was inadvertently carried over from the Environmental Assessment when use of water from Waihole Ditch was considered as a possible source for irrigation water for the golf course. Comments from Oahu Sugar indicate that this is not the case. The statement will be deleted from the Final EIS.

Letter to Hayashida

Again, thank you for your comments.

Sincerely,



William E. Wanket

ENV 2-1
JA/G



Brenner Munger, Ph.D., P.E.
Manager
Environmental Department
(808) 548-6880

February 18, 1988

Mr. Donald A. Clegg
Chief Planning Officer
City and County of Honolulu
Department of General Planning
650 South King Street
Honolulu, HI 96813

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement (EIS) for Proposed
Kunia Golf Course, Oahu, Hawaii

The proposed project 8-inch sewer line will cross the existing Kahe-Halewa #1, Kahe-Halewa #2, Kahe-Waiiau, and Kahe-Wahiawa 138KV circuits. However, these facilities will remain energized during construction. As a result, we recommend that the following HECO notes be included as part of the final construction plans.

1. The Contractor is to exercise extreme caution when the excavation and construction crosses or is in close proximity of our lines and is to maintain 13'-0" clearance for his equipment while working close to and/or under the overhead facilities.
2. The Contractor is to comply with the directions of the State of Hawaii Occupational Safety and Health Law (DOSH).
3. When excavation is adjacent to or under existing structures or facilities, the contractor is responsible for properly sheeting and bracing the excavation and stabilizing the existing ground to render it safe and secure from possible slides, cave-ins and settlement, and for properly supporting existing structures and facilities with beams, struts or underpinning to fully protect it from damage.
4. Should it become necessary, any work required to relocate HECO facilities shall be done by HECO. The Contractor shall be responsible for all costs and coordination.

Mr. Donald A. Clegg
Department of General Planning
February 18, 1988
Page 2

5. The Contractor shall be liable for any damages to HECO's facilities.
6. The Contractor shall report any damages to HECO's facilities to the HECO Trouble Dispatch at phone 548-7961.
7. A minimum of 30'-0" shall be maintained between HECO overhead conductors and the final land grade.
8. Service roads and/or trails leading to and from HECO's facilities shall remain accessible for HECO's use at all times.

Sincerely,

Brenner Munger

cc: William E. Wanket



Rec'd 2-22-88

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. Brenner Munger
Manager
Environmental Department
Hawaiian Electric Company
P. O. Box 2750
Honolulu, Hawaii 96840-0001

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

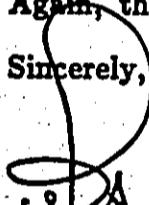
Dear Mr. Munger:

Thank you very much for your comments on the above-referenced DEIS.

We will incorporate HECO's notes, as specified in your letter, on the final construction plans.

Again, thank you for your comments.

Sincerely,


William E. Wanket

Pacific Tower
Suite 1010
1001 Bishop Street
Honolulu, HI 96813
Phone
(808) 533-4937

245 North Kukui Street, Honolulu, Hawaii 96817, Telephone (808) 537-5966

AMERICAN  LUNG ASSOCIATION *of Hawaii*
The Christmas Seal People®

March 8, 1988

Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Draft EIS for Proposed Golf Course, Kunia

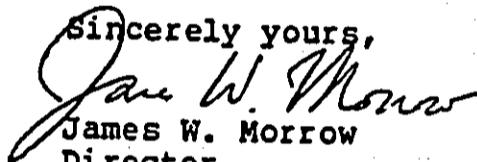
We have reviewed the subject EIS with particular attention to those sections addressing air quality impacts and have the following comments to offer.

Section VI-E.2 and Appendix B addressed air quality impact, but included no mention of the possible impact of pesticide use on air quality even though such use is normal with golf courses.

Section VI and Appendix I addressed pesticide use and possible impacts but with no mention of possible effect on air quality. The appendix provided a listing of pesticides routinely used on golf courses in Hawaii as well as a summary of their pertinent characteristics.

Given the general public concern about pesticides and chemicals in the environment and other local problems associated with golf course use or pesticides, we strongly recommend that this EIS not be accepted until an analysis of potential air quality impact of pesticides be included.

Sincerely yours,


James W. Morrow
Director

Environmental Health

JWM:ct
L8813

cc: OEQC
UH-Environmental Center
W. Wanket

LATE COMMENT

Rec'd 3-10-88

Christmas Seals Fight TB, Asthma, Emphysema, Air Pollution

WILLIAM
E.
WANKET
INC.

Land Use Consultant

March 21, 1988

Mr. James W. Morrow
Director
Environmental Health
American Lung Association of Hawaii
245 North Kukui Street
Honolulu, Hawaii 96817

RE: Response to Comments on the DEIS
Development of a Golf Course, Kunia, Oahu

Dear Mr. Morrow:

Thank you very much for your comments on the above-referenced DEIS. Please be advised, however, that your comment letter was postmarked March 9, 1988 and, according to Chapter 200, Environmental Impact Statement Rules, it failed to meet the established deadline for comments, which was March 8, 1988. Nevertheless, the applicant has decided that your comments should be addressed.

To address your concern of potential air quality impact of pesticides, I asked Charles Murdoch, Ph.D. and Richard E. Green, Ph.D. from the University of Hawaii to respond. Following are their responses:

The pesticides used on golf courses are of relatively low mammalian toxicity, ranging from hundreds to several thousand mg/kg body weight. Because they are not highly volatile and are applied in dilute sprays (50 to 100 gallons of spray solution per acre) to open areas, there is little likelihood of toxic levels in the atmosphere because of volatility once the pesticides are applied. The greatest danger of significant airborne concentrations 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 course spray droplets further reduce the hazard of airborne fine droplets. Droplets smaller than 100 microns diameter are highly subject to drift. Table 1 below shows a typical distribution of droplet sizes for a flat-fan nozzle (the type in most golf course spray equipment).

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Honolulu HI 96813
Phone
(808) 533-4937

Table 1. Droplet size range for a typical flat-fan nozzle at 20 and 40 psi. (from Hofman et al. 1986¹).

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	5.7	0.7

A low concentrations used in pesticide application, this would not result in significant quantities being carried downwind. High wind speed would increase the likelihood of drift of fine spray droplets, however, because high wind speed distorts patterns and results in poor pesticide coverage, spraying in periods of high winds is not common practice. Table 2 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% of the total spray deposited was only 17 feet.

Table 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 1% of the total spray volume (from Hofman et al. 1986).

Comparison	Pressure (psi)	Wind Speed (mph)	Percent Deposited		Distance volume to 1% of volume
			4ft.	8ft.	
14" nozzle ht.	40	3.5	3.1	0.6	7.0
27" nozzle ht.	40	3.5	5.9	1.5	13.0
18" nozzle ht.	30	9.9	10.3	3.1	14.0
18" nozzle ht.	25	9.9	10.3	3.1	15.5
18" nozzle ht.	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 later 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. There is not housing planned on the property

MORROW letter continued

of the proposed golf course. In the event that housing is developed near the golf course later, sufficient buffer space with tall vegetation should be maintained to reduce the chance of airborne spray particles.

The worst danger of airborne pesticides is to the applicators of pesticides themselves. Mixing of wettable power formulations and being in close proximity to airborne spray particles, particularly when operating spray equipment in the 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.

References

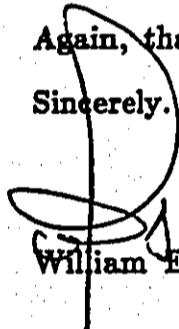
1. Hofman, Vern, Henry Kucera and Mike Berge. 1986. Spray equipment and calibration. AE73 revised. Cooperation Extension Service. North Dakota State University, Fargo, North Dakota. 31 pp.

In addition, I asked Parson Brinckerhoff to address the issue. Attached is their response.

The above responses will be incorporated into the text of the Final EIS.

Again, thank you for your comments.

Sincerely,



William E. Wanket

**PESTICIDE IMPACT ON AIR QUALITY
PROPOSED KUNIA GOLF COURSE**

March 16, 1988

INTRODUCTION

The air quality impacts of vehicles and construction activities were previously addressed in the Draft Environmental Impact Statement (DEIS) for the proposed Golf Course at Kunia. As a result of the review of the DEIS, the American Lung Association of Hawaii requested that the possible effects of pesticide and chemicals use associated with the golf course on air quality be addressed. In response to this request the following evaluation has been provided.

CRITERIA AND STANDARDS FOR PESTICIDE

Investigation of several federal and state agencies found that there has been no significant development of air quality standards for pesticides or fertilizers. However, the federal Occupational Health and Safety Administration (OHSA) has established health standards for workers applying pesticides and fertilizers. In addition, the Environmental Protection Agency (EPA) has an approved list of pesticides and fertilizers to be used for the protection of the environment.

EPA Region IX (which encompasses Hawaii) and the EPA Washington, D.C. office were contacted for information on allowable ambient air quality standards for pesticides. None have been established. Also, the states of Hawaii, California and Arizona were contacted. All three states have substantial agriculture programs and many golf courses. It was determined that pesticide use is monitored for agricultural crops primarily where water quality is concerned. No state data is available for the effects of pesticide use on air quality.

POTENTIAL IMPACTS FROM PESTICIDE USE AT KUNIA GOLF COURSE

While air pollution from vehicle emissions will occur daily, air pollution from the use of pesticides will be intermittent depending on the application schedule. The use of pesticides and fertilizers are routinely required at golf courses in order to maintain fairways and greens. Pesticides include a wide range of insecticides, herbicides, and fungicides. Detailed research has found that the fertilizers, herbicides, fungicides commonly used in golf course maintenance should pose little or no hazard to air quality.

With the exception of herbicides, pesticide applications are normally made only to greens on golf courses. Greens comprise only approximately 3 acres of a typical golf course. Because the area treated with pesticides on a golf course is small, the total amount of pesticide applied is relatively small also.

Fertilizers are relatively non-toxic and all herbicides and fungicides used in golf course maintenance in Hawaii are low to moderate toxicity (see Appendix I Table 1 of the EIS report for the Kunia Golf Course). The only chemicals used in golf course maintenance in Hawaii which are highly toxic are the organic phosphate insecticides, especially diazinon and chlorpylfos.

The labeling of pesticides for particular uses by OHSA and the EPA with strict laws (enforced by the Hawaii Department of Agriculture) for their use are perhaps the best assurance of protection of air quality. The primary purpose of these labels is to provide occupational safety and health guidance regarding proper handling and application. If properly used in accordance with label instructions, all of the chemicals listed in Table 2, Appendix I 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 considering the dilution factor in application solutions.

There are, however, certain precautions that must be followed in order to prevent significant downwind drift from pesticide spraying. Primary among these is the use of a coarse, rather than fine, spray, and application under wind conditions that would not contribute to potential drift toward sensitive areas. Should a user improperly apply these chemicals under wind conditions which would contribute to drifting then there would be an increased possibility of downwind exposure.

EXISTING CONDITIONS

Some herbicide application presently occurs on the existing sugarcane fields within the project site, and the change to golf course use will probably result in an increased use of agricultural chemicals. Because of the relatively small area of a golf course to which fertilizers and pesticides are applied, and the nature of the pesticides used in turfgrass management, there is less likelihood of contaminating the air environment. The proposed increase in use of chemical agents would not be significant.

The summary, conclusions and recommendations of a study by Richard E. Green, Ph.D. and Charles L. Murdock, Ph.D. of the University of Hawaii concerning the use and environmental impact of chemicals likely to be used on the proposed Kunia Golf Course and impacts to water quality are fully described in Appendix I.

SIMILAR STUDY RESULTS

Two other recent studies involving golf courses in Hawaii at Waialua and in Windward Oahu determined that the use of pesticides and herbicides at golf courses should not present a significant problem if applied according to prescribed methods. The use of EPA approved herbicides and pesticides was also recommended at these sites.

CONCLUSIONS

Based on the results of previous studies, an evaluation of the proposed Kunia site, and management factors involved in golf course maintenance, it is unlikely that development of the proposed Kunia golf course would pose environmental risks associated with the use of chemical fertilizers and pesticides. Therefore potential for significant degradation to overall air quality in the Kunia area from golf course pesticide use is judged to be minimal. In any event, as a mitigation measure, proposed chemical agents should be used judiciously. It is also anticipated that the use of windbreaks and a buffer strip around the project area could be implemented as mitigation measures, if necessary to reduce off-site lateral drift of pesticide.

**TRAFFIC ASSESSMENT
Proposed Golf Course Along Kunia Road
(TMK 9-4-04: 9)**

September 15, 1987

This report identifies the potential traffic impact to Kunia Road of a proposed golf course south of and adjacent to the existing Hawaii Country Club (Figure 1). The triangular parcel (TMK 9-4-04: 9) is located east of Kunia Road and consists of approximately 203 acres. The property is presently planted with sugar cane and generates minimal traffic.

A driveway to Kunia Road will be required to provide access to the site. Traffic generated by the proposed project will be added to other traffic on Kunia Road. Traffic conditions during the morning peak hour (6:30-7:30 a.m.) and the afternoon peak hour (3:30-4:30 p.m.) were evaluated.

Existing Conditions

Kunia Road is a two-lane, two-way rural highway with 11-foot lanes and 4-foot wide paved shoulders. The road is a Federal-aid Secondary highway connecting the communities of Waipahu to the south with Wahiawa to the north. Kunia Road meets the H-1 Freeway at Kunia Interchange approximately three miles south of the project site; five miles north of the site, Kunia Road ends at a signalized intersection with Wilikina Drive, which connects to the north end of the H-2 Freeway.

The project site is east of a five-mile segment of Kunia Road that is posted for a 45-mile per hour speed limit. The only existing intersections along this segment are agricultural access roads, minor driveways, and the access to the Hawaii Country Club golf course. Beyond this segment, the speed limit is 35 miles per hour and various intersections serve military bases, agricultural processing plants, Kunia Village, and residential developments.

The State Highways Division estimated that the segment of Kunia Road near the project site served an average volume of 6,900 vehicles per day¹ in 1985. Heavy trucks were estimated to be 2.5% of the morning peak hour traffic volume and 2.0% of the afternoon. At an estimated growth of four percent per year, the 1987 average daily traffic is projected to be 7,500 vehicles per day.

A traffic count taken in January, 1986 by the State Highways Division² was used to estimate peak hour volumes on Kunia Road. Morning peak hour traffic is predominantly northbound, with a total two-way volume of approximately 770 vehicles per hour (VPH). The afternoon peak hour has about 630 VPH with a higher volume of southbound traffic.

The Highway Capacity Manual defines "Levels of Service" as qualitative measures which describe traffic operational conditions considering speed and travel time, freedom to maneuver, traffic interruptions and delays, comfort and convenience, and safety. For a two-lane highway, the ability to pass a slow moving vehicle is a major consideration. Table 1 summarizes the highway level of service (LOS) descriptions for two-lane rural highways.

Table 1
HIGHWAY LEVEL OF SERVICE CRITERIA

Level of Service	Ability to pass	Platooning
A	demand well below capacity	more than 3 is rare
B	approaches passing capacity	common but short
C	near passing capacity	long platoons
D	approaches zero	opposite flows operate separately
E	virtually impossible	controlled by slow vehicles

-
- 1 - State of Hawaii, Department of Transportation, Highways Division, Traffic Summary, Island of Oahu 1985, December 1986.
 2 - State of Hawaii, Department of Transportation, Highways Division, Count Station C-9-D.

Capacity analyses indicate that the two-lane highway operates at LOS D in both peak hours. Volume-to-capacity (V/C) ratios are 0.44 in the morning peak hour and 0.32 in the afternoon peak hour.

Future Conditions Without the Proposed Project

Future traffic volumes on Kunia Road were projected using a growth rate of four percent per year for ten years. Morning peak hour conditions become LOS E, while LOS D continues to describe afternoon conditions. The V/C ratios are projected to increase to 0.65 in the morning peak hour and 0.47 in the afternoon peak hour.

Proposed Project Traffic Generation

Traffic generated by the proposed golf course was estimated using the Institute of Transportation Engineers' informational report Trip Generation³. The project was estimated to generate a total of 1,400 vehicular trips per day, with the following trips during the peak hour:

	<u>Entering Site</u>	<u>Exiting Site</u>
AM Peak Hour	59	15
PM Peak Hour	31	56

These trips were considered additional trips on Kunia Road and were distributed using a computer model to evaluate directional desire from approach and departure volumes on the highway. The future traffic assignment at the project driveway is shown in Figure 2.

Traffic Impacts

The proposed project will increase traffic volumes on Kunia Road and create a new intersection. The traffic impacts were identified by comparing levels of service and V/C ratios on Kunia Road north and south of the site and by evaluating conditions at the driveway using the unsignalized intersection analysis from the Highway Capacity Manual.

3 - Institute of Transportation Engineers, Trip Generation, Third Edition.

The new driveway will decrease the length of highway available for passing, thereby affecting capacities, and increase traffic volumes. Slightly lower V/C ratios are shown south of the site because of the longer passing zones that will be available. Table 2 presents the results of the analyses.

Table 2
HIGHWAY LEVELS OF SERVICE
(and V/C ratios)

Peak Hour	North of Site		South of Site	
	AM	PM	AM	PM
Existing (1987)	D (0.44)	D (0.32)	D (0.43)	C (0.32)
Future without project	E (0.65)	D (0.47)	E (0.63)	D (0.46)
Future with project	E (0.67)	D (0.50)	E (0.67)	D (0.48)

Future LOS will remain the same with or without the project. The V/C ratios will increase approximately five percent; despite the poor levels of service, morning volumes will be about two-thirds of capacity and afternoon volumes will be about half of capacity.

The Highway Capacity Manual analysis for unsignalized intersections evaluates gaps in the major street traffic flow and calculates capacities available for left turns across oncoming traffic and for left and right turns onto the highway from the minor street. Table 3 shows the criteria for levels of service for unsignalized intersections.

Table 3
LEVEL OF SERVICE CRITERIA (UNSIGNALIZED INTERSECTIONS)

Reserve of Capacity	Level of Service	Expected Delay to Controlled Movement
> 400	A	Little or no delays
300 - 399	B	Short traffic delays
200 - 299	C	Average traffic delays
100 - 199	D	Long traffic delays
0 - 99	E	Very long traffic delays
< 0	F	Demand exceeds capacity; extreme delays

The analysis determines the level of service from the reserve of capacity, which is the capacity less the demand volume for each controlled movement. The results of the intersection analysis, shown in Table 4, indicates that the provision of separate lanes for right and left turns from the project will significantly reduce delays for drivers wishing to turn right onto the highway.

Table 4
INTERSECTION LEVELS OF SERVICE
(and Reserve of Capacity)

Peak Hour: Left Turn off of Highway Project Road:	With project condition	
	AM	PM
a) shared exit lane	B (368)	A (622)
b) separate turn lanes	D (138)	C (208)
left turn to hwy.	E (85)	D (123)
right turn to hwy.	C (285)	A (473)

Conclusions and Recommendations

The proposed project will not have a significant impact on traffic conditions on Kunia Road. Although traffic volumes are projected to increase, the highway has sufficient capacity to accommodate the added traffic; levels of service are not expected to change because of the project. The proposed project's access will be through a new unsignalized intersection; the analyses indicate that sufficient capacity will be available.

Separate lanes for right and left turns exiting the site will minimize delays and should be provided. The projected traffic volumes also indicate that a separate turn lane should be provided for southbound traffic wishing to turn left into the site, to allow turning traffic to leave the through lane, thereby not delaying other southbound traffic; the length of the lane should be 175 feet long for storage and deceleration. The installation of the turn lane, however, should not be done unless similar improvements are provided where warranted at other locations along the two-lane segments of Kunia Road, so that a consistent highway design can be maintained.

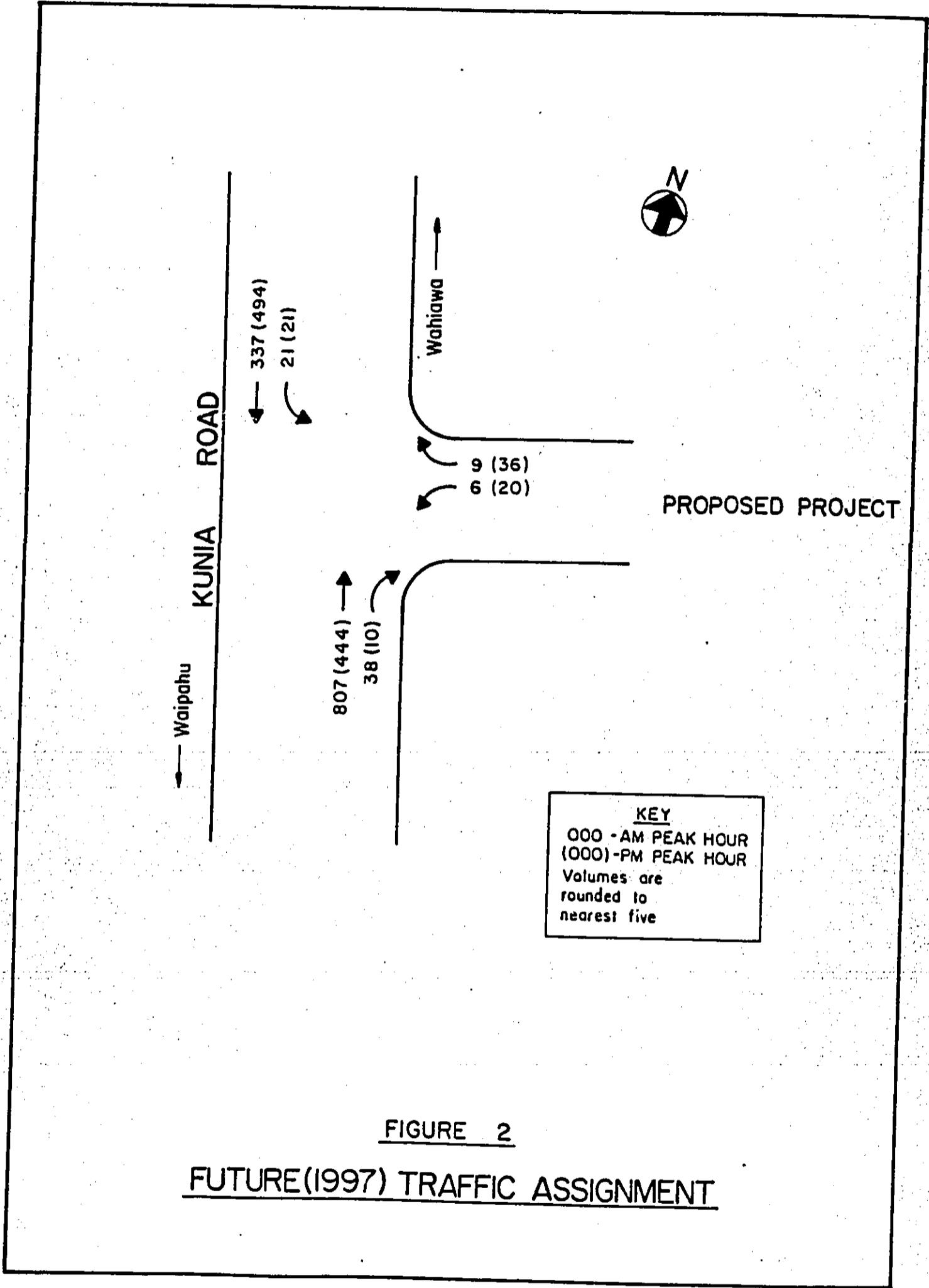


FIGURE 2
FUTURE(1997) TRAFFIC ASSIGNMENT

**AIR QUALITY ASSESSMENT
Proposed Golf Course Along Kunia Road
(TMK 9-4-04: 9)
September 15, 1987**

This report identifies the potential air quality impact due to a proposed golf course south of and adjacent to the existing Hawaii Country Club. The triangular parcel is located east of Kunia Road and consists of approximately 203 acres. This property is presently planted with sugar cane and generates minimal traffic. The proposed project will not in itself constitute a major direct source of air pollutants. By serving as an attraction for increased motor vehicle traffic in the area, however, the project must be considered to be a indirect air pollutant source.

1. AIR QUALITY STANDARDS

State of Hawaii and National Ambient Air Quality Standards (AQS) have been established for six classes of pollutants as shown in Table 1. An AQS is a pollutant concentration not to be exceeded over a specified sampling period which varies for each pollutant depending upon the type of exposure necessary to cause adverse effects. Each of the regulated pollutants has the potential to cause some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration.

National AQS have been divided into primary and secondary levels. Primary AQS are designed to prevent adverse health impacts while secondary AQS refer to welfare impacts such as decreased visibility, diminished comfort levels, damage to vegetation, animals or property, or a reduction in the overall aesthetic quality of the atmosphere. State of Hawaii AQS have been set at a single level which is in most cases significantly more stringent than the lowest comparable national limit. In particular, the State of Hawaii one hour standard for carbon monoxide is four times more stringent than the National standard.

National AQS are based on 40 CFR Part 50, while State of Hawaii AQS are set in Chapter 11-59, Hawaii Administrative Rules. This chapter was recently amended (March 25, 1986) to make Hawaii AQS for particulates and sulfur dioxide essentially the same as the most stringent National limits.

2. PRESENT AIR QUALITY

Sources of man-made air pollution are categorized as either mobile or stationary sources. Mobile sources (which include motor vehicles, aircraft, trains, and ships) predominantly emit reactive organic gases, nitrogen oxides, and carbon monoxide. Passenger cars produce about 70 percent of the total pollutants from mobile sources.

A summary of air pollutant measurements from State of Hawaii long term monitoring stations located nearest to the project is presented in Table 2. Data from several different sampling stations are included in the tabulation.

The sampling station for particulates and sulfur dioxide is located in Pearl City. The monitoring of sulfur dioxide in Pearl City was discontinued in 1984 and 1985 measurements are from the Barbers Point station.

Until September 1979, and after June 1983, carbon monoxide monitoring was conducted at the Department of Health building at Punchbowl and Beretania Streets in urban Honolulu. During 1981 carbon monoxide was measured at Fort DeRussy in Waikiki and in 1982 carbon monoxide was monitored at Leahi Hospital in Kaimuki.

Ozone levels were also measured at the Department of Health building in urban Honolulu until December 1980, when the monitor was relocated to Sand Island. During 1981 nitrogen dioxide was also monitored at the Sand Island location, but all nitrogen dioxide monitoring has since been discontinued. Lead measurements are from Liliha Street in Kalihi.

From the data presented in Table 2 it appears that State of Hawaii ambient air quality standards for particulates, sulfur dioxide, nitrogen dioxide, and lead are currently being met at nearest monitoring stations to the project area.

On the other hand, ozone and carbon monoxide readings from urban Honolulu indicate that allowable State of Hawaii standards for these vehicle-related air pollutants are being violated at a rate of about once or twice a year. Ozone is an indicator of the formation of photochemical pollutants in the air, a condition which tends to develop if the air mass over the islands has been fairly stable with little wind flow for a period stretching over several days. Carbon monoxide (CO) is considered a general indicator of microscale violations of other primary pollutants (including nitrogen dioxide, sulfur dioxide, and particulates); thus it is representative of potential health effects near automotive sources. Concentrations of CO are more directly related to vehicular emissions and tend to be highest during periods of traffic congestion. Carbon monoxide would thus be the pollutant most likely to cause difficulty in meeting allowable State of Hawaii AQS as a result of increased traffic anywhere on Oahu. However, the long-term trend for carbon monoxide for CO in Honolulu, as well as the project area, has been toward decreasing or stable concentrations due to emission control programs. (See Table 2).

3. CARBON MONOXIDE DIFFUSION MODELING

In order to evaluate the future air quality impact of projected increases in traffic associated with the proposed golf course in view of the government-mandated decreasing emission rates per vehicle it was necessary to carry out a detailed carbon monoxide modeling study. The study was designed to yield carbon monoxide concentration values which could be compared directly to allowable State and National Ambient Air Quality Standards.

Localized air quality impacts would relate primarily to the potential for concentration of carbon monoxide emissions at the intersection of Kunia Road and the project access road because of automobile queues.

A receptor site 60 feet southwest from the intersection of Kunia Road and the project access road was selected for analysis. No sensitive receptors were identified as the site is presently occupied by sugar cane and pineapple fields. The chosen receptor site was selected because it is downwind of the intersection, thus will most likely show the greatest level of impact from project-related automobile-generated air pollutants under worst case peak hour traffic conditions. Computations were made for future traffic conditions (1997) both with and without the proposed golf course using traffic volume projections for the project.

Using 1986 vehicle registration figures for Oahu, the existing peak hour vehicle mix in the project area is estimated to be 92.4% light duty autos, 4.3% light duty trucks, 0.8% medium duty trucks, 0.5% heavy duty trucks (gas powered), 1.0% heavy duty trucks (diesel-powered), and 1.0% motorcycles.

In order to adequately examine the range of potential air quality impacts both the average case meteorological conditions and worst case meteorological conditions were analyzed. For the average case, an ambient temperature of 75 degrees F and a wind speed of 6 m/s blowing from the northeast was assumed (this daily average data was provided by the National Weather Service in Honolulu).

For the worst case, an ambient temperature of 55 degrees F and a wind speed of 2 m/s blowing from the northeast was assumed.

Vehicular emission factors used in the model were obtained from the EPA Compilation of Air Pollutant Emission Factors for Mobile Source.

Using the above parameters, carbon monoxide levels for the key intersection in the project area was projected for each scenario with the CALINE4 computer model. CALINE4 is a fourth generation line source air quality model developed by the State of California Department of Transportation ("CALINE4", Report No. FHWA/CA/TL-84/15, November 1984). The purpose of the model is to assess air quality impacts near transportation facilities. Given source strength, meteorology, site geometry, and site characteristics, the model can reliably predict pollutant concentrations. To simulate worst case conditions, stability Category G was used. This stability category represents the most stable (least favorable) atmospheric conditions that would likely occur. Also, an ambient concentration of 1.5 milligrams of CO per cubic meter was assumed.

Results of the peak hour carbon monoxide study are presented in Table 3. Under average meteorological conditions there is only a minimal increase in carbon monoxide levels due to the proposed project. Under worst case meteorological conditions, there is a slightly larger increase in carbon monoxide concentrations at the receptor site.

However, all of the computed carbon monoxide concentrations are well within the Hawaii and National one hour carbon monoxide limits. It is reasonable to conclude that these standards can easily be met by the proposed project.

Eight hour CO levels are estimated by multiplying the peak hour values by a "meteorological persistence factor" of 0.7 which is recommended in EPA guidelines to account for the fact that average one hour traffic volumes over an eight hour period are lower than peak hour volume and meteorological dispersion conditions are more variable (and hence more favorable) over an eight hour period than they are for a one hour period. Multiplying projected peak hour CO levels by this factor yield the values that are shown in Table 4. As was the case with the one hour CO levels, it is estimated that neither the Hawaii or National Standards would be exceeded.

4. CONCLUSION

The proposed project is expected to have little direct impact on the air quality of the surrounding area. The estimated increase in pollution levels is very small and State and Federal air quality standards will continue to be met.

TABLE 1

**SUMMARY OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS
(Micrograms per Cubic Meter)**

Pollutant	Sampling Period	Ambient Air Quality Standards		
		Primary	National Secondary	Hawaii
Particulates	Annual Geometric Mean	75	60	60
	Maximum 24-Hour Average	260	150	150
Sulfur Dioxide	Annual Arithmetic Mean	80	--	80
	Maximum 24-Hour Average	365	--	365
	Maximum 3-Hour Average		1300	1300
Nitrogen Dioxide	Annual Arithmetic Mean		100	70
Ozone	Maximum 1-Hour Average		240	100
Carbon Monoxide	Maximum 8-Hour Average		10	5
	Maximum 1-Hour Average		40	10
Lead	Calendar Quarter		1.5	1.5

Notes:

1. Carbon monoxide standards are in milligrams per cubic meter.
2. National standards based on 40 CFR Part 50; Hawaii standards based on Title 11, Administrative Rules, Chapter 59.

TABLE 2
SUMMARY OF AIR POLLUTANT MEASUREMENTS AT
NEAREST MONITORING STATIONS

Pollutant	1979	1980	1981	1982	1983	1984	1985
PARTICULATE MATTER							
No. of Samples	58	60	59	53	55	56	47
Range of Values	20-48	22-93	19-71	19-54	17-57	16-45	16-62
Average Value	33	36	34	31	30	28	35
No. of Times State AQS Exceeded	0	0	0	0	0	0	0
SULFUR DIOXIDE							
No. of Samples	56	52	56	43	49	42	50
Range of Values	5-63	5-15	5- 5	5-10	5- 5	5- 5	5-25
Average Value	10	5	5	5	5	5	5
No. of Times State AQS Exceed	0	0	0	0	0	0	0
CARBON MONOXIDE							
No. of Samples	207		286	311	173	318	342
Range of Values	0-17.3		1.2-13.8	0-4.6	0-8.6	.6-10.9	0-10.4
Average Value	2.9		5.1	1.2	2.3	2.4	1.5
No. of Times State AQS Exceeded	10		13	0	0	1	1
OXIDANT (OZONE)							
No. of Samples	338	295	314	335	349	296	341
Range of Values	10-80	10-84	10-104	0-151	0-123	0-104	8-198
Average Value	39	48	37	32	46	44	43
No. of Times State AQS Exceeded	0	0	1	2	2	1	3
OTHERS:		NITROGEN DIOXIDE				LEAD	
No. of Samples		46				52	58
Range of Values		6-77				.5-.8	0-.5
Average Value		25				0.6	0.3
No. of Times State AQS Exceeded		0				0	0

NOTES: See text for locations of monitoring stations. Carbon monoxide reported in milligrams per cubic meter; other pollutants in micrograms per cubic meter. Carbon monoxide and ozone are daily peak one hour values; lead is quarterly; other pollutant values are for a 24 hour sampling period.

SOURCE: State of Hawaii Department of Health

TABLE 3

**RESULTS OF PEAK HOUR CARBON MONOXIDE ANALYSIS
(Milligrams Per Cubic Meter)**

Scenario	Average Case (AM/PM)	Worst Case (AM/PM)
Existing	1.5/1.5	1.7/1.7
1997 (without project)	1.5/1.5	1.8/1.8
1997 (with project)	1.6/1.6	1.9/1.9

State of Hawaii AQS: 10
National AQS: 40

TABLE 4

**RESULTS OF PEAK EIGHT HOUR CARBON MONOXIDE ANALYSIS
(Milligrams Per Cubic Meter)**

Scenario	Average Case (AM/PM)	Worst Case (AM/PM)
Existing	1.1/1.1	1.2/1.2
1997 (without project)	1.1./1.1	1.3/1.3
1997 (with project)	1.1./1.1	1.3/1.3

State of Hawaii AQS: 5
National AQS: 10

**ARCHAEOLOGICAL
RECONNAISSANCE**

**TMK 9-4-04: 9
KUNIA**

**ARCHAEOLOGICAL CONSULTANTS
OF
HAWAII**

SEPTEMBER 27, 1987

C



JOSEPH KENNEDY
Archaeologist

ARCHAEOLOGICAL CONSULTANTS
of
HAWAII

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

September 27, 1987

William Wanket
Pacific Tower 1010
1001 Bishop St.
Honolulu, HI 96813

Dear Mr. Wanket:

Archaeological Consultants of Hawaii, Inc. has performed a walk through reconnaissance of a 203.171 acre piece of property located at TMK 9-4-04, ahupua'a of Hoaeae, Ewa, island of Oahu.

At the time of this brief survey, the entire property was devoid of any vegetation whatsoever. The reason for this is that survey and sugarcane harvest were coincidental. Because this land is used exclusively for sugarcane cultivation, the likelihood of remaining surface structures, if indeed any ever existed on the property, is very remote. In addition, visibility was unlimited at the time of survey and no non-plantation above ground features were noticed.

There is water on the property - in Waiahole ditch (which is a uniform 40foot wide syphon) and two reservoir's - however, both are man made facilities created in late historic times and are associated with plantation activities. Without the water, this particular portion of Hoaeae would not be very attractive for human occupation.

This proposal is supported by an check of documents located at the State of Hawaii Map Archives. Three documents relating to this area were examined; The W. H. Pease Map prepared in 1850, the 1873 Alexander Map of Honouliuli prepared in 1873 and the Pearl Lochs Map prepared by the officers of the USS Bennington in 1897.

W. Wanket
9-27-87
page 2.

On all three maps, no signs of human activity were indicated in this portion of Hoaeae. Some pahales, those of Thompson and Kapili, did appear along with symbols indicating cultivation but all were either located well mauka or makai of the subject property.

Further indication of meager recovery potential on the subject property is the lack of formerly recorded or reported archaeological sites. Handy (1972: 472) speaks of a stone named Pohaku-pili which was placed by two gods and which marks the boundary of Waikele and Hoaeae. Because the subject property is directly on the boundary of Hoaeae and Honouliuli, we may be sure that this piece of mythological Hawaii, if still in existence, will not be jeopardized.

While there is no direct evidence in the literature for human use of this land in prehistoric times, it is likely that the land was used for gathering and most likely some limited cultivation. All evidence indicates however that more important parts of Hoaeae were located along the coast near the great fishponds and the rich agricultural lands immediately behind them.

CONCLUSIONS AND RECOMMENDATIONS

In sum then, it may be said that the subject property contains no above ground archaeological features and offers little chance of subsurface recovery. The supportive reasons are field observation under ideal conditions, a complete lack of indicator data from the literature and map sources and an environmental setting that is not consistent with habitation or irrigated agricultural techniques. Some gathering and or limited dry land cultivation may have taken place here but these practices do not easily lend themselves to archaeological investigations.

Therefore, based on the above data, I can see no need for additional archaeological work on the subject property and recommend a clearance for the proposed development of TMK 9-4-04 portion of 9, Hoaeae, Ewa, island of Oahu.

Sincerely,


Joseph Kennedy

BOTANICAL SURVEY

APPROXIMATELY 203-ACRE PROPOSED GOLF COURSE

Kunia, Island of Oahu

by

George K. Linney and Winona P. Char

PREPARED FOR:

William Wanket, Inc.

PREPARED BY:

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

SEPTEMBER 1987

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INTRODUCTION

On 9 September 1987, a botanical survey was conducted on the land proposed for a new 203-acre golf course just south of the present Oahu Country Club. A total of 93 species of vascular plants was found on the site or adjacent to it. Only 4 of these are native to the islands or were introduced by the early Polynesians. The remaining 89 are exotic weeds. None of the native or Polynesian-introduced species are considered rare, threatened, or endangered.

In this report, the following format is used. First, the methods are presented, then results. In the results, there is a description of the site and the vegetation on the site followed by a statement of potential environmental problems and concerns. At the end there is a list of all the vascular plants found on the study site.

METHODS

A walk-through survey method was used. The uncultivated areas, which are more likely to harbor native species were surveyed especially intensively. Those plants that could not be positively identified in the field were collected for comparison with the literature and previously collected specimens. The nomenclature and taxonomy used in this report are based largely on the Manual of the Flowering Plants of Hawaii by W. L. Wagner, D. R. Herbst, and S. H. Sohmer. This book, which promises to be the standard reference work for many years to come, is still in manuscript, and will be released as a Bernice Pauahi Bishop Museum Special Publication in 1989. There is presently no corresponding reference for the ferns and fern allies, though C. H. Lamoureux and W. H. Warren, Jr., have very tentative treatments in manuscript. Where these two differ, Warren's has generally been followed, primarily because of greater familiarity.

RESULTS

The site is found just south of the present Oahu Country Club and consists of actively cultivated canefields. There is very little variation in relief on the site. Almost all of the more or less 203 acres is covered by pure stands of sugarcane (Saccharum officinale) that appears to be ready for harvest. There are few other species mixed in with the sugarcane, and these are restricted to the margins, seldom extending more than a foot or two farther in. The canefield roads into the interior of the site are very dry and hard-packed red soil, and are largely covered with finger-grass (Chloris barbata). Few other species seem to tolerate the physical conditions. Almost all of the remaining species were encountered only around the perimeter of the site, associated with the neighboring golf course, ditches, the syphon, or the highway. All of these features represent increased water-availability for ruderal (wayside) plants, and this may explain why there was such a diversity compared to the interior roads. With the exception of finger-grass, which was abundant throughout, the vegetation was variable enough that seldom did one species dominate over more than a small area, before giving way to another. An especially rich assemblage of plants was found adjacent to the reservoir and a small ditch feeding it. Though these were just outside the site, they were sampled to see what the local vegetation would be under constantly moist conditions. As no species of concern were found in these wet areas, and as they constitute such a small area, they are not differentiated from the drier areas in the species list.

POTENTIAL PROBLEMS AND CONCERNS

There are no plant communities or individual species located in the study site requiring protection, nor are any species on the site considered rare, threatened, or endangered. Only 4 of the 93 species are considered to be native, but their behavior is that of ruderal weeds. They are common throughout the state in low elevation waste areas. Some of the species may be considered highly undesirable weeds, but in the local climate of the golf course and with the high-maintenance it will receive, they pose no future threat to the area.

SPECIES LIST

On the following pages is a list of all those species of vascular plants found during the botanical survey of the site for the proposed golf course. They are organized by family and scientific name. Each entry includes a common or Hawaiian name (if known), biogeographic status, and relative abundance on the site. The terms for relative abundance must not be taken to characterize the species as a whole, only within the approximately 203 acres of the study site. The following symbols and abbreviations are used:

SCIENTIFIC NAME

- cf. - resembling species listed, but identity uncertain
- s.l. - in the broad sense
- sp. - an unidentified species
- spp. - more than one species, which cannot be distinguished

BIOGEOGRAPHIC STATUS

- I - indigenous, native to the islands, but also to other geographic areas
- P - Polynesian introduction before arrival of western man
- X - exotic, introduced intentionally or accidentally since the arrival of western man

RELATIVE ABUNDANCE

- s - single individual
- r - rare, less than 10 individuals
- u - uncommon, not a significant component
- c - common, a significant component
- a - abundant, a dominant component

SPECIES LIST

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
FERNS AND FERN ALLIES			
Adiantaceae			
<u>Adiantum cuneatum</u> Langsd. & Fisch.	maidenhair fern	X	s
<u>Pityrogramma calomelanos</u> (L.) Link	gold fern	X	r
Aspleniaceae			
<u>Nephrolepis multiflora</u> (Roxb.) Jarret ex Morton	sword fern	X	r
<u>Christella parasitica</u> (L.) Leveille	oak-fern	X	r
FLOWERING PLANTS			
MONOCOTS			
Commelinaceae			
<u>Commelina diffusa</u> N. L. Burm.	dayflower	X	s
Gramineae			
<u>Brachiaria mutica</u> (Forsk.) Stapf	California grass	X	u
<u>Cenchrus echinatus</u> L.	sandbur	X	u
<u>Chloris barbata</u> (L.) Sw.	finger-grass	X	a
<u>Chloris virgata</u> Sw.	finger-grass	X	r
<u>Cynodon dactylon</u> (L.) Pers.	Bermuda grass	X	c
<u>Digitaria insularis</u> (L.)	sour grass	X	u
<u>Digitaria cf. sanguinalis</u> (L.) Heist. in Scop.	crab grass	X	r
<u>Digitaria</u> spp.	crab grass	X	u

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<u>Eleusine indica</u> (L.) Gaertn.	goose grass	X	U
<u>Panicum maximum</u> Jacq.	Guinea grass	X	C
<u>Panicum maximum</u> Jacq. var. <u>trichoglume</u> Eyles ex Robyns	green panic grass	X	U
<u>Panicum repens</u> L.	quack grass	X	S
<u>Paspalum conjugatum</u> Berg	Hilo grass	X	S
<u>Rhynchelytrum repens</u> (Willd.) C. E. Hubb.	Natal redtop	X	U
<u>Saccharum officinale</u> L.	sugarcane	X	a
<u>Sorghum halapense</u> (L.) Pers.	Johnson grass	X	S
<u>Zoysia</u> sp.	zoysia	X	S
Hydrocharitaceae			
<u>Egeria densa</u> Planch.	elodea	X	U
Liliaceae s.l.			
<u>Agave sisalana</u> Perrine	sisal	X	r
DICOTS			
Amaranthaceae			
<u>Alternanthera pungens</u> H.B.K.	khakiweed	X	C
<u>Amaranthus spinosus</u> L.	spiny pigweed	X	C
<u>Amaranthus viridis</u> L.	slender amaranth	X	C
Anacardiaceae			
<u>Schinus terebinthifolius</u> Raddi	Christmasberry	X	U

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<u>Basellaceae</u>			
<u>Anredera cordifolia</u> (Ten.) van Steenis	Madeira vine	X	S
<u>Buddlejaceae</u>			
<u>Buddleia asiatica</u> Lour.	buddleia	X	U
<u>Chenopodiaceae</u>			
<u>Chenopodium murale</u> L.	'aheahea	X	U
<u>Compositae</u>			
<u>Acanthospermum australe</u> (Loefl.) Kuntze	Paraguay bur	X	C
<u>Ageratina riparia</u> (Rege.) King & Robinson	Hamakua pamakani	X	S
<u>Ageratum conyzoides</u> L.	maile hohono	X	S
<u>Bidens alba</u> (L.) DC.	Spanish needle	X	U
<u>Bidens pilosa</u> L.	Spanish needle	X	C
<u>Calypocarpus vialis</u> Less.	hierba del caballo	X	C
<u>Conyza bonariensis</u> (L.) Cronquist	hairy horseweed	X	C
<u>Conyza canadensis</u> (L.) Cronquist	horseweed	X	U
<u>Crassocephalum crepidioides</u> (Benth.) S. Moore	crassocephalum	X	C
<u>Eclipta alba</u> (L.) Hassk.	eclipta	X	S
<u>Emilia coccinea</u> (Sims) G. Don	orange-flowered emilia	X	U
<u>Emilia fosbergii</u> D. H. Nicolson	red-flowered emilia	X	C
<u>Emilia sonchifolia</u> (L.) DC.	purple emilia	X	U
<u>Pluchea indica</u> (L.) Less.	pluchea	X	S
<u>Pluchea symphytifolia</u> (Miller) Gillis	pluchea	X	U
<u>Sonchus oleraceus</u> L.	common sowthistle	X	C

SCIENTIFIC NAME

COMMON NAME

STATUS

ABUNDANCE

Tridax procumbens L.
Verbesina encelioides (Cav.) Benth. & Hooker
Wedelia trilobata (L.) A. S. Hitchc.

coat buttons X U
golden crown-beard X C
wedelia X F

Convolvulaceae

Ipomoea cairica (L.) Sweet
Ipomoea obscura (L.) Ker-Gawler
Ipomoea triloba L.
Merremia aegyptia (L.) Urban

Koali I F
yellow bindweed X C
pink bindweed X C
hairy merremia I/P S

Cruciferae

Cardamine flexuosa With.
Lepidium virginicum L.

wild cress X S
peppergrass X F

Cucurbitaceae

Momordica charantia L.

bittermelon X C

Euphorbiaceae

Chamaesyce hirta (L.) Millsp.
Chamaesyce hypericifolia (L.) Millsp.
Chamaesyce prostrata (Ait.)
Euphorbia heterophylla L.
Ricinus communis L.

hairy spurge X C
spurge X C
prostrate spurge X C
summer poinsettia X C
castorbean X C

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
Leguminosae			
<u>Acacia confusa</u> Merr.	Formosan koa	X	u
<u>Canavalia</u> sp.	Jack bean	X	r
<u>Chamaecrista nictitans</u> (L.) Moench.	partridge pea, lau-ki	X	c
<u>Crotalaria incana</u> L.	rattlepod	X	u
<u>Crotalaria mucronata</u> Desv.	rattlepod	X	c
<u>Desmanthus virgatus</u> (L.) Willd.	virgate mimosa	X	u
<u>Desmodium triflorum</u> (L.) DC.	beggarweed	X	u
<u>Indigofera spicata</u> Forsk.	prostrate indigo	X	u
<u>Indigofera suffruticosa</u> Mill.	indigo	X	u
<u>Leucaena leucocephala</u> (Lam.) deWit	koa-hao'le, popinac	X	u
<u>Macroptilium atropurpurea</u> (L.) Urb.	wild bush-bean	X	c
<u>Medicago</u> cf. <u>lupulina</u> L.	black medic	X	r
<u>Paraserianthes</u> sp.	albizia	X	r
<u>Senna occidentalis</u> (L.)	coffee senna	X	u
Malvaceae			
<u>Malvastrum coromandelianum</u> (L.) Garcke	malvastrum	X	c
<u>Sida fallax</u> Walp.	'ilima	I	s
<u>Sida rhombifolia</u> L.	sida	X	a
Melastomataceae			
<u>Clidemia hirta</u> (L.) D. Don	Koster's curse	X	r
Phytolaccaceae			
<u>Phytolacca octandra</u> L.	pokeweed	X	r

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
Plantaginaceae			
<u>Plantago lanceolata</u> L.	English plantain	X	c
Portulacaceae			
<u>Portulaca oleracea</u> L.	common purslane	X	c
Sterculiaceae			
<u>Waltheria indica</u> L. var. <u>americana</u> (L.) R. Br. ex Hosaka	'uhaloa, hi'aloa	I/P	a
Solanaceae			
<u>Lycopersicum</u> sp.	tomato	X	s
<u>Solanum americanum</u> Mill.	popolo	I/P	u
Tiliaceae			
<u>Heliocarpus popayanensis</u> H.B.K.	white moho	X	s
Umbelliferae			
<u>Ciclospermum leptophyllum</u> (Pers.) Sprague		X	r
Urticaceae			
<u>Pilea microphylla</u> (L.) Liebm.	artillary plant	X	r
Verbenaceae			
<u>Lantana camara</u> L.	lantana	X	u
<u>Stachytarpheta jamaicensis</u> (L.) Vahl	stachytarpheta	X	u
<u>Verbena littoralis</u> H.B.K.	verbain	X	s

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
Zygophyllaceae <u>Tribulus terrestris L.</u>	puncture vine	X	r

AVIFAUNAL AND FERAL MAMMAL SURVEY OF PROPERTY
LOCATED AT KUNIA, CENTRAL OAHU

Prepared for

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AVIFAUNAL AND FERAL MAMMAL SURVEY OF PROPERTY
LOCATED AT KUNIA, CENTRAL OAHU

INTRODUCTION

The purpose of this report is to summarize the findings of a one day bird and mammal field survey conducted at the site of a proposed golf course in Kunia, central Oahu. Also included are references to pertinent literature as well as personal communication with biologists familiar with the area. Finally, the report provides some suggestions as to the possible changes in the faunal community that may occur following development of the type proposed along with recommendations regarding the preservation of key habitats.

The objectives of the field survey were to:

- 1- Document what bird and mammal species occur on the property or may likely occur given the type of habitats available.
- 2- Provide some baseline data on the relative density of each species and where possible within the constraints of the available time determine the degree and purpose to which the site is utilized by each species.

- 3- Compare these findings with published and unpublished data.
- 4- Assess the possible changes in the bird and mammal communities that might occur as a result of habitat alteration due to the proposed development.

GENERAL SITE DESCRIPTION

The project site is comprised of 203.171 acres. Sugar cane cultivation covers virtually all of the property. On the north boundry there is a golf course (Hawaii Country Club) while Waiahole Ditch forms the south and east boundry and Kunia Road the west boundry. On the south west corner adjacent to Waiahole Ditch there is an irrigation pond with patches of emergent vegetation and trees and bushes about its perimeter.

Weather during the field survey was clear with some afternoon cloudiness. Winds were from the NE at 10-20 mph.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. Attention was also paid to the presence of tracks and scats as indicators of bird and mammal activity. Existing roads around and through the property were followed and at various points (see Fig. 1) four minute counts were made of all birds seen or heard. Between these count stations walking tallies of birds seen and heard were also kept. These counts provide the basis for the population estimates given in this report. Data on habitat preferences come from these observations plus information provided in Berger (1972), Hawaii Audubon Society (1984) and Pratt et al. (1987). Annual counts of birds in central Oahu by Hawaii Audubon Society as published in their journal 'Elepaio were also consulted in order to acquire a more complete picture of the birdlife activity in the area.

Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative density and distribution.

Scientific names used herein follow those given in the recent American Ornithologist's Union checklist (A.O.U. 1983) and Hawaii's Birds (Hawaii Audubon Society 1984).

RESULTS AND DISCUSSION

Resident Endemic (Native) Birds:

No endemic birds were recorded during the survey. Given the present nature of the property the only likely endemic species that might occur would be the Short-eared Owl (Asio flammeus sandwichensis). Bremer (1987) reports this species on only three of the last ten annual surveys of the Waipio and central Oahu area. The reservoir located at the SW corner of the project site contained no endemic waterbirds. Quarterly waterbird counts on Oahu by state DLNR personnel do not provide data for this specific pond but do suggest that American Coot (Fulica americana alai) Hawaiian Duck (Anas wyvilliana) and Black-necked Stilt (Himantopus mexicanus knudseni) do occur in the area and potentially could be found at one time or another at this site. (pers. comm. Thane Pratt State of Hawaii Wildlife biologist). The latter species might occur briefly in recently cleared fields which have been flooded by rain.

Migratory Indigenous (Native) Birds:

Pacific Golden Plover (Pluvialis dominica fulva) -

A total of 13 plover were recorded during the field survey. Most were seen along the road which surrounds the property and in a recently cleared sugar cane field at the SW boundry. Time did not permit sufficient observations to determine how many of these plover were territorial versus how many were non-territorial. Johnson et al. (1981) and Bruner (1983) have shown plover are extremely site-faithful on their wintering grounds and many establish foraging territories which they defend vigorously. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years.

No other migratory birds were recorded during the survey. Given the present land use of the property Ruddy Turnstone (Arenaria interpres) and perhaps Sanderling (Calidris alba) might occasionally forage in the area following a recent harvest of the sugar cane when open bare fields were available.

Except for these brief and infrequent periods migratory birds other than the plover would likely be confined to the more hospitable environs of the

neighboring Hawaii Country Club Golf Course. Site-faithfulness of these species have been investigated by Myers et al. (1981). Their results reveal that environmental changes markedly alter territorial and site-faithfulness responses.

Migratory ducks might utilize the reservoir at the SW edge of the property. The depth of this pond and its proximity to Kunia Road probably preclude extensive use of this site. No ducks were recorded but none were expected as they typically begin to appear in Hawaii during November of each year (Berger 1972, Hawaii Audubon Society 1984).

Resident Indigenous (Native) Birds:

Black-crowned Night Heron (Nycticorax nycticorax)-
Only one night heron was seen during the field survey. This individual was observed at the reservoir located at the SW edge of the site. This species may forage along the irrigation ditches and roadsides especially following a harvest. Night Heron feed on a wide variety of prey including insects, crayfish, prawn and mice. The trees around the reservoir provide areas for roosting for this species.

Exotic (Introduced) Birds:

A total of 14 species of exotic birds were recorded during the field survey. Table one show the relative abundance and typical habitat preferences of these species. Bremer (1987) provides a more comprehensive list of exotic birds which occur in the Waipio and central Oahu area. The most abundant species during the one day field survey was the Zebra Dove (Geopelia striata). The lack of forested habitat accounts for the absence of the common White-rumped Shama (Copsychus malabaricus) and the low numbers of Northern Cardinal (Cardinalis cardinalis) both birds of dense thickets. No unexpected species were observed nor unusual densities.

Feral Mammals:

No feral mammals were seen but tracks and scats of mongoose (Herpestes auropunctatus) were observed. Without a trapping program it is difficult to conclude anything about the relative abundance of mongoose, rats, and mice. However, it is likely that their numbers are similar to what one would find elsewhere in sugar cane fields on Oahu.

Records of the endemic and endangered Hawaiian

Hoary Bat (Lasiurus cinereus semotus) are sketchy but the species has been recorded from central Oahu (Tomich 1986). Although not observed during this survey the most likely spot to see this species might be the reservoir at the SW edge of the property as they are known to forage for insects over bodies of water during the early evening hours.

CONCLUSIONS AND RECOMMENDATIONS

A one day field survey can at best provide a limited perspective of the wildlife present in the area. Not all species will likely be observed and information on their use of the site must be sketched together from brief observations and the available literature on the species. The number of species and the relative density of each species may vary throughout the year due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the ecological picture only at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the ecosystem (Williams 1987).

Thus only long term studies can provide the insights necessary to acquire both a broad view as well as a more definitive perspective of the bird and mammal populations in a particular area. However, when brief field studies are coupled with data gathered from other similar habitats the value of the conclusions drawn are significantly increased.

In terms of broad conclusions related to bird and mammal activity on the project site the following are offered:

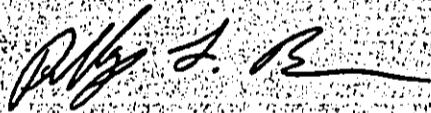
- 1- The present monoculture of sugar cane precludes wide spread use of this site by birds. Most activity was noted along the perimeter where alternative types of vegetation created the diversity of habitats needed in order to support a variety of species.
- 2- Mammal activity was limited. More detailed data would involve a long term trapping program.
- 3- The irrigation pond located at the SW corner of the property provides an additional habitat type which potentially could be an important link in the ecological picture. The trees about its edge serve as nest sites and places of refuge.
- 4- A change of land use of the type proposed will significantly alter the present habitat by creating a much larger diversity of living

spaces than are available in a monoculture of sugar cane. The planting of trees and the creation of grassy open areas will provide new habitats which will likely result in an increase of species like plover and Common Myna (Acridotheres tristis). Mammals populations will also likely change following development. The loss of the dense cover provided by sugar cane will reduce mongoose and rat/mice populations significantly. Although not recorded on the survey game birds such as Common (Ring-necked) Pheasant (Phasianus colchicus) will also be impacted by a loss of cover with the changes in habitat types due to development. This species is widespread and relatively common in sugar cane and second growth habitats on Oahu.

- 5- Overall the conversion of the property from a sugar cane monoculture to a more diversified habitat of trees and grass should be a positive change with a resultant increase in the populations of most bird species.

Recommendations:

- 1- A diversity of trees and plants in the new golf course will increase its usefulness to birds. If ponds are created emergent vegetation about the edges of these ponds would make them more attractive to water birds as well as enhance their beauty.
- 2- The present pond at the SW corner may play an important role in the wildlife of this site. Where possible this pond and its surrounding vegetation should be preserved.



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Fig. 1 Project site with four minute count stations indicated by a *

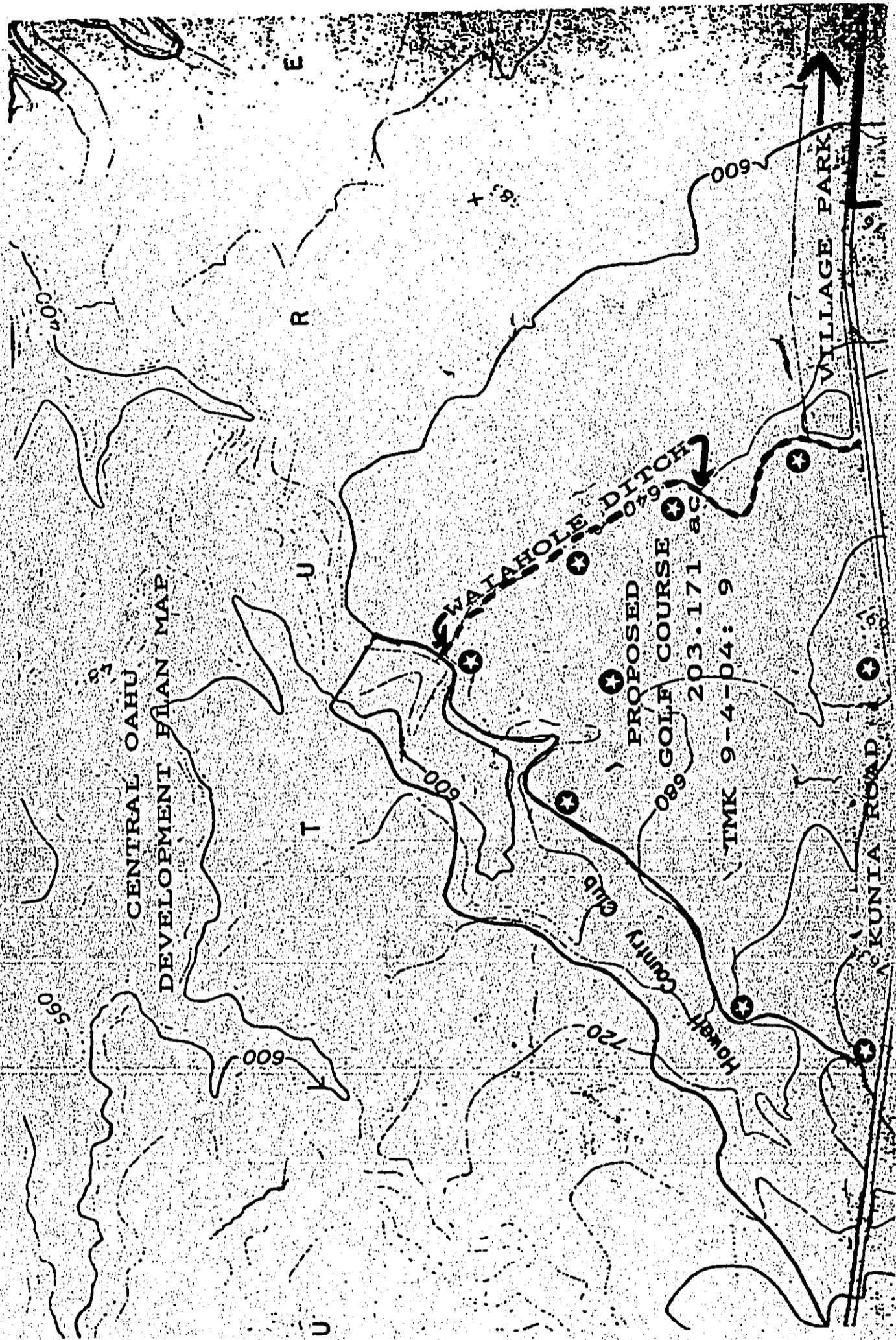


TABLE I

Relative abundance and general habitat preferences of exotic birds on property proposed for development at Kunia, central Oahu.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE/TOTAL*	HABITAT*
Cattle Egret	<u>Bulbucus ibis</u>	R = 2	Ag, G
Spotted Dove	<u>Streptopelia chinensis</u>	U = 3/18	S, G
Zebra Dove	<u>Geopelia striata</u>	A = 11/97	S, G
Common Myna	<u>Acridotheres tristis</u>	C = 6/29	U, Ag
Northern Cardinal	<u>Cardinalis cardinalis</u>	R = 2	T, S
Red-crested Cardinal	<u>Paroaria coronata</u>	U = 2/12	P, G
Red-vented Bulbul	<u>Pycnonotus cafer</u>	C = 7/22	P, U
Japanese White-eye	<u>Zosterops japonicus</u>	C = 8/36	P, T, U
House Sparrow	<u>Passer domesticus</u>	C = 9/44	U
House Finch	<u>Carpodacus mexicanus</u>	R = 7	P
Nutmeg Mannikin	<u>Lonchura punctulata</u>	R = 7	G
Chestnut Mannikin	<u>Lonchura malacca</u>	U = 4/21	G
Common Waxbill	<u>Estrilda astrild</u>	R = 2	G
Red Avadavat	<u>Amandava amandava</u>	R = 10	G

* (See page for key to symbols)

KEY TO TABLE 1

Relative Abundance = Number of individuals
observed during walking survey or frequency on four
minute counts in appropriate habitat.

- A = Abundant (ave. 10+) on 4 min counts
- C = Common (ave. 5-10) on 4 min counts
- U = Uncommon (ave. less than 5) on 4 min counts
- R = Rare (recorded number which follows is total)

Habitat Preference = Area(s) most likely to occur

- G = Grassland
- P = Parkland (grass and scattered trees)
- T = Thickets of dense vegetation
- Ag = Agricultural fields
- S = Second growth forest
- U = Urban

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**PROPOSED KUNIA GOLF COURSE:
IMPACT ON AGRICULTURE**

February 1988



DECISION ANALYSTS HAWAII, INC.

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EXECUTIVE SUMMARY

The development of the proposed Kunia Golf Course would result in the urbanization of approximately 190 acres of sugarcane lands which are currently under cultivation by Oahu Sugar Company, Ltd. (OSCo). Assuming that U.S. sugar prices will continue to be high enough to justify continued sugar operations in Hawaii, an important question is whether Kunia Golf Course—combined with other planned and proposed projects—would eventually cause the closing of OSCo, either by reducing sugarcane acreage sufficiently to reduce economies of scale, and/or by contributing to a scattered and therefore inefficient plantation rather than a more compact and efficient one. Water is not an issue to the future viability of OSCo because water now used on fields proposed for the Kunia Golf Course as well as other proposed developments will remain with OSCo for use on other fields, unless the water is not needed by OSCo.

Assuming that all proposed projects will be approved, and that it would take about 20 years to realize the full development of all projects, OSCo would retain about 11,760 acres under cultivation in 1995 when its major lease expires. If yields increase from their current average of about 15 tons of raw sugar to 16 tons per acre by the end of 1995 (which is a conservative projection), then 11,760 acres would be sufficient land to maintain the current production of about 90,000 to 95,000 tons of raw sugar per year, without any loss in economies of scale. No layoffs of sugar workers would be expected, since OSCo has a practice of reducing its employment by attrition.

However, if the sequence of urbanization results in a scattered plantation that is too inefficient to operate at the current level of production, or if urbanization and loss of sugarcane acreage proceeds at too rapid a rate to be compensated by increasing yields, then a switch from a two- to one-mill operation would be required to maintain an efficient and economically viable operation. For this case, land requirements would be about 8,440 acres, assuming a yield of 16 tons per acre and production of about 67,500 tons per year. This would provide a buffer of 3,320 acres from

which to assemble an efficient plantation; this figure is based on 11,760 acres remaining after projected urbanization (assuming approval of all planned and proposed projects), minus the estimated 8,440 acres required for a one-mill operation. It is uncertain whether or not attrition would be sufficient to accommodate a reduction in employment associated with a switch to a one-mill operation.

At full development of all the planned and proposed projects (assuming approval of all projects), the amount of land under cultivation by OSCo would be about 8,520 acres. If development proceeds gradually, and if yields increase sufficiently (as a result of genetic engineering and other advances), then it is conceivable that OSCo could maintain production near its current level. In order for this to occur, the average yield would have to increase by about 45 percent, from 15 to 21.7 tons per acre.

It is more likely, however, that a switch to a one-mill operation would be required to maintain economic viability. Assuming an average yield of 18 tons per acre by the time the various projects reach full development (which is a conservative projection), a one-mill operation would require about 7,500 acres. This would provide a buffer of about 1,020 acres from which to assemble an efficient plantation; this figure is based on 8,520 acres remaining after urbanization (assuming approval and full development of all planned and proposed projects), minus the estimated 7,500 acres needed for a one-mill operation.

To summarize the above, Kunia Golf Course, in combination with other approved and proposed projects, is not expected to threaten the economic viability of OSCo; economies of scale and a compact efficient plantation would be possible by (1) switching to a single-mill operation, or (2) retaining a two-mill operation provided that urbanization proceeds gradually and yields can be increased rapidly to compensate for the loss of acreage.

If OSCo were to cease operations for whatever reason (most likely because of low sugar prices), the loss of jobs would be less than 450 direct jobs and 510 indirect jobs. This would be equivalent to the loss of a hotel about half the size of the Hyatt Regency in Waikiki. Immediately following the mill closing, significant economic loss and social disruption would occur. But over the long term, the economic loss would be absorbed easily by expanding economic opportunities in the Ewa/Central-Oahu area.

Assuming that OSCo does close, revenues to Waialua Sugar Company, Inc. (WSCo) would be decreased slightly because OSCo's contribution to shared terminal facilities and services would be lost. At worst, the economic effect would correspond to an increase in production cost of less than 2 percent. But rather than absorb

EXECUTIVE SUMMARY

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increased terminal charges, a more profitable alternative would be to increase the refining capacity of C&H in Aiea to process all of the WSCo production. Refined sugar in excess of the Hawaii requirements would be shipped at favorable backhaul rates to Los Angeles and Seattle. Currently, Hawaiian sugar is delivered to these markets by rail from the C&H refinery in Crockett, California near San Francisco. Consequently, the net economic effect of the closing of OSCo on WSCo would be small, and would be unlikely to force the closing of WSCo—like OSCo, the future economic health of WSCo will be determined primarily by the price of sugar in the U.S. market.

The development of Kunia Golf Course on sugarcane acreage would eliminate the possibility of using these lands for diversified agriculture (including aquaculture). However, it is extremely doubtful that this would adversely affect the growth of diversified agriculture in Hawaii. There are four reasons for this assessment: (1) an extensive amount of prime-agricultural land and water has been freed from sugar and pineapple production because of past mill closings and reductions in operations; (2) a very real possibility exists that additional land and water will be freed from sugar production given the outlook for low sugar prices; (3) some—if not most or even all—of the sugar operations will make their lands available for profitable replacement crops to the extent that such crops are available; and (4) compared to the available supply, a very small amount of land and water is required to grow proven and promising crops to achieve a realistic level of food and animal-feed self-sufficiency, and to increase exports. The increasing availability of prime agricultural land in Hawaii is part of very long-term and accelerating trends occurring throughout most developed and developing market economies. Productivity and yields have been increasing faster than population growth, and genetic engineering and other advances, combined with slower population growth, indicate an acceleration of these trends. Rapid productivity and yield increases require that labor, land, and other resources be withdrawn from agriculture in order to restore balanced markets and to increase farm income for those who remain.

Since the Kunia Golf Course is not expected to adversely affect the economic viability of OSCo, and would not limit the growth of diversified agriculture, the project is consistent with the major thrust of the agricultural portion of the Hawaii State Plan, the State Agriculture Functional Plan, and the General Plan of the City and County of Honolulu. This thrust is to preserve the economic viability of plantation agriculture and to promote the growth of diversified agriculture. Also, the project would provide a public benefit (i.e., increased employment) which would over-

EXECUTIVE SUMMARY

ride the proposed "important agricultural lands" designation of the Land and Evaluation Site Assessment (LESA) Commission. Furthermore, the project would not adversely affect cultivation of adjacent sugarcane acreage and, therefore, complies with the Hawaii Right-to-Farm Act.

**PROPOSED KUNIA GOLF COURSE:
IMPACT ON AGRICULTURE**

The proposed Kunia Golf Course will involve the urbanization of about 190 acres of sugarcane lands of Oahu Sugar Company, Ltd. (OSCo). The impact of this loss on OSCo operations, as well as on the potential growth of diversified agriculture (including aquaculture), is summarized in this report.

SOIL QUALITY OF AFFECTED SUGARCANE ACREAGE

The affected sugarcane acreage consists of four soil types: mostly Kunia silty clay, 0 to 3 percent slopes (KyA), some Kunia silty clay, 3 to 8 percent slopes (KyB), some Kunia silty clay, 8 to 15 percent slopes (KyC), and some Wahiawa silty Clay, 0 to 3 percent slopes (WaA). These soils are used for sugarcane and pineapple, with WaA also used for pasture.

The soils within the petition area have been rated in terms of four classification systems commonly used in Hawaii:

—Land Capability Classification by the United States Department of Agriculture Soil Conservation Service (SCS).

This classification rates soils according to eight levels, ranging from the highest classification level I to the lowest level VIII. If irrigated, soil types KyA and WaA have a capability classification I, which indicates that the soils have few limitations which restrict their use. Soil type KyB is in Subclass IIe if irrigated, which indicates that the soil has a moderate limitation which reduces the choice of plants or which requires moderate conservation practices; the problem is that this soil is subject to moderate erosion if cultivated and not protected. Soil type KyC is in Subclass IIIe if irrigated, which indicates that the soil has a severe limitation that reduces the choice of plants, requires special conservation practices, or both; the problem is that the soil is subject to severe erosion if cultivated and not protected.

—Agricultural Lands of Importance in the State of Hawaii (ALISH), by the SCS, University of Hawaii College of Tropical Agriculture and Human Resources, and the State of Hawaii Department of Agriculture.

This system classifies lands into three categories: (1) 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; (2) unique agricultural land which is non-prime agricultural land that is currently used for the production of specific high-value crops; and (3) other prime agricultural land which is non-prime and non-unique agricultural land that is of importance to the production of crops. Most of the petition lands now planted in sugarcane are rated as "prime" agricultural lands.

—Overall Productivity Rating, by the Land Study Bureau (LSB) of the University of Hawaii.

This classification rates soils according to five levels, with "A" representing the class of highest productivity and "E" the lowest. Most of the petition lands now planted in sugarcane is rated A, although some is rated B.

—Proposed Land Evaluation and Site Assessment (LESA) System, by the State of Hawaii Land Evaluation and Site Assessment Commission

Based on soil quality, locational attributes, improvements, nearby activities, and land-use plans, this proposed system would designate a sufficient amount of the better agricultural lands so as to meet projected agricultural goals. The designated lands would be termed important agricultural lands (IAL) and, based on the proposed maps, would include the lands in the petition area now under cultivation. However, the identification 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 there is an overriding public benefit.

IMPACT ON OSCo¹

Background Information

Amfac's OSCo first milled sugar in 1899, and is now the fourth largest sugar operation in the State. It cultivates about 13,540 acres of sugarcane land, and

¹Unless otherwise noted, the material in this section is from OSCo, Amfac, and/or Section B, Chapter VI of Hawaii's Sugar Industry: Problems, Outlook, and Urban Growth Issues.

produces about 90,000 to 95,000 tons of raw sugar, or nearly 10 percent of Hawaii's total sugar production. Its lands cover portions of Central Oahu on each side of Kunia Road above Pearl Harbor, and portions of the Ewa Plain to the west of Pearl Harbor. The Ewa lands were taken over from Ewa Plantation in 1970.

Another 4,860 acres of OSCo lands were in production in 1982, the bulk of which are now fallow, while a few hundred acres have been urbanized. These lands are mostly mauka lands with high pumping costs, and lands close to the seashore where soils tend to be inferior, yields low, and hauling costs high because of the distance to the mill.

Nearly all of the land which OSCo cultivates is leased, principally from Campbell Estate with a lease expiration date of 1995, and from Robinson Estate with a lease expiration date of 1996. The lease rents on these lands are among the highest in the State for sugarcane acreage, and are adjusted as a function of the revenues from sugar operations. Both leases allow partial withdrawal of lands for urbanization. The Campbell Estate lands above H-1 Freeway and west of Kunia Road have been dedicated to agricultural use in order to obtain special property tax assessments.

OSCo is one of the major water users on Oahu, pumping up to 92.5 million gallons per day (MGD) of groundwater, and diverting in normal-rainfall years 25 to 30 MGD from the Windward side via Waiahole Ditch. Per-acre usage by OSCo can exceed 9,000 gallons per day. For comparison, pumpage by the Board of Water Supply averages about 140 MGD, and per-acre usage for single-family homes at 5 units per acre averages about 2,130 gallons per day.

Field, mill, and management employment at OSCo is approximately 450 workers. Indirect employment dependent upon OSCo is estimated to be 510 jobs (multiplier of 1.13, based on the State Economic Model). For comparison, OSCo's economic contribution to Hawaii's economy is less than half that of the Hyatt Regency Hotel in Waikiki.

Because of favorable growing conditions, good farming practices, and drip irrigation, sugar yields at OSCo are very high, about 14.5 to 15.5 tons per acre, versus a 1986 Statewide average of 12.5 tons per acre (HSPA, "Hawaii Sugar News," March 30, 1987). In fact, OSCo holds the world record sugar yield at 21.63 tons per acre set in April 1985 (HSPA, "Hawaii Sugar News," June 26, 1985). The current average yield is about 33 percent higher than the 1979 yield of 11.3 tons per acre.

But even with high yields and very efficient operations, OSCo is only marginally profitable—the principal problem being low sugar prices. The marginal profitability

is measured before accounting for new capital investment needed to replace equipment.

Outlook for Sugar Prices

In the long term, the survival of OSCo will depend primarily on the price of sugar, for which the outlook is pessimistic. In the world market, the average price of sugar is expected to remain well below the production costs for all countries. This is because most sugar is traded in controlled and/or subsidized markets, with surplus sugar dumped onto the world market for sale at a loss. Dramatic price increases have occurred, however, following a 6- to 9-year cycle, with prices increasing whenever world production falls short of consumption. But, there have been a number of fundamental developments in sugar and related industries in the past 10 years which appear to have altered the pattern of sugar prices, reducing peak prices and extending the periods of low prices. These changes include: the decline or stagnation of sugar consumption in most developed countries; inroads made by the liquid sweetener high-fructose corn syrup (HFCS); the availability of substantial sugar reserves in the form of sugarcane now devoted to ethanol production; major gains in sugar beet productivity in several European countries which were traditionally cane sugar importers; and the appearance of the European Economic Community ECC as a major exporter of refined sugar (Brown).

In the United States, Federal legislation protects sugar from the low world prices by import quotas, tariffs, and import fees. However, U.S. sugar prices are managed so that they are fairly low in order to prevent accelerating the growth of competing sweeteners, and to maintain public support. Under the U.S. Farm Bill, which runs to 1991, the target price for sugar is 18 cents per pound, with no adjustments for inflation.

The competing sweetener of major concern has been HFCS. It is as sweet or sweeter than regular sugar, costs less to produce, sells for less, is more profitable, is very similar to liquid sugar, can be substituted readily in many applications, and is easier and cheaper to handle. It has experienced rapid growth in sales at the expense of regular sugar sales. However, HFCS has captured nearly all of the liquid-sweetener market so that continued growth will depend on the market acceptance of Crystar, the crystalline version of HFCS. In addition, the new low-calorie sweetener aspartame, sold under the brand name "Equal," is capturing market share and putting additional downward pressure on U.S. sugar prices.

Regarding the long-term outlook for sugar legislation, it should be noted that, because of HFCS, many corn states have joined the sugar and sweetener coalition, making it larger and stronger than in the past, even though a number of sugar companies have closed in recent years. Also, the Farm Act is generally supported by those countries which receive a sugar quota, since they benefit from a high price for a major portion of their sugar. The considered expectation among sugar experts and lobbyists is that sugar will continue to be included in the U.S. Farm Act, but that the price-support level may be relatively low and may increase at a rate that is somewhat slower than inflation. Even though this is expected, there is a risk that efforts by sugar users and consumer groups to exclude sugar from the Farm Act or to reduce the support price will be successful.

OSCo Plans

In 1982, Amfac developed a Master Agricultural Plan which included a Survival Plan for OSCo. This plan, which has been fully implemented, was developed in response to an operating loss of nearly \$10 million in 1981 and an outlook for low sugar prices. In recognition of the fact that sugar plantations are in place with substantial improvements, but suitable replacement crops have yet to be identified, the plan amounts to a holding action to gain time to find as many replacement crops as possible before OSCo may be forced by outside economic factors to cease operations.

Key components of the plan are:

- continue to improve the economic efficiency of OSCo by increasing sugar yields and reducing production costs (both of which have been improved substantially in the last few years);
- urbanize Waikele (the only OSCo land owned by Amfac) in order to derive revenues to help support and justify continued sugar operations; and
- experiment with a variety of crops (papaya, sweet corn, potatoes, forage and feed crops, coffee, etc.) in order to find profitable replacements to sugar.

An important component of OSCo's reduction in costs is a continued decline in the labor force; over the past 2 years, employment decreased by about 150 jobs, or about 25 percent. The employment decrease is accomplished by attrition—that is, employees who retire or leave OSCo for other voluntary reasons generally are not replaced.

Continued success of the OSCo Survival Plan will depend on (1) continued Federal price supports for sugar which are sufficiently high to justify continued

operations, (2) union support to reduce costs, (3) an adequate allocation of water from the Pearl Harbor aquifer, and (4) retaining fields which are economical to farm and which provide sufficient yields to operate the mill at an economical level. After the major leases expire with Campbell Estate and Robinson Estate in 1995 and 1996, respectively, continued sugar operations also will depend on success in negotiating favorable lease terms.

An additional option which has been under consideration by OSCo is to contract operations by running a single mill rather than two mills in parallel as is currently the case. With a single mill, OSCo could reduce production from its current level of from 90,000 to 95,000 tons per year to from 60,000 to 75,000 tons without losing its economies of scale; a corresponding decrease would occur in the acreage requirements for OSCo. Of significance, Amfac's Kekaha Sugar Company, Inc., which has climatic conditions similar to those of OSCo lands and a similar yield potential, historically has been one of the most profitable sugar operations in the State. Yet this plantation has only about 8,000 acres under cultivation, and produces only about 55,000 tons of sugar per year.

Of interest, nearly all sugarcane operators throughout the world are pursuing a similar strategy to that expressed in the OSCo Survival Plan: improve efficiency by increasing yields and reducing production costs; and search for alternative crops (Brown).

Urbanization Pressures on OSCo

The gradual growth westward of urban Honolulu has consumed a large amount of former sugarcane land as evidenced by the fact that the eastern boundary of OSCo lands has moved westward by 9 miles from Moanalua Valley out past Waikele Stream. Since the 1960s, four ridges west of Halawa have been urbanized. But because of new plantings in the foothills of the Waianae mountains and on former pasture lands, sufficient acreage was cultivated to maintain economies of scale. The westward urbanization pressures of Honolulu continues, but plantings of new lands to compensate for lost fields is no longer feasible.

The economic forces which create urbanization pressures on OSCo include:

- Financial returns from urban land uses far exceed those from agricultural uses.
- Proximity to the new or growing employment centers of West Beach, Barbers Point Harbor, Campbell Industrial Park, and downtown Honolulu.

- Reasonable travel times to these employment centers because of the H-1 Freeway.
- Availability of water if it is freed from sugar production.
- Proximity to the Honouliuli waste-treatment facility.
- Low construction costs compared to areas that require extensive grading or removal of structures.

In contrast, redevelopment of downtown suffers from the high expense and displacement problems required to remove existing structures, the high expense and inconvenience of redeveloping inadequate infrastructure, less desirable high-rise housing compared to single-family homes, and strong community opposition on occasion. Hawaii Kai suffers from a lack of employment growth centers, relatively little land available for further single-family housing, severe transportation problems, and community opposition to further development. Similarly, the Windward side suffers from a lack of growing employment centers, transportation problems, and community opposition to further development.

In view of these factors, the City & County of Honolulu has designated the Ewa area as a "Secondary Urban Center" which will be developed to accommodate a major portion of Honolulu's future growth. Developments approved and proposed for the Ewa/Central-Oahu area which would affect OSCo acreage include:

	<u>Sugarcane Acreage</u>
Kunia Golf Course	190
Kapolei Village	775
Kapolei Town Center	693
Lusk Kapolei	55
Ko Olina Resort (approved)	281
Other (see text)	241
Ewa Gentry (300 acres approved by the State, and 75 by the County)	932
Ewa Marina (approved)	410
West Loch Estates (partially approved by the State)	195
Village Park (547.5 acres approved by the State)	980
Golf Course (J. Myers)	<u>270</u>
Total	5,022

In this listing of major developments, the 241 acres for "Other" represents acreage to the west of Kapolei; OSCo expects to fallow this acreage due to the expense of farming this relatively small and isolated area. It is likely that this land would be laid fallow as soon as Kapolei Village is developed down to Waimanalo Road, which would occur in the latter stages of the project. Regarding the Kunia Golf Course, the land owner lacks withdrawal rights before the lease expires in 1996.

Acreage Required to Maintain Economies of Scale

Before addressing the question of how the acreage withdrawals for the above projects would affect the economic viability of OSCo, acreage requirements of OSCo are discussed. These requirements are summarized in Table 1 for a one- and two-mill operation as a function of yield. As mentioned previously, OSCo currently produces from 90,000 to 95,000 tons of raw sugar per year using two mills. With a single mill, OSCo could reduce production to from 60,000 to 75,000 tons without losing its economies of scale. The mid-values for these ranges are used in Table 1: 67,500 and 92,500 tons of raw sugar per year for a one- and two-mill operation, respectively.

Also shown in Table 1 are yield assumptions, along with two past yields and OSCo's world-record yield: 11.3 tons of raw sugar per harvested acre in 1979, 15 tons in 1987, and 21.63 tons for the record yield. The two past yields indicated the substantial increase which can occur over time, while the record yield indicates future potential under favorable farming conditions.

Average sugar yields fluctuate from year to year but, over the long term, yields have increased gradually over time, and are expected to continue their gradual increase. For the future, increasing yields are expected to occur as a result of contracting operations to higher-quality fields, introducing improved varieties of cane, improving farming practices, adding chemical ripeners, introducing more efficient harvesters, etc. In the long-term, genetic engineering provides the promise of dramatically improved cane varieties that will have much higher yields and will be cheaper to farm because they will require less fertilizer, will resist diseases, and will produce less leafy trash.

Based on long-term industry trends, a conservative projection of OSCo's average yield in 1995, when the lease with Campbell Estate expires, is 16 tons of raw sugar per harvested acre; 20 years into the future, a conservative projection for the average yield is 18 tons per acre. The projected increase in the average yield is less than 1 percent per year.

Table 1.— OSCo ACREAGE REQUIREMENTS FOR ONE AND TWO MILLS, BY YIELD LEVEL¹

Yield (tons of raw sugar per harvested acre)	One Mill ² (67,500 tons of raw sugar per year)	Two Mills ³ (92,500 tons of raw sugar per year)
10	13,500 acres	18,500 acres
11	12,273	16,818
11.3 (1979 average yield)	11,947	16,372
12	11,250	15,412
13	10,385	14,231
14	9,643	13,214
15 (1987 average yield)	9,000	12,333
16 (1995 conservative projection)	8,438	11,563
17	7,942	10,882
18 (2008 conservative projection)	7,500	10,278
19	7,105	9,737
20	6,750	9,250
21	6,429	8,810
21.6 (record yield)	6,241	8,553
22	6,136	8,409

¹It is assumed that one-half of the acreage is harvested annually.

²The estimated output from a one-mill operation would be from 60,000 to 75,000 tons of raw sugar per year.

³Current production from the two-mill operation is from 90,000 to 95,000 tons of raw sugar per year.

Table 1 indicates that OSCo could reduce acreage and maintain economies of scale by increasing its average yield and/or switching from a two- to a single-mill operation. Increasing the average yield to 16 tons per acre would reduce land requirements from the current 13,540 acres to about 11,560 acres, thereby freeing about 1,980 acres. If the average yield were to increase to 18 tons per acre, this would reduce land requirements to about 10,280 acres, which would free about 3,260 acres. Switching from a two- to one-mill operation while maintaining yields at 15 tons per acre would reduce land requirements to about 9,000 acres and free about 4,540 acres. Switching to a single mill and increasing yields to 16 tons per acre would reduce land requirements to about 8,440 acres, and free about 5,100 acres. Finally, switching to a single mill and increasing yields to 18 tons per acre would reduce land requirements to only about 7,500 acres, and free about 6,040 acres.

Although these acreage reductions would allow economies of scale to be maintained, economic viability will also depend on other factors, one of the most important of which will be a favorable U.S. price for sugar. The agricultural quality of the lands which remain, and the form of the plantation would also be important. In general, any reduction in the plantation lands should occur from the outside in because this would result in a compact plantation with high-quality lands: a more compact plantation reduces trucking and other costs, while higher quality lands contribute to higher yields.

Outlook for OSCo

Assuming that U.S. sugar prices will continue to be high enough to justify continued sugar operations in Hawaii, an important question is whether Kunia Golf Course—combined with other planned and proposed projects—would eventually cause the closing of OSCo, either by reducing sugarcane acreage sufficiently to reduce economies of scale, and/or by contributing to a scattered and therefore inefficient plantation rather than a more compact and efficient one. The concern is primarily over three proposed projects: Kapolei Village, Kapolei Town Center, and Ewa Gentry. Water is not an issue to the future viability of OSCo because water now used on fields proposed for the Kunia Golf Course as well as other proposed developments will remain with OSCo for use on other fields, unless the water is not needed by OSCo.

Immediate Outlook

The immediate outlook for OSCo acreage is that relatively little acreage will be lost to urbanization. Few developments have necessary approvals, financing,

infrastructure in place, and are in a position to proceed. Furthermore, construction for most projects will proceed incrementally.

Regarding Kunia Golf Course, OSCo has lease rights to the end of 1996 which, under the terms of the lease, will not be affected by redistricting of the land. Also, any increase in property taxes which may occur as a result of the redistricting would be assumed by the land owner. Therefore, the reclassification would not place any pressure on OSCo to remove these lands from agriculture production prior to the lease expiration date.

Although unlikely, it is theoretically possible for the land owner to buy back the lease rights from OSCo. Such an action would be consistent with the OSCo Survival Plan: derive revenues from urbanization to help support OSCo in order to buy time to find replacement activities for sugar.

Outlook to 1995

Assuming that all the planned and proposed developments previously listed are approved, a 20-year average development period for the housing, commercial, and resort projects, and at least a one-year delay before construction begins for most of the projects, then the loss of sugarcane acreage by the end of 1995 when the major lease with Campbell Estate expires would be about 1,780 acres. Remaining acreage under cultivation by OSCo would fall from 13,540 acres to about 11,760 acres, assuming no replanting of fallowed land.

In terms of land required to maintain economies of scale, 11,760 acres would provide sufficient land to maintain a two-mill operation, assuming the projected average yield of about 16 tons per year in 1995 (see Table 1).

In terms of the form of the plantation, the Kunia Golf Course is on the edge of the plantation, which is consistent with the desired sequence of urbanization of OSCo lands: i.e., from the outside of the plantation towards the center. For Kapolei Village and Kapolei Town Center the development sequence would proceed from mauka to makai (from north to south). This is not the preferred sequence (from the outside in, which is west to east), nor is it the worst sequence (from within the plantation towards the outside, which is from east to west). For Ewa Gentry, the development sequence would be from Ewa Villages starting on land already approved for development, then proceeding makai. Again, this is not the preferred sequence, but it does proceed from an existing urban area in an outward direction toward inferior lands rather than inward toward superior lands.

If the resulting form of the plantation proves to be inefficient for a two-mill operation (or if urbanization proceeds much more rapidly than projected), then an efficient sugar operation could be achieved by switching to a one-mill operation. For this case, land requirements would be about 8,440 acres, assuming a yield of 16 tons per acre (see Table 1). This would provide a buffer of 3,320 acres from which to assemble an efficient plantation; the figure of 3,320 acres is based on 11,760 acres remaining after projected urbanization assuming approval of all planned and proposed projects, minus the estimated 8,440 acres needed for a one-mill operation.

In summary, by the end of 1995 when the major lease with Campbell Estate expires, Kunia Golf Course, in combination with other planned and proposed projects, is not expected to threaten the economic viability of OSCo. However, in order to retain economic viability, a switch from a two- to a one-mill operation may be required if urbanization proceeds rapidly, or if the sequence of urbanization results in a scattered plantation that is inefficient for a two-mill operation.

Long-Term Outlook

Assuming approval and full development of all the planned and proposed projects, the amount of land under cultivation by OSCo would decline by 5,022 acres, from 13,540 acres to about 8,520 acres. If development proceeds gradually, and if yields increase sufficiently (possibly resulting from advances in genetic engineering), then it is conceivable that OSCo could maintain economies of scale and an economically viable operation with two mills. It is more likely, however, that a switch to a one-mill operation would be required to maintain economic viability. Assuming an average yield of 18 tons per acre, a one-mill operation would require about 7,500 acres. This would provide a buffer of about 1,020 acres from which to assemble an efficient plantation; the figure of 1,020 acres is based on 8,520 acres remaining after urbanization assuming approval of all planned and proposed projects, minus the estimated 7,500 acres needed for a one-mill operation.

In summary, given a change from a two- to a single-mill operation, Kunia Golf Course, in combination with other approved and proposed projects, is not expected to threaten the economic viability of OSCo.

Economic Impact of Reducing OSCo Operations

Assuming that a two-mill operation remains economically viable, little or no loss in revenues to OSCo would occur as a result of urbanizing sugarcane lands because production would remain near its current level. Also, the reduction in employ-

ment associated with the projected reduction in acreage is not expected to require any layoffs of sugar workers since OSCo makes a practice of reducing employment through attrition.

For a one-mill operation, production would decline by about 25,000 tons of raw sugar per year, or 27 percent of current production. Based on 1986 prices (\$334.59 per ton for sugar, and \$45.80 per ton for molasses, with one-third of a ton of molasses produced for each ton of sugar), lost revenues would amount to about \$8.7 million per year. But because less sugar would be grown and milled, production costs would also decline. Whether or not attrition would be sufficient to accommodate a reduction in employment associated with a switch to a one-mill operation is uncertain.

Economic Impact of Closing OSCo

If OSCo were to cease operations for whatever reason (most likely because of low sugar prices), the loss of jobs would be less than 450 direct jobs and 510 indirect jobs, with the actual number dependent upon the reduced employment made possible by continuing productivity increases. This would be the economic equivalent of losing of a hotel about half the size of the Hyatt Regency in Waikiki. Immediately following the mill closing, there would be a significant economic loss and social disruption. But over the long term, the economic loss would be absorbed easily by expanding economic opportunities in the Ewa/Central-Oahu area. For example, the new hotels at Ko Olina will be the equivalent of about nine OSCos in terms of direct plus indirect jobs and—when tip income and all indirect jobs are considered—will provide higher average wages (based on analysis with the State Economic Model). Other new jobs in the Ewa area will be provided by Barbers Point Harbor, expansion of Campbell Industrial Park, development of Kopolei Town Center, growth of diversified agriculture made possible by lands freed from sugar (growth which is likely to be at the expense of Neighbor Island farmers), and other economic activities which may be attracted to the area or which may occur spontaneously due to of the increased availability of land and water, and lower urban land costs than would otherwise be the case. Therefore, most if not all sugar employees can be expected to find other employment if this should be required. However, some unskilled sugar workers and those having non-transferable skills may receive reduced pay when and if they are forced to find non-sugar jobs.

Assuming a policy favoring rapid urbanization of lands freed by the closing of sugar operations—a policy which presumably would be designed to increase the supply of land for housing and various economic opportunities, and increase competition

among landowners and developers, with the objective of decreasing housing costs and increasing economic opportunities—three to four decades, or even longer, would be required to absorb the land. During this period, a huge supply of land and water would remain available for diversified agriculture and other economic activities. Even at full urbanization, over 2,000 acres would remain available for agriculture in the blast zone surrounding the Navy's magazine storage area located at West Loch, Pearl Harbor.

IMPACT ON WAIALUA SUGAR COMPANY

If OSCo ceases operations for whatever reason, the profitability of WSCo would be decreased—an operation which employs about 450 workers. This is because OSCo's contribution to the Honolulu Harbor terminal charges would be lost. In 1986, these charges were \$978,000, of which \$418,800 were WSCo's share. If only WSCo's production were to be handled by the Harbor, then the terminal manager estimates that the charge would be only about \$100,000 less than currently. Therefore, the terminal charge to WSCo would increase from \$418,800 to about \$878,000, or an increase of \$460,000. Based on WSCo's 1986 production of 72,446 tons, the increase in WSCo's cost amounts to 0.3 cent per pound. This is less than a 2-percent increase in the cost of production.

Rather than absorb the increased terminal charges, a more profitable alternative would be to increase the refining capacity of C&H in Aiea from about 45,000 tons per year to about 72,500 tons per year so as to process all of the WSCo production. A crude estimate for the cost of the plant expansion is about \$2 million. Refined sugar in excess of the 36,000-ton-per-year Hawaii requirements would be shipped at favorable backhaul rates to Los Angeles and Seattle. Currently, Hawaiian sugar is delivered to these markets by rail from the C&H refinery in Crockett, California near San Francisco. The economic feasibility of this alternative is considered to be "very probable."

In view of the above, a closing of OSCo for whatever reason is unlikely to force the closing of WSCo. Like OSCo, the future economic health of WSCo will be determined primarily by the price of sugar in the U.S. market.

IMPACT ON DIVERSIFIED AGRICULTURE

The development of Kunia Golf Course is an irretrievable commitment of prime agricultural land to urban use. For the purposes of this discussion, prime agricultural land is loosely defined to mean any high-quality agricultural land capable of providing high yields for a variety of crops, and would include the lands currently cultivated in

the petition area. This commitment to urban use raises the question of whether Kunia Golf Course would affect adversely the development of diversified agriculture (including aquaculture), either immediately or in the long term. Before addressing this question, the demand for and the supply of prime agricultural land for diversified agriculture is clarified.

Demand for Prime Agricultural Land

As part of its analysis to identify IAL (see page 2), the LESA Commission adopted projections of the amount of agricultural land required to increase food and animal-feed self-sufficiency given resident plus visitor population growth, and increased crop exports. The projections for the State and Oahu are shown in Tables 2 and 3, respectively. As indicated, an estimated 52,684 additional acres will be required Statewide to accommodate the the 1983-to-1995 increase in production. The corresponding figure for Oahu is 7,979 acres. As shown, 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 crops which generally do require prime agricultural land, plus a contingency of 10 percent of all acreage other than for beef and cattle.

It should be noted that the LESA projections and the corresponding Illustrative Generalized IAL Maps contain, or appear to contain, a number of major flaws which have led to a gross overestimation of the amount of agricultural land required:

- Based on a thorough, in-depth, and widely reviewed analysis of the market potential for crops grown on Molokai (Plasch and Garrod), and analysis of previous projections distributed by the State of Hawaii Department of Agriculture, the LESA projection for diversified agriculture appears to be excessively optimistic. Apparently, it is assumed that many unprofitable crops will become profitable, that Hawaii farmers will be able to undersell low-cost summer crops from California, and that each and every activity will experience rapid growth. Verification of the extent of these flaws is hampered by the fact that the assumptions and analysis which underlie the LESA projections have not been made available for public inspection.
- Some of the acreage estimates are for harvested acreage, which leads to an overestimate of the land requirements for those crops which are harvested more than once a year (e.g., a crop harvested twice a year should have its acreage requirement halved).

Table 2.— 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
Contingency⁶	--	29,500	29,500
TOTAL	1,036,712	689,036	--
TOTAL, Excluding Beef/Cattle	271,262	323,946	52,684

Table 2.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
STATE OF HAWAII: 1983 AND 1995
(continued)

- ¹Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
- ²Often includes land in a holding operation awaiting discovery of profitable uses.
- ³The decline in acreage primarily reflects the loss of Puna Sugar Co.
- ⁴Includes some pasture and 8,000 of guinea grass from Molokai.
- ⁵Overstated in that the acreage figures are for harvested acres, not the amount of land required.
- ⁶Based on 10% of all acreage other than that for beef/cattle. Adding a contingency amounts to double counting in that the projections are optimistic to begin with. Also, the contingency figure includes 17,770 acres for expansion of sugarcane, even though the sugar industry is expected to decline, not expand.

Table 3.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
CITY AND COUNTY OF HONOLULU: 1983 AND 1995

Crop or Activity	1983	1995	Increase
<u>Crops and Activities which Generally Do Not Require Prime Agricultural Lands</u>			
Beef/cattle ^{1,2}	18,200	10,090	--
Livestock:			
Dairy	340	402	62
Eggs/Poultry	250	390	140
Swine	144	200	56
Subtotal for Livestock	<u>734</u>	<u>992</u>	<u>258</u>
Unique Crops:			
Aquaculture	300	2,400	2,100
Flowers/Nursery	495	850	355
Papaya	70	170	100
Taro/Watercress	60	85	25
Subtotal for Unique Crops	<u>925</u>	<u>3,505</u>	<u>2,580</u>
<u>Crops and Activities which Generally Do Require Prime Agricultural Lands</u>			
Plantation:			
Sugarcane ²	27,200	25,300	-1,900
Pineapple	11,829	11,800	-29
Subtotal for Plantation	<u>39,029</u>	<u>37,100</u>	<u>-1,929</u>
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	1,155	1,595	440
Subtotal for Other Crops	<u>3,651</u>	<u>5,965</u>	<u>2,314</u>
Contingency⁵	--	4,756	4,756
TOTAL	62,539	62,408	--
TOTAL, Excluding Beef/Cattle	44,339	52,318	7,979

Table 3.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
CITY AND COUNTY OF HONOLULU: 1983 AND 1995
(continued)

- ¹Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
- ²Often includes land in a holding operation awaiting discovery of profitable uses.
- ³Includes some pasture.
- ⁴Overstated in that the acreage figures are for harvested acres, not the amount of land required.
- ⁵Based on 10% of all acreage other than that for beef/cattle. Adding a contingency amounts to double counting in that the projections are optimistic to begin with. Also, the contingency figure includes 2,530 acres for expansion of sugarcane, even though the sugar industry is expected to decline, not expand.

- The LESA contingency of 29,500 acres is excessive, especially since LESA projects a requirement for less than 9,000 additional acres of prime agricultural lands. The contingency is large primarily because the LESA methodology implicitly allows for expansion of sugar operations—a grossly unrealistic possibility. Furthermore, the contingency amounts to double counting since optimistic projections have a built-in contingency.
- The LESA methodology assumes that prime agricultural lands that were freed from sugar and pineapple production and placed in pasture or some other low-profit operation will stay in these uses. This is very unrealistic in that these are holding operations for land until profitable crops can be identified.
- The LESA methodology incorrectly assumes that sugar is a healthy industry, and that sugar lands would be unavailable for more profitable replacement crops.
- The Illustrative Generalized IAL Maps incorrectly allocates prime agricultural lands to certain activities which do not need such lands (e.g., aquaculture should be allocated the agriculturally low-quality coastal lands at Kahuku).

The relevant figures from Tables 2 and 3 are not the total figures, but the increase in the amount of prime agricultural land required to accommodate diversified agriculture: the increase is 8,858 acres for the State, and 2,314 acres for Oahu. As discussed above, these figures are excessive; a more realistic estimate for the State is probably closer to 1,200 acres (Plasch and Garrod). Nevertheless, even using the excessive LESA estimate, the amount of additional prime agricultural land that would be required to accommodate diversified agriculture, and provide the hope (but not the realistic expectation) of profitable operations, is surprisingly small.

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 the small Hawaii market. However, the extreme difficulty of developing large export markets should be noted. Numerous and extensive crop searches and experiments for over a century by many people and organizations has led to surprisingly few major long-term successes in Hawaii, thereby indicating 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. As noted previously, low sugar prices have led nearly all sugarcane operators throughout the world to search for profitable replacement crops, particularly crops which can maintain export earnings.

Supply of Prime Agricultural Land

Regarding the supply of land, an enormous and growing supply of prime agricultural land is available for other uses. Since 1970, about 83,000 acres of Hawaii's prime agricultural land has been freed from sugar and pineapple production: about 43,000 acres of land freed from sugar production (about 9,000 acres on Oahu and 33,600 on the Neighbor Islands), and over 40,000 acres freed from pineapple production (about 12,000 acres on Oahu and over 28,000 on the Neighbor Islands) [Plasch, Hawaii's Sugar Industry, HSPA, Hawaii Agricultural Reporting Service]. Some of the land freed from sugar and pineapple production has or will be converted to urban, diversified agriculture, and aquaculture uses. Also, some of the land freed from pineapple use on Oahu was converted to sugar production. 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 large share of this on Oahu. Much of this land is fallow, in pasture, or some other low-value land-holding operation.

This supply of prime agricultural land probably will increase given the very real possibility of future sugar-mill closings. As discussed above, the outlook for sugar prices is unfavorable, and some unprofitable mills are in operation today only because they have lease and/or energy contracts which make closing too expensive. However, these contracts eventually will end.

Furthermore, much of the sugarcane lands is in holding awaiting the discovery of profitable replacement activities, so is part of the supply of prime agricultural land available to profitable diversified agriculture crops. For example, one of the components of the OSCo Survival Plan is to experiment with a variety of crops in order to find profitable replacements to sugar.

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, especially lands freed from sugar production. However, some of the lands freed from sugar are at high elevations where pumping costs are relatively high.

Additional lands which have been made available for diversified agriculture are in government-sponsored agricultural parks throughout the State. Lands for agricultural activities which do not require prime agricultural land include pasture land, land for livestock operations, and unique lands. 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 well-suited for growing

papaya. The supply of unique lands is quite large and distinct from the supply of prime agricultural lands.

Availability of Land to Small Farmers

Even though considerable agricultural land is available, it should be noted that in many areas of the State small agricultural parcels are not available to small-scale farmers under long-term leases. The reason for the unavailability is that land-use regulations and the political environment make it unprofitable and too risky to lease small farm parcels. It is unprofitable because agriculture is generally a low-value use of land which can afford only relatively low lease rents, while County subdivision regulations designed for rural estates require expensive electrical power, paved rather than gravel roads, and buried rather than surface water lines. The combination of low rents and expensive subdivision requirements makes it unprofitable to subdivide land for small farms. For example, rather than develop the State agricultural park in Kahuku, it would have been cheaper for the State to give each farmer \$100,000. In addition, there is the risk that when the lease expires, the farmer will turn to the legislature to try and prevent an escalation of the lease rent, or to prevent eviction by the landowner in favor of a higher and more profitable use--this is often the case for long-term leases for land on which the farmer has built a home. Such an economic environment favors leases to large-scale operators (including cooperatives consisting of many small 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.

The unavailability of small parcels of land to farmers is a serious problem, but does not invalidate the fact that there is a vast supply of prime agricultural land available for profitable diversified agricultural activities. However, the activities must be large scale, or the subdivision requirements circumvented.

Outlook for Diversified Agriculture

Based on the above analysis, ample prime agricultural land will be available to easily accommodate prime agricultural land requirements of diversified agriculture. This conclusion derives from the fact that there is a vast amount of prime agricultural land and water that has been freed from sugar and pineapple production in recent years, the very real possibility that additional sugarcane acreage and water will be freed given the outlook for low sugar prices, the fact that some if not most or even all of the sugar operations would make their lands available for profitable re-

placement crops, and the surprisingly modest land requirements for diversified agriculture. In other words, the limiting factor will be the market, not the land supply. Kunia Golf Course, combined with major housing developments in the Ewa/Central-Oahu area and elsewhere, involves far too little land to affect this conclusion. Therefore, Kunia Golf Course would not affect adversely the growth of diversified agriculture.

Consistency with Overseas Long-Term Trends

Hawaii's increased availability of prime agricultural land compared to that of prior decades is part of some very long-term and accelerating trends occurring throughout most developed and developing market economies. For example, an excess of about 45 million acres of agricultural land exists in the United States (Dvoskin). Productivity and yields have been increasing faster than population growth; and genetic engineering—which gives promise of developing crops having higher yields, increased resistance to diseases and pests, and increased tolerance to climatic variations—and other advances, combined with slower population growth, indicate an acceleration of these trends. Rapid productivity and yield increases lead to overproduction, market gluts, low agricultural prices, low farm income, bankruptcies, and a need to withdraw labor, land, and other resources from agriculture in order to restore balanced markets and increase farm income to those who remain. The major agricultural problem facing the United States and many other economies is how to make this withdrawal an orderly one so as to minimize social problems. This is a problem associated with tremendous success in agriculture, and contrasts sharply with and invalidates the 200-year old prediction of Thomas Malthus that population will increase faster than the food supply.

IMPACT ON AGRICULTURAL LAND VALUES

Concern has been expressed that the redistricting of agricultural land to urban use would increase speculative pressures on other agricultural lands, thereby accelerating appreciation of the price of agricultural land. The essence of this issue is whether or not the State, through the actions of the Land Use Commission, is in a position to manipulate the price of land, so that perceived changes in policy would affect agricultural land values.

The market value of agricultural land consists of two components: the agricultural component, which is the present discounted value (PDV) of the agricultural lease rents; and the "speculative" component, which is the PDV of the anticipated

urban value of the land when the conversion from agricultural to urban use occurs. For Oahu, the speculative component dominates; its presence is normal and proper, and its large value is a strong market signal that the residents of Oahu would be better off if more land were to be converted from agricultural to urban use.

By manipulating the supply of urban land, the Land Use Commission could manipulate the value of agricultural land. If the Land Use Commission were to take a firm position on preserving prime agricultural land, this would extend—possibly indefinitely—the date to when agricultural land is converted to urban use which, in turn, would decrease the "speculative" component of agricultural land values. The problem with this, of course, is that a restricted supply of urban land would greatly increase urban land and housing prices, and would slow economic growth that is dependent on the supply of urban land.

It should also be noted that the price of agricultural land does not affect its agricultural use. Generally, agricultural land will be used in whatever manner generates the highest lease rents, regardless of the price of the land. For example, if agricultural land has a high market value because it is anticipated that it will be converted to urban use 20 years hence, the highest and best use until that conversion occurs may be the cultivation of sugarcane. Even if the land value were to double, this would not affect the fact that the highest and best use is cultivation of sugarcane until that conversion occurs.

CONSISTENCY WITH STATE AND COUNTY PLANS

Kunia Golf Course is consistent with the major thrust of the agricultural portions of the Hawaii State Plan, the State Agriculture Functional Plan, and the General Plan of the City and County of Honolulu. This thrust is to preserve the economic viability of plantation agriculture and to promote the growth of diversified agriculture (see Table 4). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured. The thrust of these plans is not to preserve prime agricultural lands simply for the sake of preservation—preservation is to occur only if there is a potential agricultural need for these lands.

Regarding employment, the Kunia Golf Course is clearly in support of State and County policies, objectives, and priority directions which encourage increased employment opportunities. The Kunia Golf Course will provide an estimated 50 jobs, or 11 percent of the employment of OSCo on just 1.4 percent of OSCo's current acreage under cultivation.

Nevertheless, certain priority guidelines (but not objectives or policies) dealing with population growth and distribution do call for directing urban growth primarily to existing urban areas and marginal agricultural lands, and away from important agricultural lands (e.g., Section 226-104 (b)(2) of the Hawaii State Plan). While this is desirable, it is unrealistic in terms of the supply of available lands; large parcels of urban or marginal agricultural land near large population centers, having adequate access, and being suitable for development are not available. If such parcels were available, they would immediately be proposed for development. Because of this lack of urban or marginal agricultural lands, the State, the City and County, and private developers are proposing major developments on agricultural lands.

Since the Kunia Golf Course would not adversely affect the economic viability of OSCo, would not limit the growth of diversified agriculture, but would contribute to increased employment, the project is consistent with the major thrust of the State and County Plans. Also, the project would provide a public benefit which would override the proposed IAL designation of the LESA Commission. Furthermore, the project would not adversely affect cultivation of adjacent sugarcane acreage and, therefore, complies with the Hawaii Right-to-Farm Act.

Table 4.— **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 4.— 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)

Population

Objective C. To establish a pattern of population distribution that will allow the people of Oahu to live and work in harmony.

Policy 1. Encourage the gradual development of a secondary urban center in the West Beach-Makakilo area to relieve developmental pressures in the urban-fringe and rural areas.

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, live-stock production, and other types of diversified agriculture.

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MARKET ANALYSIS
PROPOSED KUNIA GOLF FACILITY

Prepared for
Nihonkai Lease Company, Ltd.

Prepared by
John Zapotocky, Consultant

September 1987

G

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I

EXECUTIVE SUMMARY

Nihonkai Lease Company is an affiliate of a Japanese company which owns and operates the Nihonkai Country Club in Japan. The company proposes to develop a first class golf facility at Kunia, Oahu. The company plans to market the facility to the visitor market, including the international and domestic visitor market and the local country club market. The purpose of this study is to assess the demand for the proposed golf facility.

The proposed country club is located in Kunia adjacent to and south of the existing Hawaii Country Club. The facility's primary attraction would be a first class championship golf course, to be designed by a nationally known (to be selected) golf course architect. The facility would also include a clubhouse of approximately 25,000 square feet, tennis facilities, swimming pool and exercise facilities. Club storage, a cart barn and adequate parking facilities would also be provided.

Development time frame will be dependent on receiving the necessary approvals from various government agencies, subject to an existing lease with Oahu Sugar Company and the design and development of the facility. Marketing of memberships in the facility is expected to take place during the development phase of the project and for two to three years following development.

Nationally, the outlook for golf participation between 1987 and 2000 looks very positive because of the following factors: expected higher incomes, aging population, early retirement, more leisure time and flex time. A recent study indicated that nationally, golf participation may increase from 17,500,000 to a range of 19,900,000 to 41,450,000 by the year 2000 using growth assumptions ranging from 0% to 5%. This projected growth, when analyzed from the point of view of additional golf courses needed, showed potential demand for between 1,400 to 7,900 golf courses by the year 2000 assuming 0% and 3% growth rates.

The prospects for golf in the State of Hawaii are tied to the growth of population and tourism as well as the potential growth in the participation in golf. Because of the important role tourism plays in the economy of Hawaii, resort development is a primary factor in projecting demand for golf in the State of Hawaii. In 1965 only two golf courses in Hawaii could be considered resort courses; by 1985 there were 20 golf courses classified as resort courses out of the 57 golf courses in the State. Presently only three of the State's resort courses are on Oahu; however, additional courses are expected to be built with proposed resort developments at West Beach and Kuilima.

A recent study on the State's participation in the recreational industry indicated that in 1985 Hawaii attracted 200,000 golfers who spent \$30,000,000 at the State's resort courses. The maturing of the resort industry and the golf reputation being developed by the State is expected to generate increased golf interest in Hawaii.

The City and County of Honolulu contains approximately 80% of the State's population and a large segment of the tourist industry, yet contains a disproportionately small share of the golf facilities. This disparity is increased if the ratio of population to golf holes is adjusted to account for the military golf facilities which are not available to the general public. The ratio of golf holes on Oahu is approximately one hole per 2,000 persons while for the State as a whole, it is closer to one hole per 1,100 persons.

Presently, golf facilities on Oahu are being used at or close to capacity. The City government has come under increasing pressure to develop new municipal facilities and currently planning is underway for a new municipal course. A review of known projects indicates that 19 golf course developments are under study by private developers in addition to the new municipal course. An analysis of the resort and residential demand for golf in the City and County of Honolulu indicates a demand for seven golf courses on Oahu by the year 2000 with no growth in golf participation. If Oahu attains the 2% growth factor (the mid-range of growth projected nationally) an additional nine courses will be required to meet the

demand. Thus a potential of 16 new courses may be required on Oahu by the year 2000 to meet the anticipated need.

It should be noted that five of the golf courses proposed for Oahu are the recreational and open space elements of new planned developments and thus would provide additional internal tourist or residential support for their development. It is unlikely that all of the courses under consideration would be built and even less likely that all of them would be built by the year 2000. In fact, there is pressure to convert existing golf courses into other uses as has been suggested at Ala Wai Golf Course (using a portion of the course for a convention center).

The Ewa and Central Oahu Development Plan areas currently contain six golf courses: three military and three open to the public. All of the existing courses are operating at capacity. Those courses that are open to the public service primarily the local market with the exception of Mililani, which services a mix of local golfers and tourists. There are ten golf courses proposed for the Ewa and Central Oahu areas, with one of the ten, the West Beach Golf Course, now under construction.

An analysis of the demand for golf in the Ewa and Central Oahu areas between 1987 and 2000 indicates that approximately five courses will be required by the year 2000 if just the projected growth in population and tourism occurs without any increase in golf participation. If it is assumed that growth of 2% annually occurs in golf participation, then an additional three courses will be needed to satisfy the demand, for a total of eight courses by the year 2000.

An analysis of the demand for private country clubs indicates a demand from both local and tourist sources.

The Nihonkai Lease Co. golf facility proposal has numerous advantages over other proposed golf facilities in the Ewa and Central Oahu area. It is one of the few that has been

proposed by an experienced country club owner and operator. It is one of three that is a stand-alone golf facility and not part of a larger overall development scheme, allowing designers to use the site to the best golf advantage without regard to other "more valuable" land uses. The Kunia site is at the highest elevation of all of the proposed golf courses, allowing for panoramic views of the ocean and the mountains. The Kunia site is located on a secondary state highway with excellent freeway access.

The proposed Nihonkai Lease Co. golf facility will be one of a number of new facilities designed to meet the growing recreational needs of the tourist and resident population.

With a first class facility and a strong marketing program, the proposed development should find strong demand and be absorbed by the market over a four-year period at any time between 1991 and 2000.

II
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; twenty resort; sixteen 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 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 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 country clubs all have waiting lists, the military courses are said to be at capacity, and the public daily fee courses are nearing capacity with fee increases anticipated as course capacity is approached.

III
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 have 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 III-1).

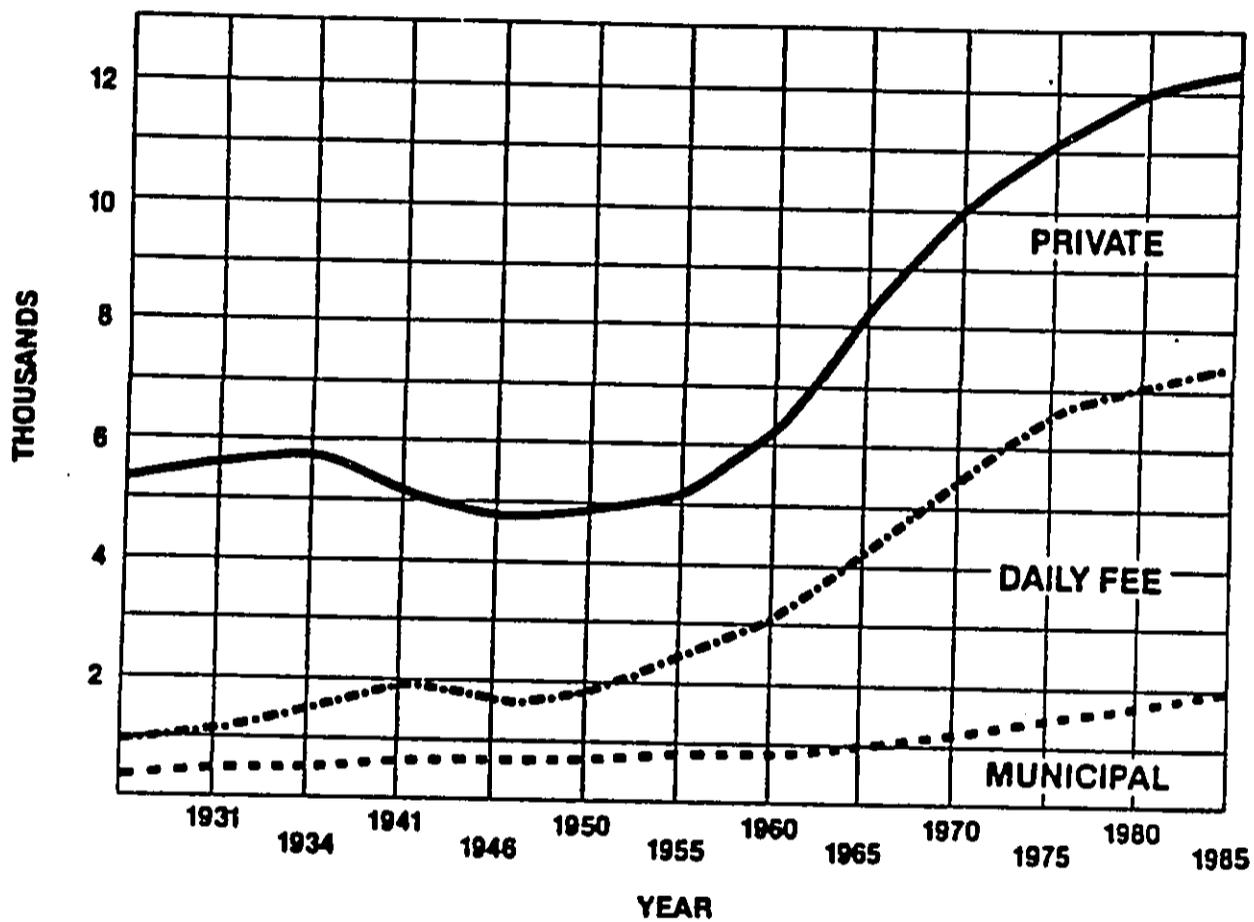
At a recent symposium sponsored by the National Golf Foundation, a nationally recognized organization of golf related operators, managers, manufacturers and related affiliates, Dr. John F. Rooney of Oklahoma State University presented a paper on the "Demand for Golf in the Year 2000". The paper presented 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 III-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 III-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

Growth in Facilities

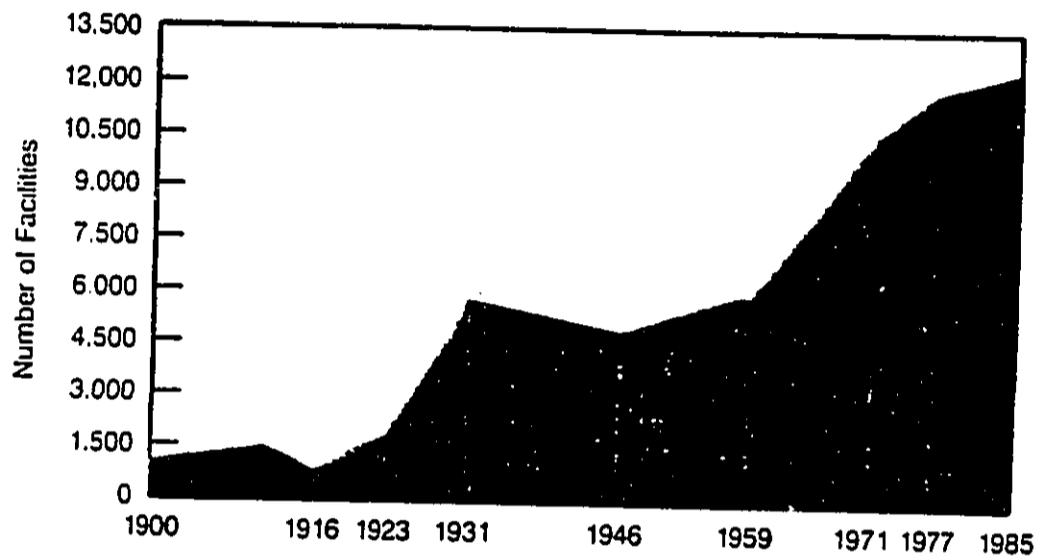
Number of Golf Facilities



Trends

- o Over the past decade, the total number of facilities has grown about nine percent.
- o 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.
- o Twenty-five years ago, private courses comprised 50 percent of the total number of facilities. In 1985, private courses make up 39 percent of the total number.

Growth of U.S. Golf Facilities



Source: G. Cornish and R. Whitten, *The Golf Course and NGF*

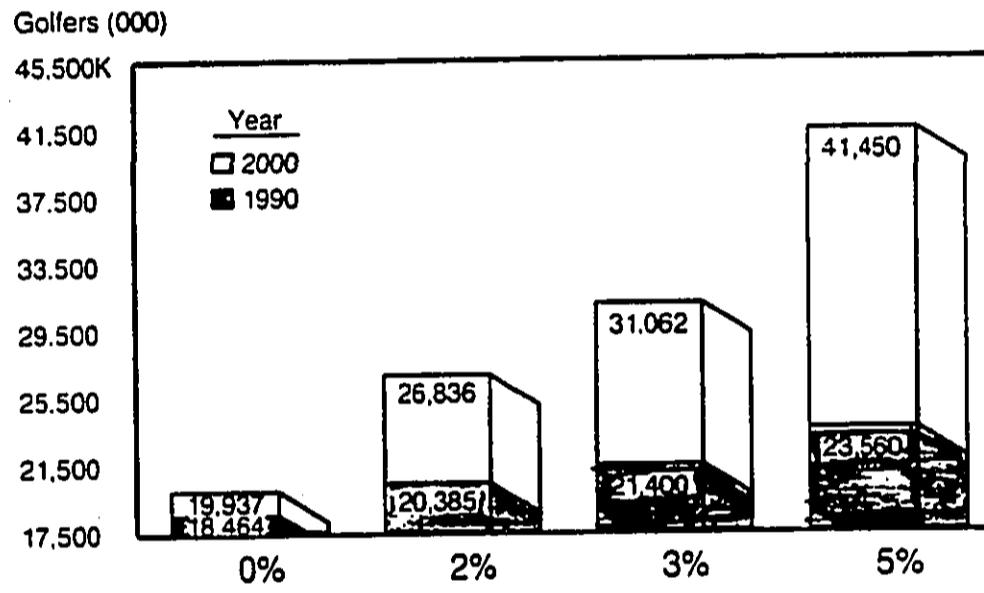
Golf Growth: 1960-1986

	1960	1970	1980	1986
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.



Potential Growth in Golf Participation



tight supply and that the availability of public golf facilities declined in 23 of 50 states, including Hawaii. (See Exhibit III-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 III-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.

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."

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



**Course Development Required
to Meet Potential Growth**

<u>Year</u> % Growth in Golf Population	Today	2,000 at 0% Growth	2,000 at 2% Growth	2,000 at 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	7926
Required Average Yearly Increase in Number of Courses to 2,000 ³	--	100/yr.	387/yr.	566/yr.

¹ Courses = 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

IV

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 nationally with high golf intensity. (See Exhibit IV-1.) 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-F Series projections the median age of Hawaii's population is expected to increase from 29.9 in 1985 to 33.7 in the year 2000 with the 35- to 54-year-old population expected to grow by 40%. 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 if the mix of Hawaii's visitors shift towards the up-scale market.

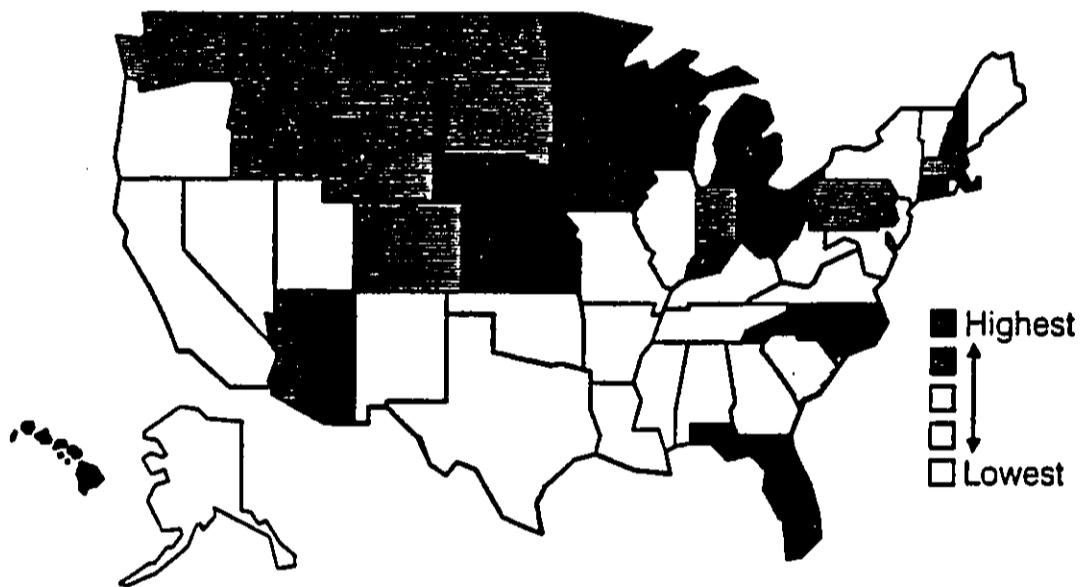
Resort Golf

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 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 IV-2) indicated that resort courses have developed on the neighbor islands to a greater degree than on Oahu when measured



Golf Intensity



Source: Rooney, Adams Golf Involvement Index

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
Maui	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.

against average visitor census or visitor expenditures by county (Exhibits IV-3 and IV-4). 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.

Background - Hawaiian Resort Golf

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.

1. Coopers & Lybrand, *A Master Plan for the Continued Development of Hawaii as a Sports Center*, February 1987.

WESTBOUND VISITOR ARRIVALS, BY COUNTIES VISITED:
1980 TO 1985

[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 for 1984 and 1985]

Year	State total ^{1/}	City and Co. of Honolulu	Hawaii County	Kauai County	Maui County
1980 ...	3,046,132	2,398,740	761,103	781,409	1,378,189
1981 ...	2,974,791	2,398,480	672,683	757,811	1,389,892
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

^{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: 1980 TO 1985

[Unlike the preceding table, this table includes eastbound and north-bound visitors as well as westbound arrivals. Based on a 20-percent sample through 1983 and a 10-percent sample for 1984 and 1985.]

Year	State total	City and Co. of Honolulu	Hawaii County	Kauai County	Maui County
1980 ...	96,497	66,680	7,195	7,259	15,363
1981 ...	95,968	66,455	6,561	7,225	15,727
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

Source: Hawaii Visitors Bureau, release dated March 1986 and records.

ESTIMATED EXPENDITURES BY VISITORS TO HAWAII, BY
COUNTIES: 1970 TO 1985

[Millions of dollars. Excludes expenditures by Hawaii residents]

Year	State total	City and County of Honolulu ^{1/}	Other counties ^{1/}			
			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 ^{2/} ...	4,582	2,895	1,686.6	248.9	359.4	1,078.3
1985 ^{2/} ...	4,884	3,056	1,828.0	285.9	407.9	1,134.2

^{1/} Interisland air fares have been distributed on a prorata basis. Expenditures by eastbound visitors have been included with Oahu.

^{2/} Preliminary estimate.

Source: Hawaii Visitors Bureau, "Neighbor Island Statistics," tabular release dated March 1986.

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 seven resort championship golf courses with a number of new facilities in the planning stages. Unlike a tennis court each golf course is unique. Avid golfers have seen opportunities for experiencing a number of championship facilities continually expand, thus encouraging them to return year after year. This has also resulted in word of mouth advertising upon their return home.

Future Prospects

Future prospects for growth in demand for Hawaiian resort golf look extremely bright for the following reasons: continued maturation of the Hawaii destination resort industry, favorable demographic trends in the United States (primary source of the Hawaiian visitor market), growth of eastbound tourist business (primarily Japanese).

Maturing Industry

While golf course play at selected resorts shown in Exhibit IV-5 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.

Exhibit IV-5

<u>Resort and Number of Golf Courses</u>	<u>Actual Rounds FY 1986</u>	<u>Desired Maximum Rounds¹</u>	<u>Two Tiered Pricing²</u>	<u>Rounds Reserved for Hotels³</u>	<u>Percent Rounds from Resort Complex</u>	<u>Comments</u>
Princeville 1 course	70,000 ⁴	50,000	\$65/\$44	100	over 50%	Additional course under construction
Kaanapali 2 courses	106,000	108,000	No ⁵	No	60%	Additional course under consideration for North Beach Expansion
Wailea 2 courses	90,000 ⁶	100,000	\$80/\$45	90	70%	Additional course under consideration
Mauna Lani 1 course	43,000	44,000	\$100/\$50	No	66%	Additional course 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. All resorts have priority reservations policies which give priority to hotels in making reservations for golf play. All operators have seasonal pricing policies. Rates shown are for high season. Kaanapali may not offer low season rates in 1987.
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.
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. The Sheraton Princeville opened in advance of the new golf course and therefore Princeville is accommodating demand on the existing course.
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.
6. In 1986, Wailea instituted its two tiered pricing policy. Rounds in 1985 totaled 96,000.

Further, Wailea and Kaanapali benefit from the availability of neighboring courses such as Seibu and Kapalua, respectively, where development of visitor accommodations (hotels and condos) is, at very early stages, comprising only 10 to 20% of ultimate development. It should be emphasized that all of the resort facilities shown in Exhibit IV-5 are planning additional golf courses.

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 course by Japanese investors in recent years. To date, the Japanese golfer has not been a significant 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 1986 westbound tourists increased by 40% while eastbound tourists increased by 52%. (See Exhibit IV-6.) This, coupled with the fact that Japanese visitors, the primary component of eastbound visitors, spend, on the average, 25% more per trip than westbound visitors, indicates a trend towards higher average visitor spending. The July/August 1987 issue of Bank of Hawaii's *Business Trends* publication indicates that figures for the first half of 1987 show westbound visitors decreased by 4% while eastbound visitors increased by 15%.

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

**VISITOR ARRIVALS AND AVERAGE DAILY VISITOR CENSUS:
1980 TO 1987**

Year ^{1/}	Visitors staying overnight or longer			Average daily visitor census	
	Total	Westbound ^{2/}	Eastbound ^{3/}	Westbound ^{2/}	All
1980	3,934,504	3,046,132	888,372	86,788	96,497
1981	3,934,623	2,974,791	959,832	85,449	95,968
1982	4,242,925	3,278,525	964,400	94,740	105,310
1983	4,368,105	3,396,115	971,990	97,390	108,040
1984	4,855,580	3,721,380	1,134,200	106,260	118,660
1985	4,884,110	3,708,610	1,175,500	103,820	116,700
1986	5,606,980	4,256,390	1,350,590	118,210	134,850
1986: 1st Q ...	1,393,170	1,087,640	305,530	127,060	142,340
2nd Q ...	1,421,160	1,094,260	326,900	118,670	134,840
3rd Q ...	1,450,850	1,073,130	377,720	114,120	132,600
4th Q ...	1,341,800	1,001,360	340,440	113,070	129,720
1987: Jan-Feb..	944,570	706,190	238,380	(NA)	(NA)
Percent change from corresponding period in previous year					
1980	-0.7	-3.0	8.2	-3.2	-2.2
1981	0.0	-2.3	8.0	-1.5	-0.5
1982	7.8	10.2	0.5	10.9	9.7
1983	3.0	3.6	0.8	2.8	2.6
1984	11.2	9.6	16.7	9.1	9.8
1985	0.6	-0.3	3.6	-2.3	-1.7
1986	14.8	14.8	14.9	13.9	15.6
1986: 1st Q ...	7.0	7.5	5.5	6.1	7.3
2nd Q ...	25.8	30.2	13.0	32.6	31.9
3rd Q ...	14.5	12.0	22.2	10.1	13.3
4th Q ...	13.1	11.5	18.5	12.0	14.3
1987: Jan-Feb..	6.9	3.1	19.8	(NA)	(NA)

NA - Not available.

^{1/} Beginning in 1984, sample size reduced from 20 to 10 percent and numbers rounded to the nearest 10.

^{2/} Arriving from the Mainland United States or Canada.

^{3/} Arriving from the Orient and Pacific areas.

Source: Hawaii Visitors Bureau.

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 Graph 1). In fact, it is not unusual at Hawaiian resort developments for January and February to account for 15 to 20% of total annual rounds played. While this seasonality has been recognized by resort managers for many years, the competition for high season starting times at many resorts has led to experimentation in 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 marketing strategies have become more sophisticated for the high season times, low season times have been getting extra attention. Resort managers have become increasingly aware of the large number of starting times which go unused during the low season and have been attempted to attract local play to tap this unused resource.

Number of Rounds Available Per Golf Course

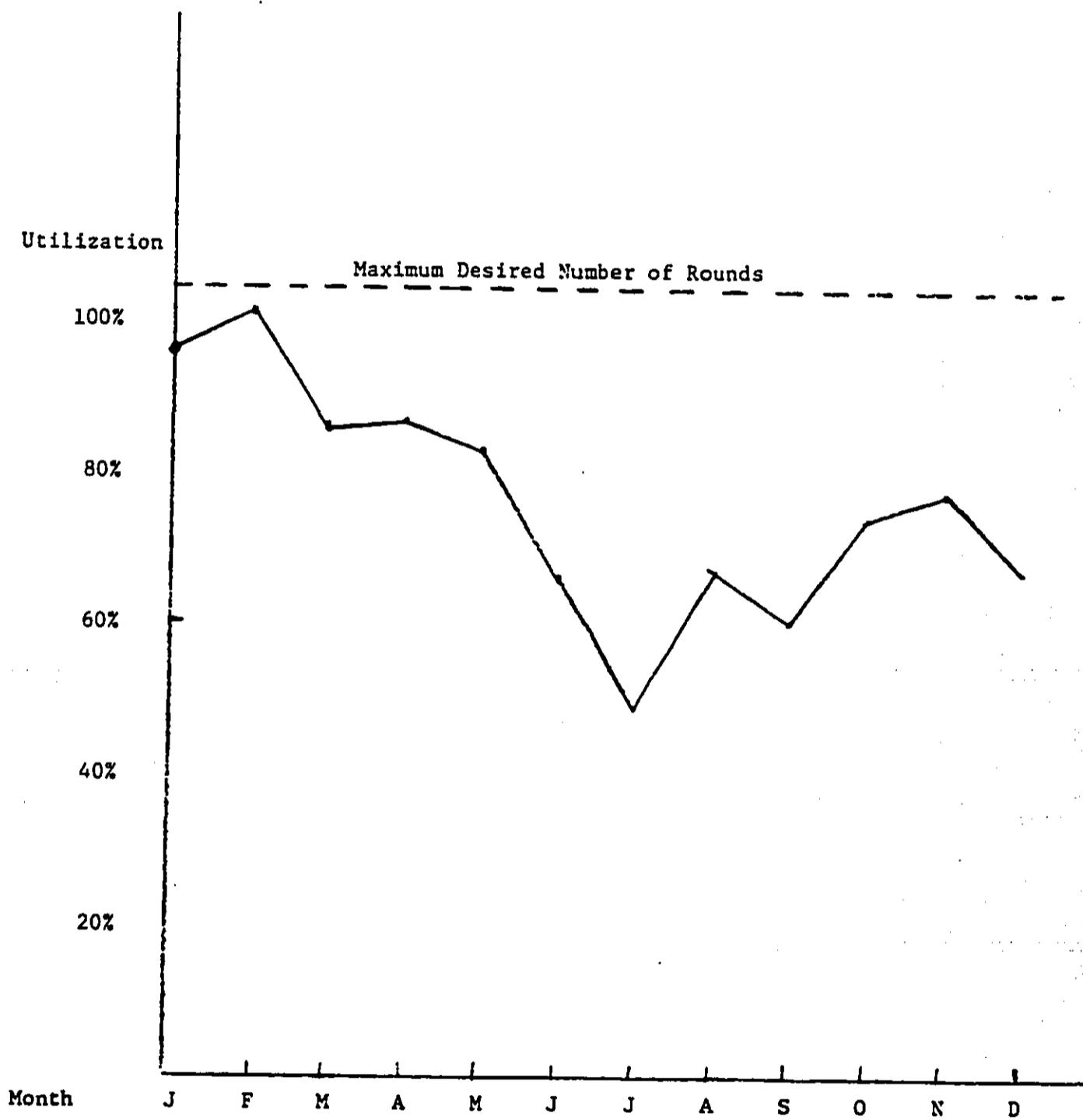
Golf course capacity itself is the product of a number of physical and aesthetic considerations. Resort courses in Hawaii have in general limited play to between 175 and 215 rounds per day. At this level of play, golfers can enjoy the game at a leisurely pace with only a minimum of waiting and with minimum interaction with others playing on the course. Assuming an average of 200 rounds per day and 350 playing days per year, the capacity of resort courses should be at 70,000 rounds annually. Experience has shown that demand for golf from resort guests is strongest during the winter months. 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.

Computation of Demand for Resort Golf

While the guests' desire for golf is impacted by the demographics of a typical guest and by pricing, a fair indicator of the golf requirements of guests can be estimated by the demands

Figure IV-1

Typical Utilization of
Mature Hawaiian Resort
Golf Facilities



Source: Chaney Brooks and Company and John Zapotocky, Consultant

for golfing privileges made by potential hotel developers and operators. These individuals, due to their experiences at other resort properties, have determined the level of golf availability to make their operations competitive with other resort operations of similar types. While this figure varies from resort to resort, a ratio of one round per golf per ten rooms is a standard commitment sought by resort operators in today's marketplace. It is further estimated that every 15 residential units in a destination resort will generate one round of golf. See Exhibit IV-7 for demand experience and estimates of selected resorts.

**Golf Demand for Resort Hotel and
Resort Residential Development at
Selected Destination Resorts in Hawaii**

<u>Island of Hawaii</u> ¹	<u>Annual Rounds Per Hotel Room</u>	<u>Annual Rounds Per Resort Res. Unit</u>
Mauna Kea Beach Hotel	145	
Mauna Lani Bay Hotel	145	
Other Mauna Lani Hotels	100	
Mauna Lani Resort Res.		25
Mauna Lani Terrace (1986 actual)		32
<u>Island of Maui</u> ²		
Wailea Development Company		
Hotels	30	
Resort Residential		39
<u>Island of Kauai</u> ³		
Princeville Development Co.		
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.

HOTELS • Information presented above shows hotel generated rounds on a daily basis ranging from one round per 2.5 rooms at Mauna Kea to one round per 12 rooms at Wailea.

RESORT RESIDENTIAL • Information presented above shows resort residential units generating between one round per 9 units at Wailea and one round per 19 units at Princeville.

GOLF DEMAND FOR THE CITY & COUNTY OF HONOLULU**Existing Conditions**

The Island of Oahu has twenty-eight golf courses. Of these, four are private country clubs, nine are military, four are municipal courses, eight are privately owned but open to the public (daily fee), and three are considered resort courses. After eliminating the military courses and the population eligible to use the military courses, the ratio of golf holes to population is one hole to 2,000 population. (The number of golf holes is used in order to eliminate discrepancies caused by courses of varying size, i.e., 9-hole, 18-hole and 27-hole). (See Exhibit V-1.)

During the past few years, interest in golf at local courses has increased with most of the local courses, increasing utilization and fees. Municipal courses on Oahu are some of the busiest in the country and the world. (See Exhibit V-2.) 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 nineteen courses under consideration by various developers. Others may be under consideration that have not been announced. (See Exhibit V-3.)

Growth in Demand 1987-2000

As shown on Exhibit V-4, golf demand on Oahu will increase by seven courses by the year 2000 if projected resort and population growth follow estimates made by the City's Department of General Planning. Total golf courses on Oahu by 2000 should then be 35 (28 existing plus seven additional).

If, however, it is assumed that interest in the sport of golf grows by 2% per year in the City & County of Honolulu as has been predicted nationally, demand will grow by approximately

**City & County of Honolulu
Per Capita Golf Analysis 1980**

Per capita golf analysis performed by the National Golf Foundation (1,105 persons per hole)¹ indicates that Hawaii ranks 21st among the states in population per golf hole, a respectable showing. However, if this analysis is applied on a countywide basis, military golf courses and population are excluded from the analysis, the island of Oahu and the City & County of Honolulu would rank 48th out of the 50 states in persons per golf hole (2,001), ahead of only Louisiana and Alaska.

Resident Population ²	1980	964,700
Resident Population ³	1980 Oahu	765,900
Military Population ²	Armed Forces	61,000
	Dependents	<u>64,000</u>
	Total	125,000

of retirees 9,040⁴ × 3.15 average persons per household 1980 = 28,500

Number of Golf Holes on Oahu⁵ (less military courses) 306

C & C Honolulu	765,900	Population less military	612,400
Military Pop. (Oahu)	125,000	Golf Holes	306
Retirees & Families	28,500	Persons per golf hole =	2,001

1. National Golf Foundation, *Golf Facilities in the United States - 1985*, Table D, page 16.
2. Table, *State Data Book 1981*, Resident Population by Military Status.
3. Table 6, Resident Population by County 1970 to 1981
4. Table 240, *State Data Book 1981*, Military Personnel Receiving Retired Pay 9/30/80
5. Table 179, *Golf Courses and Tennis Courts, By Islands 1980-1981*, p. 201.

Source: John Zapotocky, Consultant

**City & County of Honolulu
Municipal Golf Courses¹
FY 1986 and FY 1987**

	<u>1986</u>	<u>1987</u>
Ala Wai	197,000	198,000
Pali	144,000	140,000 ²
Makalena	155,000	165,000
Kahuku	<u>38,000</u>	<u>42,000</u>
	534,000	545,000

1. Information provided by Dave Mills, the Golf Administrator for the City and County of Honolulu.
2. Increased rainouts experienced 1987 over 1986.

Notes:

- The City Council has budgeted planning funds for 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 design or construction phases 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.

EXHIBIT V-3

GOLF COURSES PROPOSED
CITY & COUNTY OF HONOLULU

<u>Location</u>	<u>Number</u>	<u>Resort</u>	<u>Private Fee</u>	<u>Private Club</u>	<u>Municipal</u>
Ewa and Central:					
West Beach	2	2			
Meyers (Ewa)	1½		1½		
Gentry (Ewa)	1		1		1
West Loch	1				
Nihonkai Lease Co.					
(Kunia)	1			1	
Village Park	1		1		
Waiawa	2		1	1	
Waikele	<u>1</u>	<u>—</u>	<u>1</u>	<u>—</u>	<u>—</u>
	10½	2	5½	2	1
Primary Urban Center:					
Inside Diamond Head	1				1
Other Oahu:					
Iolani School	1			1	
Kuilima	1	1			
Hawaii Kai	1		1		
Mokuleia	2	2			
Pupukea	1		1		
Waikane	1		1		
Maunawili	<u>2</u>	<u>—</u>	<u>—</u>	<u>2</u>	<u>—</u>
	10	3	3	3	1
Grand Total	<u>20½</u>	<u>5</u>	<u>8½</u>	<u>5</u>	<u>2</u>

SCHEDULE V-4

GROWTH IN DEMAND FOR GOLF HOLES

ISLAND OF OAHU

1987 TO 2000

Growth Based on
forecast resort
and residential
growth

	<u>Total</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
Resort															
Hotel (1)	50					5	5	5	5	5	5	5	5	5	5
Residential (1)	43					4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Residential population (2)	36	<u>2.5</u>	<u>2.5</u>	<u>2.5</u>	<u>2.5</u>	<u>2.6</u>									
	129	2.5	2.5	2.5	2.5	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9

129 Holes/18 holes = 7.16 golf courses

(1) For the purposes of this analysis only the major developments proposed for West Beach and Kuilima have been considered. For a number of years Waikiki, Oahu's major resort center, has had a hotel room cap and development restrictions imposed by the Waikiki Special Design district. Other areas designated for resort development such as Makaha and Laie do not appear to warrant golf facilities.

Destination resort development estimates provided for Kuilima and West Beach in City Zoning ordinances 86-39 and 86-09, respectively, show a total of 5,500 resort hotel units and 7,200 resort residential units programmed for development between 1991 and 2000. Assuming all of the units are developed as scheduled, resort hotel units generate one round per ten units and resort residential generate one round per 15 units, then 550 hotel rounds and 480 resort residential rounds total 1,030 rounds per day. Dividing by 200 rounds per course = 5.15 courses or 92.7 holes.

(2) Based on projections of the Department of General Planning of the City and County of Honolulu, population will grow from 833,000 in 1987 to 926,000 in 2000 for a total of 93,000. Reducing this number by the 20,000 of residential populations contained in the West Beach and Kuilima communities, for which golf demand is computed separately, leaves a 73,000 increase in population. Dividing the 73,000 by 2,000 persons per hole results in an increased demand of 36.5 holes over 14 years or a total of 2.6 holes per year.

West Beach and Kuilima communities, for which golf demand is computed separately, leaves a 73,000 increase in population. Dividing the 73,000 by 2,000 persons per hole results in an increased demand of 36.5 holes of 14 years. Thus annual average demand equals 2.6 holes per year (36.5 holes ÷ 14 years).

35% by the year 2000. If it is further assumed that this growth factor is applied only to the non-military courses, then an additional nine courses (19 existing plus seven new = 26 courses \times 35% = 9 courses) will be required.

Thus a grand total of 16 courses could be required by the year 2000 if a 2% per year growth in golf participation is assumed.

Demand for Private Golf Courses

Exhibit V-5 indicates that Hawaii is one of 27 states where the number of private courses is less than 37% of the total. In fact, only four of Oahu's courses are private, for a total of 21% of non-military courses. A survey of Oahu's four private courses indicated that at the present time membership at all courses was closed. Oahu's newest country club, Honolulu International Country Club, closed its membership in August of 1987. The other three clubs — Waialae, Oahu and Mid-Pacific — have had closed memberships for a number of years. Waiting lists range from 40 at Mid-Pacific to over 100 at Oahu Country Club. It appears that there is potential demand for an additional country club facility, among the seven to 16 new courses required by the year 2000.

VI
SUPPLY AND DEMAND FOR
GOLF COURSES IN THE EWA/CENTRAL OAHU AREA

Existing Conditions

The Ewa and Central Oahu Development Plan areas currently contain approximately 20% of the population and 20% of the Oahu golf courses. These Development Plan areas are the basic market area for the proposed golf facility in Kunia. There are six golf courses located in the area; three are military, one is municipal and two are daily fee courses. Military courses at Schofield Barracks and Barbers Point are not considered in this analysis because they operate solely for the benefit of military personnel. The remaining three courses — Mililani, Hawaii Country Club and Ted Makalena — are currently well utilized. Mililani is operating at capacity with a mix of local and tourist play, primarily Japanese. Hawaii Country Club is at capacity on weekends but has some additional capacity during the weekdays. According to the manager, approximately 80% of business is local and 20%, tourist. Ted Makalena golf course is a municipal facility, which, according to Dave Mills, the City's director of golf, is currently operating near capacity (165,000 rounds).

There are presently ten and a half golf courses which are planned for the Ewa and Central Oahu Development Plan areas. One of these courses, the West Beach course, is currently under construction. (See Exhibit V-3.)

Growth in Demand 1980 to 2000

The General Plan for the City & County of Honolulu and the implementing Development Plans for Ewa and Central Oahu specify that growth in employment and residential development be directed at the Ewa area. Based on DGP residential projections, approximately 50% of the growth for all of Oahu between 1987 and 2000 will take place in Ewa and Central Oahu. In addition approximately 70% of the growth in resort

development is projected for the West Beach Development in Ewa. Thus additional courses needed in the Ewa and Central Oahu areas can be estimated by adding resort and residential demand. (See Exhibit VI-1.)

Exhibit VI-1 shows future demand for golf courses in Ewa and Central Oahu to be approximately five golf courses. If these five courses are added to the existing three non-military courses operating in the area, a total of eight courses will be required by 2000.

If one assumes a 2% annual growth in golf participation is applied to the projected eight non-military courses in Ewa and Central Oahu, then a further 2.8 courses may be required for a total of 10.8 courses or a total of approximately eight new courses. Thus the total demand for golf courses in Ewa and Central Oahu ranges between five and eight new courses by the year 2000.

Additional Demand for Golf in Ewa and Central Oahu

Oahu wide demand for golf courses, discussed in Section V of this report, indicates a potential demand of seven to sixteen courses. A review of the potential sites under consideration for the development of additional golf courses on Oahu (Exhibit V-3) indicates that only one potential site (inside Diamond Head) is located in the Primary Urban Center, home to 50% of Oahu's population by the year 2000. The reason for this locational discrepancy is that the Primary Urban Center represents the urban core of the island of Oahu, which is heavily developed with urban uses. Any increase in demand for golf by residents of the Primary Urban Center will of necessity have to be satisfied outside of the Primary Urban Center. One of the most likely areas to be the beneficiary of this overflow demand is the Central Oahu and Ewa areas, because of the availability of land and an

GROWTH IN DEMAND FOR GOLF HOLES

EWA AND CENTRAL OAHU

1987 TO 2000

Growth Based on
forecast resort
and residential
growth

	<u>Total</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
Resort															
Hotel (1)	36					3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Residential (2)	31					3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Residential population (3)	<u>19</u>	<u>1.3</u>	<u>1.3</u>	<u>1.3</u>	<u>1.3</u>	<u>1.4</u>									
	86	1.3	1.3	1.3	1.3	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1

86 holes/18 = 4.8 golf courses

- (1) Golf Rounds per hotel unit estimated at one round per ten rooms. Maximum rounds permitted on resort golf course estimated at 200 per day. Number of holes equals golf courses times 18. 4,000 rooms/10 = 400 rounds. 400 rounds/200 rounds = 2 golf courses times 18 = 36 holes. Resort development time frame = 10 years. 36 holes/10 years = 3.6 holes per year.
- (2) Golf rounds per resort residential unit equals 1 round for every 15 units. Same assumptions that apply to the hotel computations in (1) above apply to resort residential rounds. 5,200 units/10 = 346 rounds. 346 rounds/200 rounds per course = 1.7 golf courses times 18 holes = 30.6 holes; rounded = 31 holes.
- (3) Residential growth -- Department of General Planning population estimates Ewa and Central Oahu Development Plan areas less 14,000 population attributed to West Beach residential: (Year 2000 estimate = 207,000) - (Year 1987 estimate = 159,000) = 48,000. Historic relationship of golf holes to population is one hole per 2,000 persons. 48,000/2,000 = 24 golf holes/14 years = 1.71 holes.

excellent transportation network of roads which have excess capacity during non-rush hour times.

Demand for Private Golf Course in Ewa and Central Oahu

The nearest private golf facility to the Ewa and Central Oahu areas is the Honolulu International Country Club, which is six miles from the boundary of the Central Oahu area and more than ten miles from the geographic center of Central Oahu and Ewa. As indicated previously, memberships for all existing private facilities are closed. Exhibit VI-2 shows a demand for a private club membership in the area to exceed 1,200 membership by the year 2000, enough to sustain between 1.2 and 2 courses, depending on the maximum number of golfing members desired. This estimate checks against the current ratio of private facilities to total facilities on Oahu.

If the ratio of private clubs remains constant at 21% of non-military golf facilities, then the demand for new private facilities in Central Oahu and Ewa should grow by between 1 and 1.5 courses by the year 2000.

Estimated Supply of Golf Courses

At the present time ten and a half golf courses have been proposed for the Ewa and Central Oahu Development Plan areas.

Exhibit VI-2

Demand for Private Club Membership
Ewa and Central Oahu Areas
1987 to 2000

		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Non-Resident:	Foreign	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	Resort	—	—	—	—	24	24	24	24	24	24	24	24	24	24
		33	33	33	57	57	57	57	57	57	57	57	57	57	57
	Cumulative	33	66	99	132	189	246	303	360	417	474	531	588	645	702
Resident:	Resort					23	23	23	23	23	23	23	23	23	23
	Local	93	15	15	15	15	15	15	15	15	15	15	15	15	15
		93	15	15	15	38	38	38	38	38	38	38	38	38	38
	Cumulative	93	108	123	138	176	214	242	290	328	366	404	442	480	518

Demand for Private Clubs in the Ewa and Central Oahu area will come from three distinct sources.

Foreign Memberships: The Honolulu International Country Club demonstrated the feasibility of marketing international memberships (primarily to Japanese Nationals) by selling 500 memberships over a ten-year period. Thus a demand has been shown for at least 50 memberships per year. Because of the growth in Japanese tourism and the three golf facilities (containing four golf courses) proposed to market at least a portion of their membership to this market it is estimated that this market can be increased to approximately 100 memberships per year. Nihonkai's share of this market is estimated to be 33%, assuming an even distribution over the three facilities. Thus demand from this source is estimated at 33% per year.

Resort Memberships: The Wailea, Princeville and Kaanapali Resort courses have golf membership programs to varying degrees. At the present time, approximately 25% of the Wailea units have golf memberships, 10% of Princeville units have memberships. At Kaanapali no memberships were offered after thirty memberships were sold in the early 1960's. If West Beach generates memberships at a rate of 10% of its residential units, a total of 520 memberships would be demanded by the year 2000.

Because of its proximity to the West Beach Development, Nihonkai Country Club in Kunia is expected to obtain 90% of the demand for this type of membership or a total of 468 memberships between 1991 and 2000 for a total of 47 memberships per year. Note: Memberships are expected to be divided evenly between persons who are primarily permanent residents and those who are only seasonal residents.

Local Memberships: At the present time there are approximately 2,000 local members of private country clubs. There are approximately 680,000 non-military residents of Oahu. Thus the ratio of private club members to population is one per 340 persons. If this ratio is applied to the projected population growth less the population attributed to resort residential developments (93,000 less 20,000 = 73,000), $73,000 \div 340 = 214$ members.

If the local memberships are allocated over a 14-year period, 1987 to 2000, then annual demand is approximately 15 per year. If it is further assumed that there is an existing demand from current residents of the Central and Ewa area and that it is at 25% of the rate of memberships from future growth due to the assumption that those desiring memberships would have acquired them at existing clubs. Then of the approximately 100,000 non-military population in Ewa and Central Oahu, it is estimated that demand for 74 memberships exist ($100,000 \div 340 \times 25\%$).

<u>Ewa</u>	<u># Courses</u>	<u>Type</u>	<u>Status</u>
West Beach	2	Resort	One under construction and one on the Development Plan
Meyers	1 ½	Daily Fee	Seeking Zoning Approval
Waikele	1	Daily Fee*	Approved, awaiting development
Village Park	1	Daily Fee*	Applied for Development Plan approval
Gentry Waiawa	2	Daily Fee/ Private	Applied for Development Plan approval
Gentry Ewa	1	Daily Fee*	Part of master plan
West Loch	1	Municipal	Design underway
Kunia/Nihonkai Lease Co.	1	Private	Development Plan approval applied for
	<u>10 ½</u>		

* Initial indication of intention only.

Of the ten courses which have been proposed, seven have been proposed in conjunction with various real estate developments, while three — West Loch, Meyers, and Nihonkai — are proposed as pure golf facilities. It should be noted that DGP population estimates for the area do not include increases in population which would occur if the Village Park and Gentry Waiawa developments were to be approved. Thus if these courses were to be approved demand would be increased by the growth in the population in the surrounding development. Further, it is unlikely that all of the proposed courses will be approved and, if approved, that they would all be developed. As with any other type of land development, golf course development is subject to the same approval and financing uncertainties. In the opinion of the consultant, only seven of the ten proposed courses will make it through all of the necessary steps in order to actually open prior to the year 2000.

In addition to the Nihonkai Country Club in Kunia, only one other private club is under consideration for the Ewa and Central Oahu area. The Gentry Companies have proposed a private golf club in conjunction with a Retirement Village proposed for the Waiawa area of Central Oahu. This facility, if approved, would be expected to draw its membership from the more than 4,000 units planned for this new retirement community. Thus this facility

would supply its own membership. Outside of the Ewa and Central Oahu area, two private clubs are also being planned. Both facilities are located in Windward Oahu at Maunawili and on Iolani School property in Kaneohe, containing a total of three courses. Due to the substantial distance from the Ewa and Central Oahu areas, these other facilities would be expected to be competitors only for foreign memberships.

Summary of Ewa and Central Oahu Supply and Demand

Demand for golf facilities in the Ewa and Central Oahu area is estimated to range between 5 and 8 courses by the year 2000. The area may also be the beneficiary of increased demand generated in the Primary Urban Center. Ten courses are under consideration in the Ewa and Central Oahu areas, one by the City government and nine by private developers. Ultimately, not all of the proposed courses are expected to be developed. The portions of total demand allocated to private facilities is estimated to range between one and two courses, depending on the desired size of the golf membership at the facility.

VII

**ADVANTAGES OF THE PROPOSED
NIHONKAI LEASE COMPANY
GOLF FACILITY IN KUNIA**

The proposed Nihonkai Lease Company Golf Facility at Kunia is an ideal location to service the golf needs of the Ewa and Central Oahu Development Plan areas.

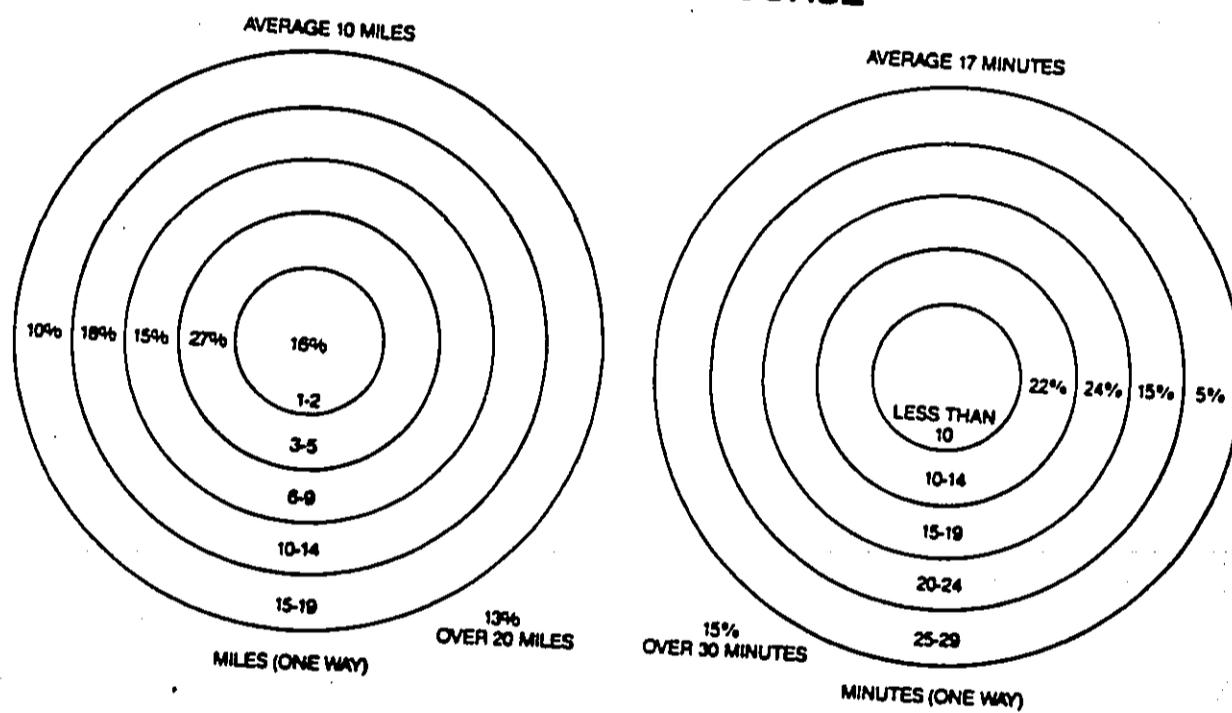
The proposed site is located on Kunia Road, three miles north of the intersection of Kunia Road and the H-1 Freeway. It consists of approximately 200 acres of gently sloping land offering panoramic views of the Pacific Ocean, Waianae Mountains and the Koolau Mountains. On the north the site is bounded by the Hawaii Country Club, an existing golf facility; on the south, by agricultural uses. The western side of the site is bounded by Kunia Road.

The site offers excellent access to all areas of Central Oahu and Ewa via Kunia Road and the H-1 and H-2 freeway systems. Exhibit VII-1 shows the results of a National Golf Foundation Survey conducted in 1985 which indicates that the average distance to a golfer's most frequently played course is ten miles or seventeen minutes. Figure VII-1 indicates that all of Central Oahu and Ewa, as well as a significant portion of the Primary Urban Center, fit within an area of these average distances from the proposed site.

The Kunia Site is at the highest elevation of all of the proposed golf courses for the Ewa and Central Oahu area. It is also located on gently sloping land which allows for views to the ocean. The surrounding recreational and agricultural uses allow for uninterrupted views in every direction.

The proposed golf facility is to be developed exclusively for golf and recreational purposes. The golf course design is permitted to utilize all of the site's topographic and view resources without regard to their impact on other development proposed for the site. This gives the proposed development an advantage over golf facilities that are proposed as recreational

DISTANCE TO MOST FREQUENTLY PLAYED GOLF COURSE



Source: National Golf Foundation, *Golf Consumer Profile*, December 1986.

and open space elements of master development plans. An element of a master plan must necessarily be a compromise in order to benefit the entire plan, while the proposed stand-alone facility need only consider the design impacts on golf.

The Nihonkai Lease Company is an affiliate of a Japanese company with an interest in a major country club facility in Japan. Thus the company has experience in the operation aspect of golf facilities and can use this experience in the planning of the proposed facility.

Summary

The site for the proposed golf facility in Kunia appears to be ideally suited to service the golf needs of the Ewa and Central Oahu Development Plan areas. Being dedicated solely to golf and other recreational needs, the proposed facility can be planned and developed to take maximum advantage of the site for these purposes. The site's location is in proximity to areas of major residential and resort growth.

VIII
CONCLUSION

The Ewa and Central Oahu Development Plan areas of the City & County of Honolulu should provide strong demand for new golf facilities through the year 2000 due to projected growth in both population and the growth of visitors to the area. Greatest growth is projected for the years 1991 to 2000 because of the resort and resort residential development scheduled for the massive West Beach project. During those years it is anticipated that a minimum of eight golf holes per year (approximately half of an 18-hole golf course) will be required annually to meet the needs of the Ewa and Central Oahu areas. Necessarily absorption of golf courses in the area will be dependent on the demand as well as the supply of new facilities.

Ten golf facilities have been identified as being proposed for the Ewa and Central Oahu areas. Actual development of these facilities will be dependent upon both Government approvals and the economics of their development. Facilities which are elements of large planning schemes may be subject to additional uncertainty relating to the marketability of the project proposed for overall development.

The Central Oahu and Ewa areas will present a number of markets for golf services including: the resort market, the foreign market, the residential market, the municipal market and the private club market. Thus a number of facilities could be developed simultaneously and not be directly competitive. The proposed Nihonkai golf facility, due to the advantages of its location and design concept, should be a strong competitor for the estimated future demand for golf in the Ewa and Central Oahu areas.

DEVELOPMENT PLAN AMENDMENT
PUBLIC FACILITIES MAP

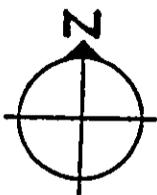
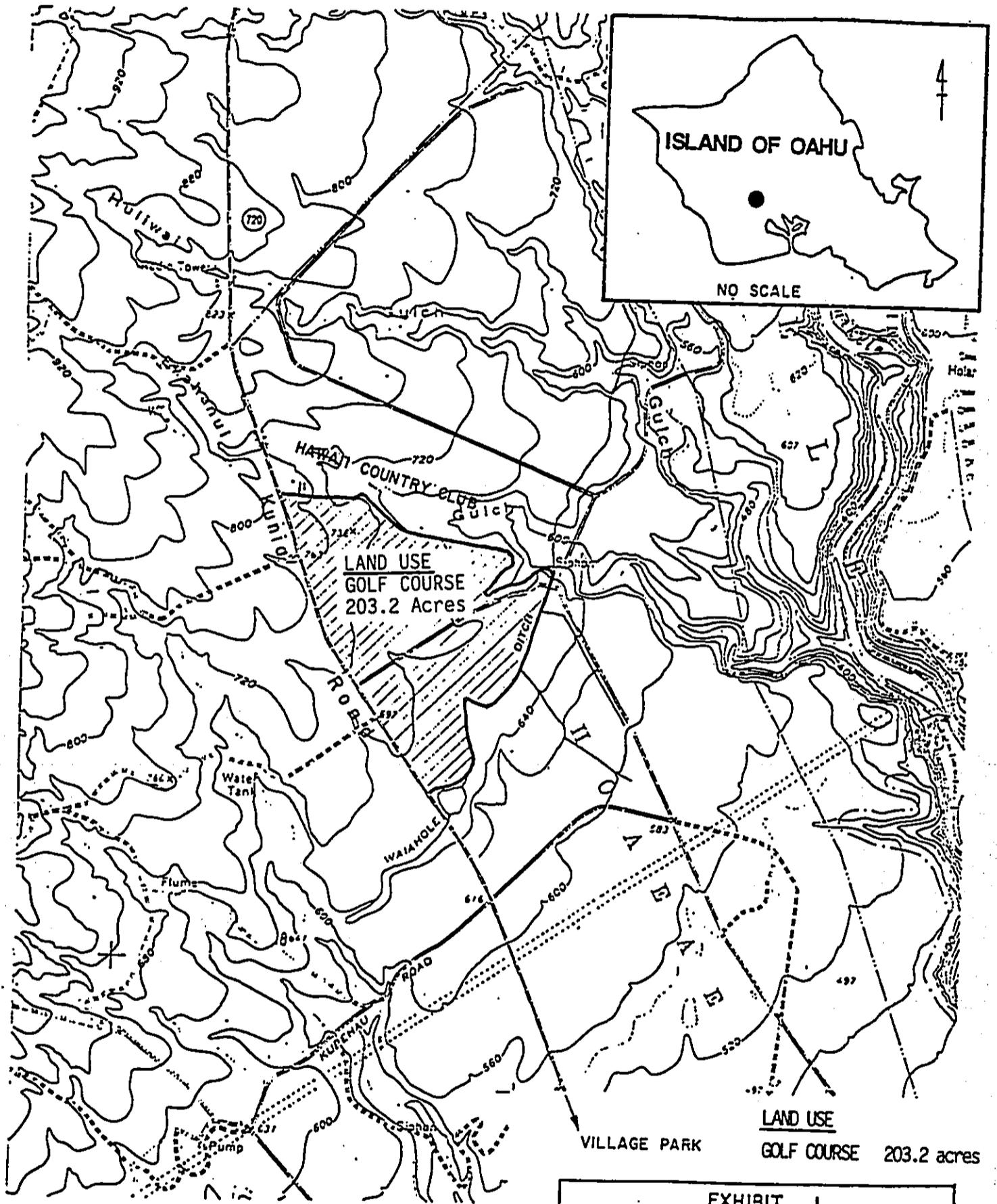
KUNIA GOLF COURSE

Prepared For
NIHONKAI LEASING CO.

SEPTEMBER 1987

By
HIDA, OKAMOTO & ASSOCIATES, INC.
HONOLULU, HAWAII

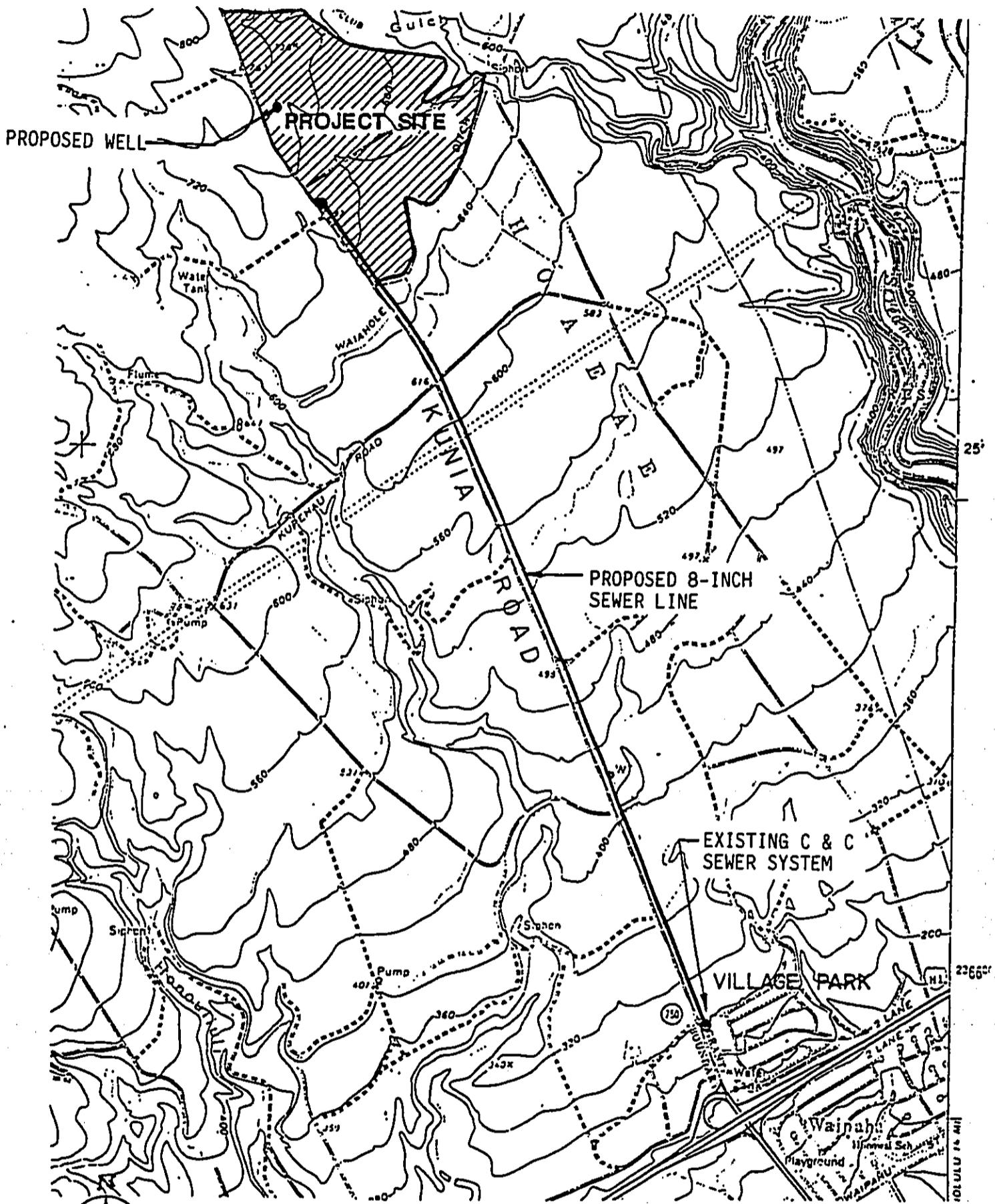
H



SCALE: 1:24000 (APPROX.)
1000 0 2000 4000 FEET

EXHIBIT I
DEVELOPMENT PLAN AMENDMENT
KUNIA GOLF COURSE
GENERAL BOUNDARIES

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII



SCALE: 1:24000 (APPROX.)
 1000 0 2000 4000 FEET

HIDA, ORAMOTO & ASSOCIATES, INC.
 CONSULTING ENGINEERS
 HONOLULU, HAWAII

EXHIBIT 2
 DEVELOPMENT PLAN AMENDMENT
 KUNIA GOLF COURSE
 GENERAL BOUNDARIES

FACILITIES MAP AMENDMENT

DGP Form 101
(For Privately Funded Projects)
(Revised December 17, 1985)

DEVELOPMENT PLAN PUBLIC FACILITIES MAP
MAJOR AMENDMENT APPLICATION

NOTE: Only "major" projects need to be shown on the Development Plan Public Facilities Maps. See Attachment A of the Instructions for the distinction between "major" and "minor" projects.

I. APPLICANT INFORMATION

A. Name Nihonkai Leasing Co.
B. Address 2222 Kalakaua Avenue, Suite 1400 Honolulu, Hawaii 96815
C. Contact Person Harvey K. Hida
Phone 942-0066 Date Submitted September 1987

II. PROJECT INFORMATION

A. Project Title Kunia Golf Course
B. Project Description Development and installation of pumps and appurtenances on one new well.
C. Project Location Land situated on the north easterly side of Kunia Road at Hoaena, Ewa, Oahu, Hawaii. Being a portion of Royal Paten 4490, Land Commission Award 10,474, Apana 9 to N, Namauu.

Tax Map Key 1st Division 9-4-04: 9

Neighborhood Board Area

Name Waipahu

Number 22

Census Tract(s) _____

DP Area(s) Central, Oahu

D. Type of Amendment Request (mark "x")

Add _____ Delete _____ Change _____

E. Basis for Amendment To serve the proposed golf course domestic water demand.

F. DP Public Facilities Reference No. _____
(Assigned by DGP)

G. Maps Attached (mark "x")

Location Map x

Site Plan x

Service Area Map _____

H. Start of Land Acquisition (year) 1987

Start of Construction (year) 1992

I. Estimated Project Costs (in thousands of dollars)

	<u>Within 6 Years</u>	<u>Beyond 6 Years</u>
1. Land Acquisition	_____	_____
2. Planning & Engineering (P&E)	40	_____
3. Construction	400	_____
4. Beautification	_____	_____
5. Inspection	_____	_____
6. Furniture, Fixtures, Equipment	_____	_____
7. Relocation	_____	_____
8. Other	_____	_____
9. Total	440	_____

III. DP MAP STATUS

A. Current Public Facilities Map Status

1. Is project on the current PF Map?

Yes _____ No x (If no, skip to #5.)

2. Current Project Description _____

3. Site Location on PF Map

a. Site Location Determined _____
(Tax Map Key)

b. Location Undetermined _____
(TMK to smallest detail possible)

4. Timing (mark "x")

"Within 6 years" _____

"Beyond 6 years" _____

Programmed by increments? Yes _____ No _____

5. Current DP Land Use Map Designation(s) Underlying the Project Site (mark "x")

Preservation	_____	Agriculture	XX
Residential	_____	Apartment	_____
Commercial	_____	Resort	_____
Industrial	_____	Military	_____
Park	_____	Public Facility	_____
Quasi Public	_____		

B. Proposed Public Facilities Map Status (Skip if request is to "delete" a project.)

1. Proposed Site Location

Sit: Location Determined 9-4-04: 9
(Tax Map Key)

Location Undetermined _____
(TMK to smallest detail possible)

2. Timing (mark "x")

"Within 6 years" XX

"Beyond 6 years" _____

D. Are public facilities adequate to handle additional load? Yes _____ No XX

Explain and attach letters from impacted agencies indicating commitment to handle the additional loads.

E. Will this facility be dedicated to the City? Yes _____ No XX

When is this dedication anticipated? _____

V. GROWTH IMPACTS

A. Indicate the basic type(s) of development this project supports (residential, resort, commercial, industrial, etc. Golf Course) _____

B. Indicate the size of the development this project supports.

Land Area 204 Acres

Population (residential or resort) _____

Floor Area (commercial or industrial) 10,000 sq. ft.

C. Is this project oversized to accommodate future development? Yes _____ No XX

Explain. _____

D. Will future development require DP land use amendment? (Attach location map.) Yes _____ No _____

E. Indicate the ultimate size of the development.

Land Area _____

Population (residential or resort) _____

Floor Area (commercial or industrial) _____

DGP Form 101
(For Privately Funded Projects)
(Revised December 17, 1985)

DEVELOPMENT PLAN PUBLIC FACILITIES MAP
MAJOR AMENDMENT APPLICATION

NOTE: Only "major" projects need to be shown on the Development Plan Public Facilities Maps. See Attachment A of the Instructions for the distinction between "major" and "minor" projects.

I. APPLICANT INFORMATION

A. Name Nihonkai Leasing Co.
B. Address 2222 Kalakaua Avenue, Suite 1400 Honolulu, Hawaii 96815
C. Contact Person Harvey K. Hida
Phone 942-0066 Date Submitted September 1987

II. PROJECT INFORMATION

A. Project Title Kunia Golf Course
B. Project Description Construct new 8" sewer line along the existing
Kunia Road right-of-way.
C. Project Location Land situated on the north easterly side of Kunia
Road at Hoana, Ewa, Oahu, Hawaii. Being a portion of Royal
Patent Land Commission Award 10,474, Apana 9 to N, Namaau.

Tax Map Key 1st Division 9-4-04: 9

Neighborhood Board Area

Name Waipahu

Number 22

Census Tract(s) _____

DP Area(s) Central, Oahu

D. Type of Amendment Request (mark "x")

Add XX Delete _____ Change _____

E. Basis for Amendment To serve the proposed golf course

F. DP Public Facilities Reference No. _____
(Assigned by DGP)

G. Maps Attached (mark "x")
Location Map X
Site Plan X
Service Area Map _____

H. Start of Land Acquisition (year) 1987
Start of Construction (year) 1992

I. Estimated Project Costs (in thousands of dollars)

	<u>Within 6 Years</u>	<u>Beyond 6 Years</u>
1. Land Acquisition	_____	_____
2. Planning & Engineering (P&E)	<u> 54 </u>	_____
3. Construction	<u> 900 </u>	_____
4. Beautification	_____	_____
5. Inspection	_____	_____
6. Furniture, Fixtures, Equipment	_____	_____
7. Relocation	_____	_____
8. Other	_____	_____
9. Total	<u> 954 </u>	_____

III. DP MAP STATUS

A. Current Public Facilities Map Status

1. Is project on the current PF Map?
Yes _____ No X (If no, skip to #5.)

2. Current Project Description _____

3. Site Location on PF Map

a. Site Location Determined _____
(Tax Map Key)

b. Location Undetermined _____
(TMK to smallest detail possible)

4. Timing (mark "x")

"Within 6 years" _____

"Beyond 6 years" _____

Programmed by increments? Yes _____ No _____

5. Current DP Land Use Map Designation(s) Underlying the Project Site (mark "x")

Preservation	_____	Agriculture	XX
Residential	_____	Apartment	_____
Commercial	_____	Resort	_____
Industrial	_____	Military	_____
Park	_____	Public Facility	_____
Quasi Public	_____		

B. Proposed Public Facilities Map Status (Skip if request is to "delete" a project.)

1. Proposed Site Location Kunia Road contiguous to T.M.K
9-4-04: 9-4-102:
Site Location Determined 9-4-02: _____
(Tax Map Key)

Location Undetermined _____
(TMK to smallest detail possible)

2. Timing (mark "x")

"Within 6 years" XX _____

"Beyond 6 years" _____

3. Has project or any portion of this project been previously considered for inclusion on the PF Map?

No XX Yes _____

If yes, what were previous DGP Public Facility Application No(s)? _____

4. Is there a concurrent land use amendment being processed to which this project relates?

No _____ Yes X

If yes, what is concurrent DGP Land Use Application No.? _____

IV. IMPACT ON PUBLIC FACILITY SYSTEMS

A. Additional Load or Demand

1. Sewage

a. 0.1 mgd, average flow to nearest 0.1 mgd

b. 0.2 mgd, peak flow to nearest 0.1 mgd

2. Water

a. _____ mgd, average flow to nearest 0.1 mgd

b. _____ mgd, peak flow to nearest 0.1 mgd

3. Traffic

_____ Average Daily Traffic (ADT)

_____ Peak Hour Volume

4. Other

B. Explain the basis for demand or load figures under A. above. Used the City's Design Criteria to determine the quantity of flow.

C. How will this project interface with the public system? Describe and include map. There is no public system currently available in the area.

D. Are public facilities adequate to handle additional load? Yes _____ No XX

Explain and attach letters from impacted agencies indicating commitment to handle the additional loads.

E. Will this facility be dedicated to the City? Yes XX No _____

When is this dedication anticipated? _____ 1995

V. GROWTH IMPACTS

A. Indicate the basic type(s) of development this project supports (residential, resort, commercial, industrial, etc.) Golf Course

B. Indicate the size of the development this project supports.

Land Area 204 Acres

Population (residential or resort) _____

Floor Area (commercial or industrial) 10,000 sq. ft.

C. Is this project oversized to accommodate future development? Yes _____ No XX

Explain. _____

D. Will future development require DP land use amendment? (Attach location map.) Yes _____ No _____

E. Indicate the ultimate size of the development.

Land Area _____

Population (residential or resort) _____

Floor Area (commercial or industrial) _____

ENVIRONMENTAL IMPACT OF
FERTILIZER AND PESTICIDE USE
ON THE PROPOSED KUNIA GOLF
COURSE

A REPORT TO

William E. Wanket Inc.

November 16, 1987

PREPARED BY

Charles L. Murdoch, Ph. D

Richard E. Green, Ph. D.

I. INTRODUCTION

The development of the proposed golf course 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. These chemicals may be subject to movement from the site of application, either by runoff during high intensity storms, or by movement toward groundwater when water infiltration exceeds evapotranspiration (ET). Although the Kunia site is a relatively low-rainfall, high-ET area, high-intensity storms occur occasionally, resulting in runoff through drainage ways to the coast. Irrigation in excess of ET contributes water recharge to groundwater, thus water management is an important determinant in the control of chemical movement.

This report provides an assessment of the anticipated environmental impact of chemicals applied to a golf course at this site based on an analysis of site factors and recommended management practices. In addition, the impact of a golf course with appropriate management is compared with the existing situation (sugarcane culture).

II. APPROACH

Background information on soils, topography, drainage and storm runoff was obtained from Hida, Okamoto and Associates, Inc. Due to our familiarity with the location and anticipated difficulties with access, we did not visit the site. Detailed topographic and soils maps provided information required for an assessment of infiltration and runoff potentials. Published data on water balance in the area provided an estimate of groundwater recharge with both sugarcane and turf cover. Chemical use in sugarcane is estimated from published information while the anticipated use of chemicals in golf course management is based on our own recommendations.

III. ANALYSIS OF RELEVANT FACTORS WHICH MAY IMPACT ON CHEMICAL MOVEMENT

A. Site factors

1. Geology, soils, topography

The geology of this area is dominated by basalt from the Koolau and Waianae volcanic series, with alluvial fans from the mountains and ash deposits complicating the picture. Weathered basalt, alluvium and ash underlie the soils, which are described briefly in the report by Hida, Okamoto and Associates. The Kunia soil series (Ky symbol) occupies most of the proposed golf course area, as shown in the appended Exhibit 8 map from the Hida et al. report. Most of the Kunia series area has a very gentle slope (0 to 3 percent), as indicated by the "A" symbol in KyA. The KyB and KyC symbols refer to slopes of 3 to 8 percent and 8 to

15 percent, respectively. Thus most of the area to be included in the golf course has a low to moderate slope. The Kunia soil has "moderate permeability" (Foote et al., 1972), which corresponds to a hydraulic conductivity range of 0.034 to 0.106 cm/minute (Bresler and Green, 1982). The portion of Wahiawa series (WaA) at the east boundary of the proposed golf course is also sloping very gently; this soil has a higher permeability than the Kunia series.

The combination of gently sloping topography and permeable, well-drained soils suggests that runoff should be minimal, except under conditions of prolonged, high-intensity rainfall.

Another factor which may have an impact on pesticide movement through the soil profile is the organic carbon content of the Kunia soils. These soils are classified as Ustoxic Humitropepts, suggesting a relatively high organic carbon content. High carbon content of soils enhances sorption of pesticides on the soil and thus reduces leaching or runoff of the chemicals.

2. Climate and hydrology

Monthly average rainfall at the site varies from a low of about 20 mm/month in June and July to a high of about 135 mm/month in January, with a mean annual rainfall of about 800 mm (31 inches). A water balance for the non-caprock area of Southern Oahu can be determined from data presented by Giambelluca (1983). Average annual precipitation for the entire area is 1007 mm (39.6 inches). Runoff was calculated to be 68 mm (2.7 inches) for the same region, while ET for irrigated sugarcane is about 1350 mm (53 inches). Thus, without irrigation, there is a net deficit of about 411 mm (16 inches). The data indicate that unirrigated cropped or grassed areas providing a full canopy for ET would not contribute recharge to the Pearl Harbor Aquifer. Actually, because of the water deficit, sugarcane culture in this area would not be economically productive without irrigation.

The relationship between topography and storm runoff has been addressed in the report by Hida, Okamoto and Associates. Existing drainage patterns will be maintained, and retention structures are planned to minimize runoff during peak rainfall periods. Details of such developments are not specified. It is apparent from examination of Exhibit 1 of their report, however, that the proposed Kunia Golf Course area contributes a small amount of drainage water in relation to the entire watershed. Because of dilution with the much larger volume of water from off site, the concentration of chemicals contributed by management of the golf course in drainage water reaching the coast would be insignificant.

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 applied to only the greens, tees, fairways, and part of the roughs of a golf course. Typical areas in these types of turfgrasses 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 iron and aluminum hydroxides which are plentiful in the soil of this location 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 N uptake 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. This nitrogen movement could be avoided by applying a slow-release nitrogen fertilizer.

Fertilizer use rates for the different golf course areas are shown in Table 1. 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 1. Approximate fertilizer use rates for different areas of a typical 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	3 weeks	1.15
Fairways	50	1.5	8 weeks	10.0
Roughs	30	1.0	3 months	2.60
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 are applied in a regularly scheduled, preventative program. A typical pesticide program for golf courses in Hawaii is given in Table 2 below. There are several chemicals which may be substituted for certain ones in this suggested program. Properties of the chemicals listed in Table 2 (Hartley and Kidd, 1983), as well as those of most chemicals used in turf in Hawaii, are given in Appendix Table 1.

Table 2. A typical pesticide program for golf courses in Hawaii.

Turfgrass area	Area (acres)	Chemical	Frequency	Rate/application	Annual total
I. Herbicides					
A. Greens	3	MSMA	6 times/year	2lb. ai/acre	36 lb. ai
		bensulide	2 times/year	12 lb ai/acre	72 lb. ai
B. Tees	3	MSMA	6 times/year	2 lb. ai./acre	36 lb. ai
		33 Plus	3 times/year	1 pint/acre	9 pints
		bensulide	2 times/year	12 lb. ai./acre	72 lb. ai
C. Fairways	50	MSMA	6 times/year	2 lb. ai./acre	600 lb. ai
		33 Plus	3 times/year	1 pint/acre	19 gallons
		metribuzin	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.
		diazinon	As needed	5 lb. ai./acre	Approx. 250 lb. ai.
III. Fungicides					
A. Greens	3	metyalaxy	As needed	1.3 lb. ai./acre	Approx. 25 lb. ai.
		chlorothalonil	As needed	8 lb. ai./acre	Approx. 72 lb. ai.
B. Tees	3	metyalaxy	As needed	1.3 lb. ai./acre	Approx. 25 lb. ai.
		chlorothalonil	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 controllers. Many are computer controlled, so that each sprinkler head on the golf course can be adjusted from a computer terminal to apply a selected amount of water on each cycle.

Because golf greens are constructed of sand (or mixes dominated by 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 and the amount of available water in the soil. 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. Amounts of water applied at each irrigation are about 20,000 gal. for greens and 500,000 gals. for fairways.

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 chance for 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. As was previously mentioned, golf course irrigation systems are sophisticated, allowing precise control of the amount of water applied.

IV. ENVIRONMENTAL IMPACT OF CHEMICALS APPLIED TO THE PROPOSED GOLF COURSE COMPARED TO THOSE APPLIED TO EXISTING AGRICULTURAL CROPS.

A. Existing conditions

The proposed golf course site is presently cropped with sugarcane. The cane is drip irrigated, providing efficient use of applied water. The principal fertilizer nutrients applied are N and K; water soluble forms are applied through the drip system. Typical quantities applied are about 300 pounds of N and 400 pounds of K₂O, with most of the fertilizer being applied during the first year of the crop. As mentioned previously, only nitrate (NO₃) is considered a potential pollutant of groundwater. However, there is no evidence that NO₃ levels in the Pearl Harbor aquifer have been seriously impacted by NO₃ leaching from sugarcane fields (Green and Young, 1970). Use of drip irrigation in recent years has probably reduced irrigation recharge to the aquifer, thus reducing the quantity of leached-N.

Pesticide use for insect and disease control in sugarcane culture is minimal, since insects are controlled biologically. Fungicide is used only to treat seed pieces before planting (principally Benlate), thus the quantities applied are small and localized. Only herbicides for weed control are applied to the soil as surface sprays, usually two or three times in the first 6 months after planting. Herbicide practices

have not changed substantially in the past 20 years, with the exception of the adoption of the use of glyphosate (Roundup) for in-field post-emergence spot spraying and control of weeds in field boundaries, ditches, and roadsides. The principal pre-emergence herbicides used in the Kunia area are usually atrazine and either ametryn or diuron. Typical quantities applied are 6 pounds active ingredient (ai.) per acre per crop.

Studies on Oahu several years ago (Green et al., 1977) indicated that diuron was transported from sugarcane and/or pineapple fields to the West Loch of Pearl Harbor via Waikele stream. While the herbicide could not be detected in water, it was found at low levels in sediments from both the stream and the bay. The quantities of diuron in sediments were thought to be too low to be of environmental consequence. Neither atrazine or ametryn was found in either water or sediments.

In the last two years, atrazine has been detected in some private wells in analyses conducted by the Hawaiian Sugar Planter's Experiment Station. It is not yet known whether atrazine has reached the major potable groundwater sources on Oahu, but where it has been found the levels are very low (parts per trillion). Thus it is probable that both atrazine and fertilizer nitrogen have leached below the root zone with furrow irrigation in the past. As both must be driven to groundwater by excessive application of irrigation water, it is likely that drip irrigation, which provides better water control, has reduced chemical leaching in comparison with furrow irrigation.

B. Proposed golf course

Fertilizer, pesticide and irrigation applications to the proposed golf course have been discussed previously. Golf course management is much more intense than sugarcane management. At first glance it would appear that more fertilizers are being applied to the golf course than to sugarcane because of the higher application rates to turfgrasses. After closer examination, however, it is shown that because only a small portion of the area is fertilized, total fertilizer use will be similar. If sugarcane culture uses 300 pounds of N per acre for one year of the two-year growing cycle, this results in about 30 tons of N for the 2 years. Golf course culture, as shown in Table 1 above, requires approximately 14.6 tons of N each year. For a two year period about 29 tons of N would be applied in golf course fertilization.

Because the area treated with pesticides on a golf course is small, the total amount of pesticide applied is relatively small also. The pesticides used in golf course management are mostly of very low toxicity (Appendix Table 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.

Turfgrasses are relatively permanent. Once an area is established, it is not cultivated with the associated erosion that occurs when sugarcane fields are cultivated for replanting. In fact, the presence of a large turfed area, such as the proposed golf course, would reduce the sediment load entering the drainage way and eventually Pearl Harbor.

While the recent adoption of drip irrigation in most sugarcane production (including that in the area of the proposed golf course) has resulted in more efficient water use, and therefore less recharge of groundwater, sprinkler irrigation of turfgrasses is even more efficient. By proper management of water, there should be minimal recharge because of the evapotranspiration deficit discussed previously.

V. SUMMARY AND CONCLUSIONS

Analysis of the site and management factors involved in golf course maintenance suggest that it is unlikely that development of the proposed Kunia golf course would pose environmental risks associated with the use of chemical fertilizers and pesticides. The site is a relatively low-rainfall (approximately 31 inches/year) high-ET (approximately 53 inches/year) area with a net ET deficit. There will, therefore, be no recharge of groundwater from rainfall. Proper irrigation practices will also result in minimal recharge of groundwater.

Nitrate would be the only fertilizer element of concern in runoff waters. However, because of the small amount applied at any one application, and the large dilution from water off-site in the surface drainage way, nitrate content of drainage water would be insignificant.

With the exception of herbicides, pesticide applications are normally made only to greens on golf courses. Since greens comprise only approximately 3 acres of a typical golf course, contribution of fungicide and insecticide contamination of surface waters would be small. The herbicides used on golf fairways are primarily MSMA, metribuzin and 33 plus (or other mixtures of 2,4-D, mecoprop and dicamba). These herbicides are rapidly degraded and/or are tightly sorbed on soil colloids and organic matter and have little potential for water contamination.

Development of a golf course in the proposed area would likely reduce the sediment load in Waialeale stream. Data of Green et al. (1977) showed that diuron in West Loch of Pearl Harbor was associated with sediment. While the levels were not high, sediment was apparently the major source of contamination. Turfed areas would reduce the sediment level because of the permanent nature of turf and the trapping of sediment as it flows through grassed drainage ways.

It is apparent that sugarcane culture has not led to serious contamination of either surface or groundwaters in the site of the proposed golf course, or elsewhere on Oahu. Because of the permanent nature of turfgrass cover, the relatively small area of a golf course to which fertilizers and pesticides are applied, and the nature of

the pesticides used in turfgrass management, there is perhaps less likelihood of contamination of waters by chemicals applied in maintenance of a golf course.

VI. RECOMMENDATIONS

Irrigation management is critical to the conclusions reached above. If excessive irrigation water is applied, the likelihood of contamination of groundwater, especially with nitrate, is increased. 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. Excellent discussion of irrigation scheduling can be found in the book Golf Course and Grounds Irrigation and Drainage (Jarret, 1985).

As our conclusions are also based on sound management practices with regard to fertilizer and pesticide application, we recommend that a well qualified Golf Course Superintendent (preferably a Certified Golf Course Superintendent) be given the responsibility of managing the golf course.

ADDENDUM

The Summary and Conclusions (para. 1, lines 7-9) should have read "There will be little recharge from rainfall in this area except during unusually high rainfall periods. Since such events will occur at infrequent intervals, the leaching of significant quantities of fertilizer nutrients and pesticides is not expected. There is no historical evidence of the leaching of herbicides used in sugarcane production in this area to the Pearl Harbor aquifer, even though irrigation of sugarcane provided much more recharge than will result from irrigation of turf on the golf course. Proper irrigation practices will contribute little recharge, so leaching of chemicals should not be a problem.

VII. LITERATURE CITED

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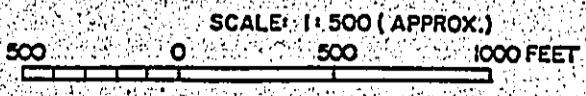
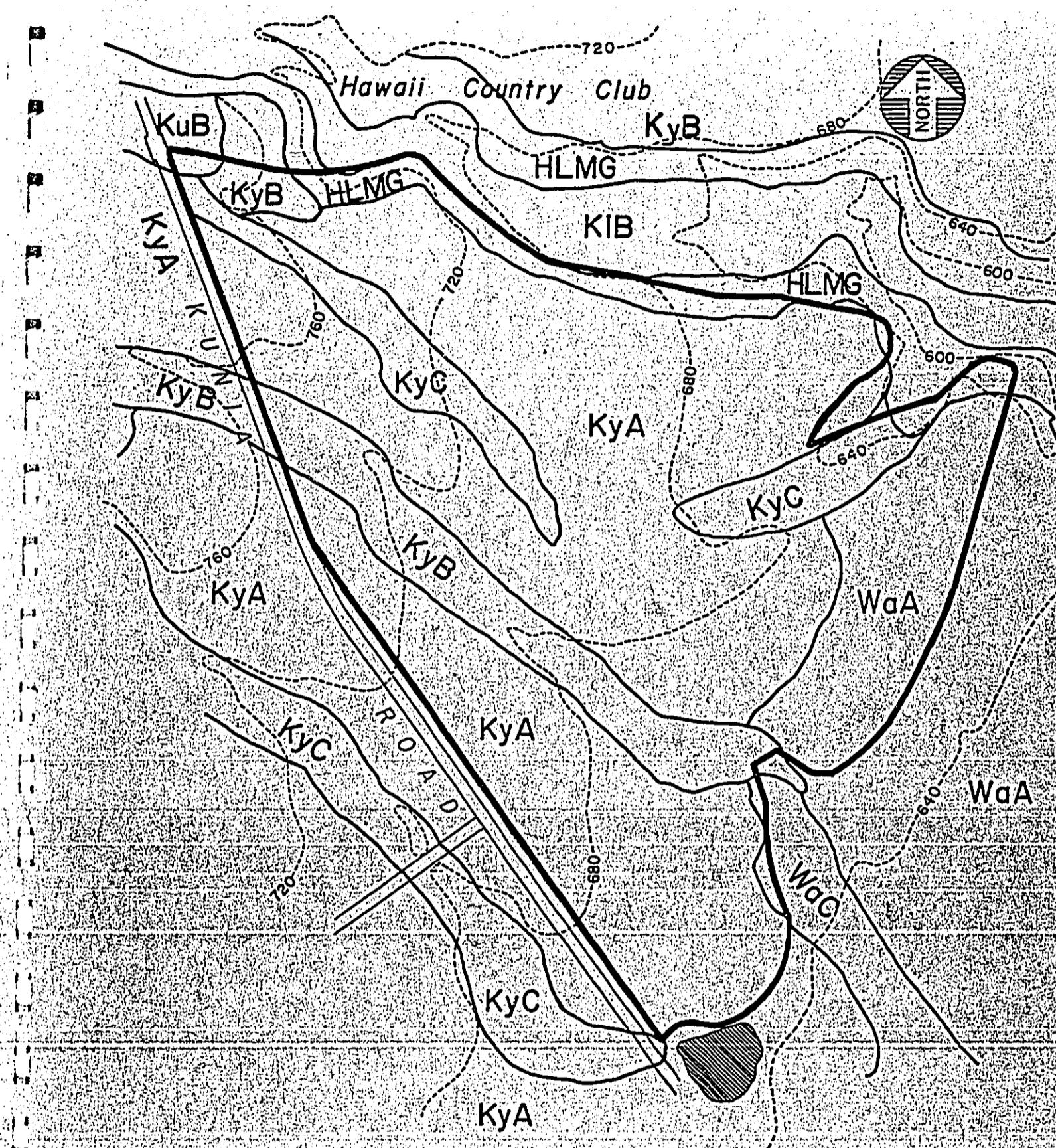
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APPENDIX



HIDA, OKAMOTO & ASSOCIATES, INC.
 CONSULTING ENGINEERS
 HONOLULU, HAWAII

EXHIBIT 8
 DEVELOPMENT PLAN AMENDMENT
 KUNIA GOLF COURSE
 GENERAL BOUNDARIES

SOIL CLASSIFICATION

Appendix Table 1. Properties of pesticides used in turfgrasses in Hawaii.

Pesticide common name	Trade name (s)	Oral LD-50 (mg/kg body wt.)	Toxicity to fish & wildlife	Water solubility	Soil behavior
Herbicides:					
MSMA	WeedHoe etc	1800	Low	Very soluble	Tightly sorbed
glyphosate	Roundup, Kleenup	150	Mod. to birds, none to fish	Very soluble	Inactivated on soil contact
metribuzin	Sencor	2200	Moderate	122 mg/l	Moves readily, Rapidly degraded
2,4-D	part of mixtures	370-700	High to fish	46 mg/l	Rapidly degraded
mecoprop	ditto	700-1500	Low	0.62 mg/l	Moderately residual
dicamba	ditto	1000-2000	Non toxic to fish	0.08 mg/l	Moderately residual
oryzalin	Surflan	10000	Mod. to birds, toxic to fish	2.5 mg/l	Moderately residual
oxadiazon	Ronstar	8000	Toxic to fish	0.7 mg/l	Half-life 1-6 months
propyzamide	Kerb	5620-8350	Low	15 mg/l	Half-life approx. 1 mo.
simazine	Princep	>5000	Low	5 mg/l	Half-life approx. 2-3 mo.
chlorthal-dimethyl	Dacthal	>3000	Low	0.5 mg/l	Residual activity approx. 3 mo.
bensulfide	Betasan, Betamec	770	Mod. to fish	25 mg/l	Tightly sorbed-long residual
parquat dichloride	Ortho Paraquat CL	150	Mod. to birds, none to fish	Readily soluble	Immediate inactivation
benfluralin	Balan	10000	Low to birds, high to fish	<1 ppm	Strongly sorbed
Insecticides					
diazinon	Spectricide	300-850	High	4 mg/l	Readily degraded
chloropyrifos	Dursban	135-163	High	2 mg/l	Slowly degraded, strongly sorbed
benidocarb	Ficam	40-156	High	40 mg/l	Rapidly degraded
carbaryl	Sevin	400-850	Moderate	<1 ppm	No information
trichlorfon	Dylox	450-630	Moderate	154 g/l	No information
Fungicides					
anilazine	Dyrene	<5000	Low	8 mg/l	Half-life 12 hours
benomyl	Benlate	9590	Low	2 mg/l	Half-life 6-12 mo.
chlorothalonil	Daconil 2787	>10000	Low to birds, mod. to fish	0.6 mg/l	Half-life 1.5-3.0 mo.
iprodione	Chupco 26019 RP	3500	Low	13 mg/l	Rapidly metabolized
mancozeb	Dithane M-45	>8000	Low	practically insoluble	No information
quintozone	PCNB, Terrachlor	12000	Non-toxic	0.44 mg/l	No information
thiram	Tersan	7500	Low	30 mg/l	Rapidly degraded
triadimefon	Bayleton	568	Low	260 mg/l	Rapidly degraded
metalaxyl	Subdue	669	Non-toxic	7.1 g/l	Rapidly degraded
thiophanate-methyl	Cleary 3336	7500	Low	3.5 mg/l	Rapidly degraded