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FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

FEB 3 1987

FILE NO.: OA-8/13/86-1947
DOC. NO.: 2426B

Mr. Robin Oura, Project Manager
LANDPRO
800 South Beretania St., 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

SUBJECT: Final Environmental Impact Statement (EIS) on Conservation District Use Application (CDUA) No. OA-1947 for a Golf Course and Accessory Uses at Koolaupoko, Oahu, Hawaii

We have completed our review on your Final EIS submitted on January 5, 1987.

The judgment in question is the acceptability or non-acceptability of the Final EIS in accordance with Chapter 343 Hawaii Revised Statutes, as amended, and Title 11, Chapter 200 Administrative Rules

In our view, acceptance means that the document fulfills the definition of an Environmental Impact Statement (EIS), adequately describes identifiable environmental impacts, and satisfactorily responds to comments received during the review of the statement.

The EIS means to us that an informational document has been prepared in compliance with the rules and regulations promulgated under Chapter 343-5 Hawaii Revised Statutes. This document must disclose the environmental effects of the proposed action, effects of the proposed action on the economic and social welfare of the community and State, effects of the economic activities arising out of the proposed action, measures proposed to minimize adverse effects, and alternatives to the action and their environmental effects.

We find that information has been provided in the final document which adequately addressed the following areas of concern:

Water Resources
Protection of Stream Uses
Erosion and Sediment Control
Archaeological Resources
Alternative Clubhouse Sites
Noise and Wind
Aesthetics
Recreation
Economics

Furthermore, we find that the subject document satisfies all procedural requrements set forth in Chapter 343, Hawaii Revised Statutes and Title 11, Chapter 200, Administrative Rules.

We are of the opinion that a major purpose in accepting or not accepting a statement, as suggested under Title 11, Chapter 200 of the Administration Rules, is that the document adequately discloses environmental impacts and satisfactorily responds to comments.

Considering our focus on the requirements for information and disclosure as having been adequately met, we find the document acceptable under Chapter 343 Hawaii Revised Statutes, as amended, and the Administration Rules.

In our view, the document, in and of itself, should not be used as a vehicle to promote or detract from any required subsequent judgment on the proposed project itself. We have consistently maintained this position on all EIS's prepared for Conservation District Use Applications.

Finally, we should point out that the acceptability of this statement is based upon criteria set forth in Chapter 343 Hawaii Revised Statutes and Title 11, Chapter 200 Administrative Rules. Nevertheless we have concerns, relating to the substance within the document, which will be addressed in the final analysis of your CDUA.

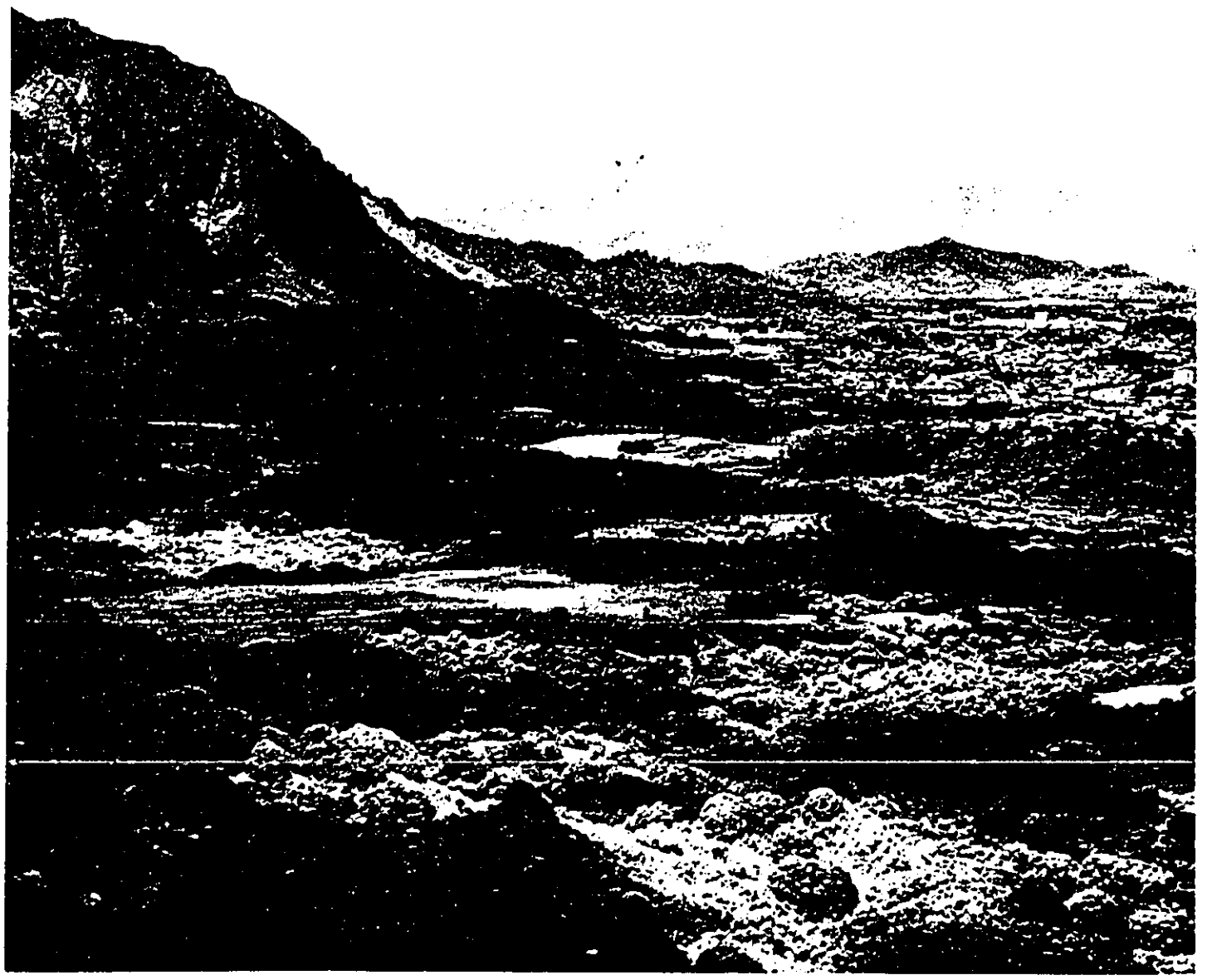
Should you have any questions regarding this matter, please feel free to contact Dean Uchida of our Office of Conservation and Environmental Affairs at 548-7837.

Very truly yours,

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

cc: DHM, OEQC

FINAL ENVIRONMENTAL IMPACT STATEMENT



GOLF COURSE ON IOLANI SCHOOL PROPERTY

ENVIRONMENTAL IMPACT STATEMENT
FOR
GOLF COURSE ON IOLANI SCHOOL, PROPERTY
KANEOHE, OAHU

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

Duk Hee Murabayashi, President

DHM inc.
Environmental Planning Consultant for
the Nitto Kogyo Company, Ltd.

January 1987

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CHAPTER I

I. SUMMARY

Nitto Kogyo Company, Ltd. is proposing to develop an 18-hole world-class championship golf course with accessory uses on Iolani School lands at Koolaupoko, Oahu (TMK 4-5-42:1 and 6). The project area for the proposed golf course consists of approximately 225 acres, and is adjacent to the H-3 right-of-way on the north and Kionaole Road on the east. The golf course complex will consist of the following land uses: 18-hole golf course, clubhouse, driving range, tennis courts, swimming pool, access and parking, drainage improvements and utilities.

The project area is located on lands within the State Conservation District. Therefore, the project will require the approval of a Conservation District Use Application (CDUA) by the Hawaii State Board of Land and Natural Resources. The Department of Land and Natural Resources (DLNR) has determined that an Environmental Impact Statement (EIS) under the provisions of Chapter 343, HRS, is required as part of the CDUA review process. This document was prepared to fulfill that requirement. The Board of Land and Natural Resources is the "accepting authority" for the EIS, as defined by Chapter 343.

Construction of the project will create localized and short-term impacts on noise levels, air and water quality, and views from Pali Lookout **and certain locations of Hoomaluhia Park.** An environmentally sensitive design, use of siltation basins and berms, and prompt landscaping will reduce land disturbance and adverse effects during construction operations. The long-term adverse impacts of increased traffic volume on Kionaole Road and Kamehameha Highway, increased noise and auto emissions, and occasional impact to water quality, are not expected to be significant. Long-term beneficial impacts of the golf course include employment opportunities, positive economic impacts, and preservation of the site as visually attractive, well managed open space.

In response to the public comments and concerns expressed during the draft EIS public review period (Nov. 8-Dec. 8, 1986) and at the CDUA public hearing (Nov. 20, 1986), the clubhouse location has been changed to the former Knowles residence area. The new location is preferred by the City Department of Parks and Recreation and the public.

Discussions related to the orginal clubhouse location is kept in the final EIS. Discussions on alternative clubhouse sites are added in Chapter XI. Alteratives to Proposed Action.

(Corrections and additional discussions to the draft EIS are in **bold** type set in this final EIS.)

CHAPTER II

II. STATEMENT OF PURPOSE AND NEED FOR ACTION

The intent of the proposed project is to develop a world class championship golf course complex which will enhance the sport of golf on Oahu and provide a unique and challenging golfing experience. The proposed golf complex is also expected to afford recreational opportunities including tennis, swimming and dining/banquet facilities for members and their guests.

Although the proposed use, a golf course, is consistent with the use of lands classified as Resource subzone for outdoor recreational uses (Sec. 13-2-13(b)(3)), a Conservation District Use Permit is required to develop this project. This is because the project area for this proposed golf course is located within the boundaries of the Conservation District Resource and General Subzones as defined by the Department of Land and Natural Resources (Administrative Rules, Title 13, Chapter 2; Regulation No. 4). A golf course is consistent with the objectives of the Resource and General Subzones in that it will maintain use of the natural resources of the area by environmentally sensitive design and development such as minimizing grading, and maintaining existing drainage channels. Also, the project area will maintain landscaped open space in an area on the fringe of existing urban development, yet premature for urban development itself.

Golfing is one of the most popular sports on Oahu and the existing courses are heavily used. There are currently 28 golf courses on Oahu, including four courses owned by the City and County of Honolulu, nine military courses, 13 privately owned courses and two resort courses. (Appendix A).

The 1980 Hawaii State Comprehensive Outdoor Recreation Plan identifies golf as an "Action Priority" recreation need on Oahu, representing the highest level of short-term need. In response to the need for more golf courses, several courses, in addition to the subject project, have been proposed at the following locations and are in various stages of planning:

Location	No. of 18-hole Courses
Maunawili	2
Kipapa Gulch	2
Waiawa	2 (possibly 3)
West Beach	2
Kuilima (Kawela Bay)	1
Ewa Marina	1
Waikele	1

Nitto Kogyo Co., Ltd. is a world-wide leading golf course development and operating company with its headquarters in Japan, and subsidiaries in the U. S. and France. Nitto currently has sixteen golf courses throughout Japan and three courses in the USA, 2 in California and 1 in Hawaii - the Makaha Valley Country Club (known as "Makaha East") located on Oahu. Nitto has a total golf course membership of about 35,000.

CHAPTER III

III. PROJECT DESCRIPTION

A. PROJECT LOCATION

The proposed project site is located in Kaneohe, Oahu, and lies southwest (mauka) of Kamehameha Highway between the Pali and Likelike Highways. The subject property is bordered on the north by Hoomaluhia Park, on the east by Kionaole Road which also borders the Pali Golf Course, on the south by the summit of the Koolau Range, and on the west by the Likelike Highway. (Exhibit III-1). The property is identified as Tax Map Key parcels 4-5-42:1 & 6, consisting of 233.075 and 471.540 acres respectively, for a total of 704.54 acres. (Exhibit III-2).

Encumberances within the property include the 33 acre right-of-way for the proposed H-3 Freeway located along the northern edge of the property adjacent to Hoomaluhia Park, one 4.5-acre parcel of leased land, and a HECO easement containing 138 kv and 46 kv transmission lines.

The "Project Area" for the proposed golf course development consists of approximately 225 acres within the 705-acre area. It is located in the northern portion of the property, adjacent to the proposed H-3 right-of-way (R-O-W) and Kionaole Road. The project area does not include the 4.5-acre leased parcel, currently utilized for banana farming.

This Environmental Impact Statement will address the existing conditions and potential impacts of the proposed development within the designated "Project Area" of approximately 225 acres.

B. HISTORICAL PERSPECTIVE

Review of the historical data* suggest that the project area was never heavily populated. Apparently, a sacred hala grove, formerly existed within the project area in the pre-contact period. Early historic documents mention this grove and also indicate that at least one house site may have been located in the vicinity of the project area.

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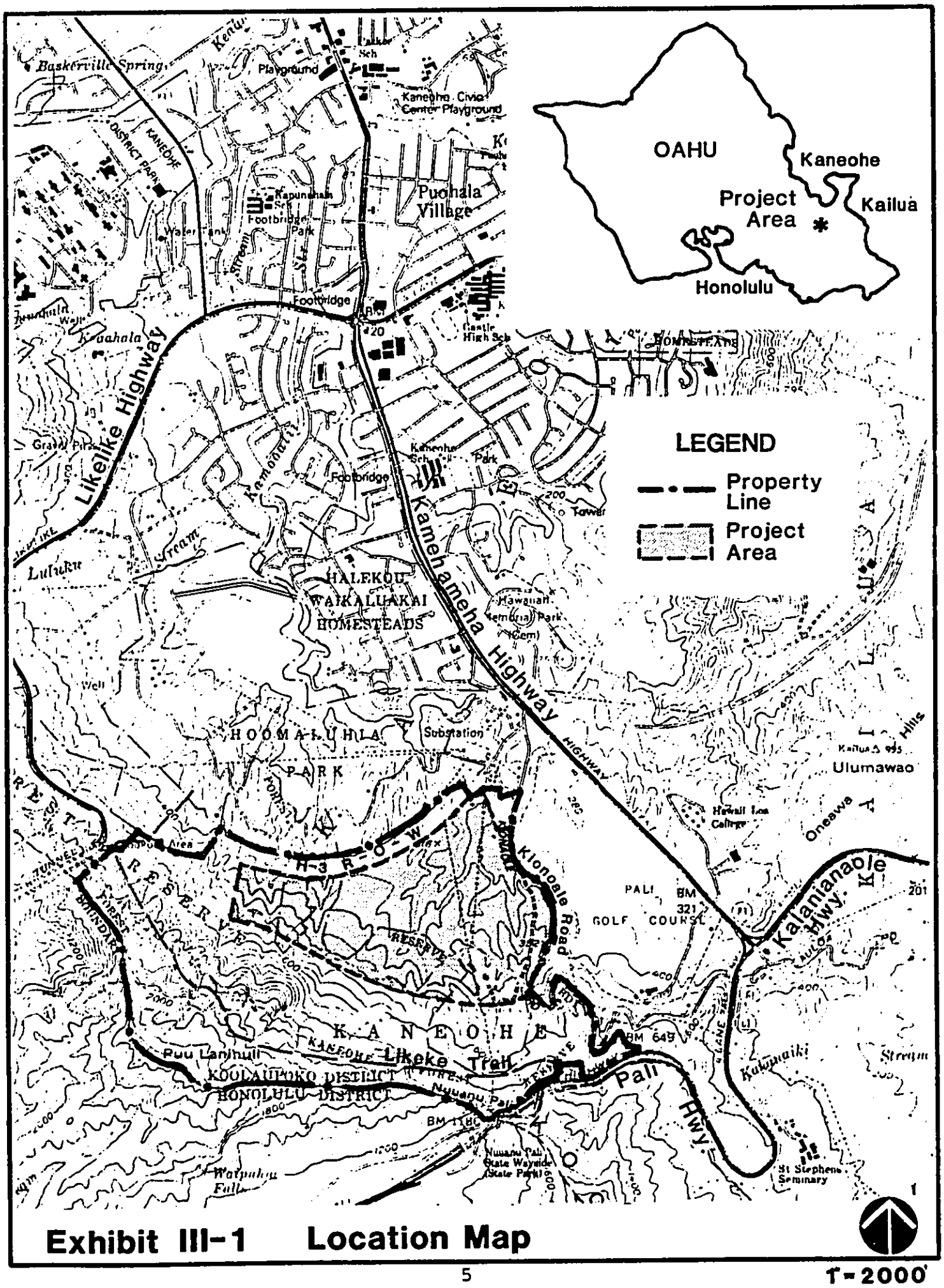
*Shun, Kanalei; Price-Beggerly, Patricia; and Athens, J. Stephen. Archaeological Inventory Survey of an Inland Parcel, Kaneohe-Kailua, Oahu, Hawaii. 1986.


OAHU
Kaneohe
Project Area
Kailua
Honolulu
LEGEND
Property Line
Project Area
Likelike Highway
Kamehameha Highway
Pali Hwy.
Kalanianaole Hwy.
H-3 R-O-W
HALEKOU
WAIKALUAKAI
HOMESTEADS
HOOMALUHIA
PARK
KANEOHE
Ulumawao
Puohala Village
Kaneohe Civic Center Playground
Baskerville Spring
Footbridge
Footbridge Park
Kapunahala Sch
Kaneohe Sch
Castle High Sch
Hawaiian Memorial Park Cem
Substation
Well
Hawaii Loa College
St Stephens Seminary
Nuuanu Pali State Wayside (State Park)
Waipuhia Falls
Ruu Lanihuli
KOOLAUPOKO DISTRICT
HONOLULU DISTRICT
Klonoale Road
GOLF COURSE
PALI BM 321
BM 649
BM 1186
Kaluanui Stream
Kaluaaiki Stream
Luluku Stream
Kaneohe Bay Dr
Kamooalii
Waiahole
Waiahole Ditch
Kaneohe District Park
Kaneohe Bay
Mokapu Area
Tower
Hills
Exhibit III-1 Location Map
1" = 2000'

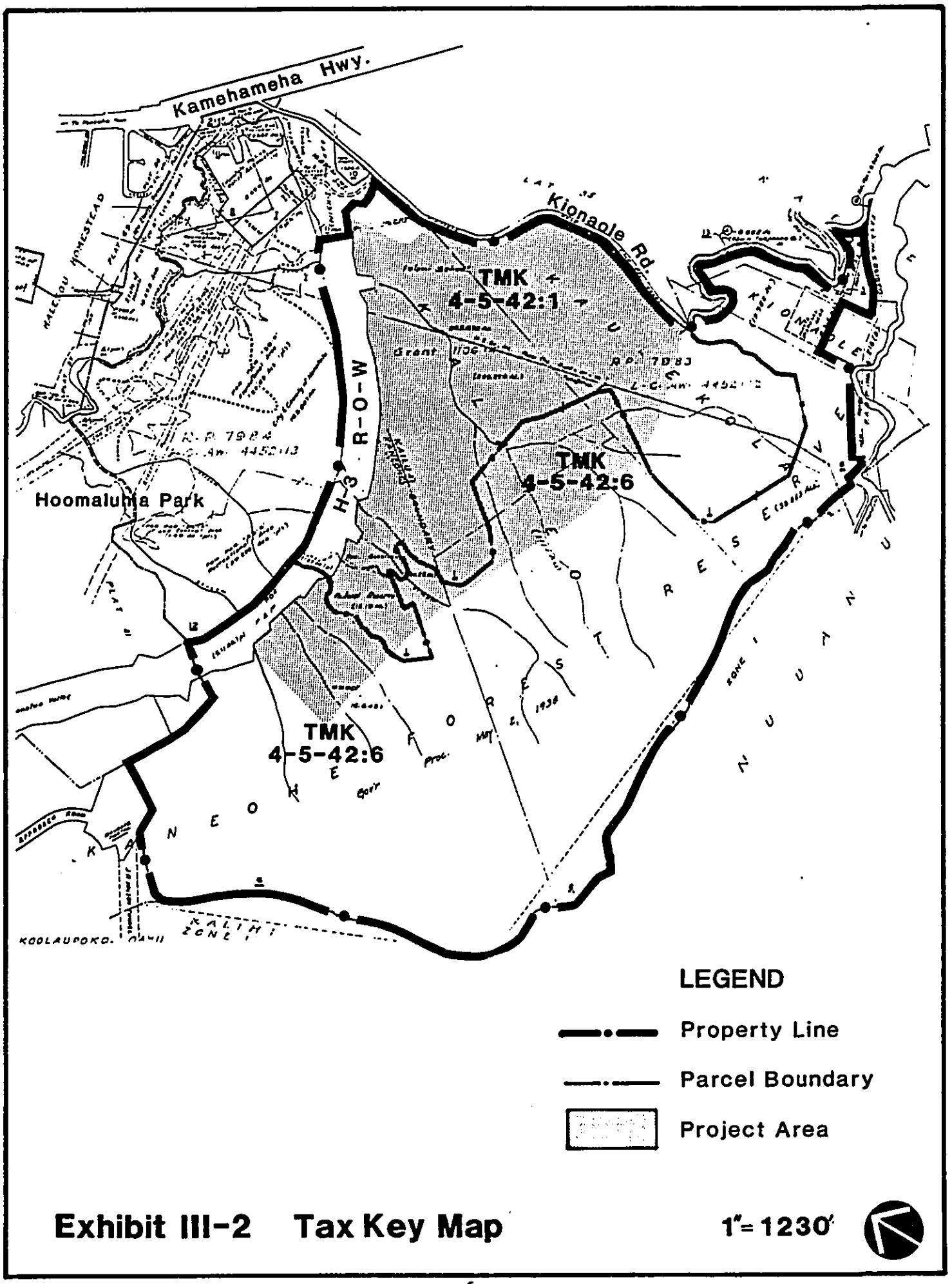


Exhibit III-2 Tax Key Map 1"= 1230'

During the Great Mahele of 1848, Queen Kalama, wife of Kamehameha III, was awarded title to the ahupuaa of Kaneohe and Kailua, including a major portion of the project area. In 1867, the Queen and C. C. Harris established the Kaneohe Plantation to raise sugarcane. Due to the irregular topography, it is unlikely that the project area was used for sugar production. After the Queen's death in 1870, C. C. Harris purchased the lands from the heir, Charles Kanaina. Upon Harris' death in 1881, his daughter, Nannie R. Rice, inherited his lands and continued to purchase land within the study area.

In 1917, Harold K. L. Castle purchased a large number of land parcels from Mrs. Rice including lands within the project area. In the transaction, there was a grant of right-of-way for power lines to the Hawaiian Electric Company. During this time, pineapple cultivation in the area flourished. The pineapple industry was short-lived however, apparently due to insects and poor soil. Also in the 1900-1930 time frame, a number of Japanese Americans leased land within the project area and established truck farms, most of which fronted on the Old Pali Road (now Kionaole Road). The family of S. Sakamoto still leases 4.5-acre parcel abutting the project area.

In the 1930's, a portion of the land was used for grazing dairy cattle; and during the war years, a military camp was located in the vicinity of the project area.

In 1974, upon the death of H. K. L. Castle, his estate donated several parcels of land to Iolani School, including the project area. In an effort to further increase its endowment fund, in 1981 Iolani School proposed development of 971 mixed residential units (single family, duplexes and townhouses) on 383.8 acres of the 975.6 acre property (TMK 4-5-25:23; 4-5-41:1; 4-5-42:1, 6, 8, & 10). The remaining 591.8 acres would be left in open space. For Phase I of the development, Iolani filed a petition in December 1982 with the State Land Use Commission for amendment of district boundaries and reclassification of 201.4 acres from Conservation to Urban (TMK 4-5-41:por of 1 and TMK 4-5-42:pors of 1 & 6, 8, & 10). Phase I proposed construction of 611 mixed residential units on 201.4 acres, and Phase II proposed 360 units on 182.4 acres.

The State Land Use Commission (LUC) required Iolani to prepare and file an Environmental Impact Statement (EIS) prior to receiving consideration of their petition for the reclassification of the project area to Urban District. The EIS and an EIS Addendum were accepted in January 1984. However, Iolani withdrew the petition for State Land Use District boundary change amendment and reclassification in August 1984.

Recently, Nitto Kogyo Company, Ltd. expressed interest in TMKs 4-5-42:1 and 6 of the Iolani property for the development of a world class golf course complex. Iolani School and Nitto are now in the process of negotiating the sale of these portions of the Iolani lands.

Since the project area is located on State Conservation land, a Conservation District Use Application (CDUA) was filed with DLNR on August 13, 1986 for approval of the proposed development. In accepting the CDUA for processing, DLNR has determine that an EIS is required (September 11, 1986). This document has been prepared to fulfill that requirement.

C. PROJECT DESCRIPTION

The proposed golf course project will be designed to achieve a harmonious relationship with the natural environmental resources of the upland Kaneohe site and to be compatible with existing land uses surrounding the site. Natural features of the site, such as streams and stream valleys, varied terrain, significant vegetation, and dramatic views and vistas, will be retained and enhanced. Significant historic and archaeological sites will be preserved and incorporated into the course design wherever possible. Existing agricultural activity adjacent to the project will not be in the proposed project area and may continue and existing tenant allowed to remain.

The 225 acre project area will include the following land uses: (Exhibit III-3)

1. Golf Course

The 18-hole championship golf course will encompass about 180-acres, including fairways, greens, tees, and adequate open space along existing stream beds.

2. Golf Clubhouse

The clubhouse will be located at the west end of the golf course. Panoramic views of the course, the Koolaus, and surrounding area will be enjoyed from the carefully sited clubhouse. Anticipated clubhouse facilities include a pro-shop, dining room, banquet facility for about 500 people, club rooms, locker rooms, offices, and golf cart storage and maintenance area. Tennis courts, swimming pool and outdoor landscaped areas would also be developed as part of the clubhouse complex. Exhibits III-4, 5 and 6 portray a preliminary site layout for the area as well as sections and elevations.

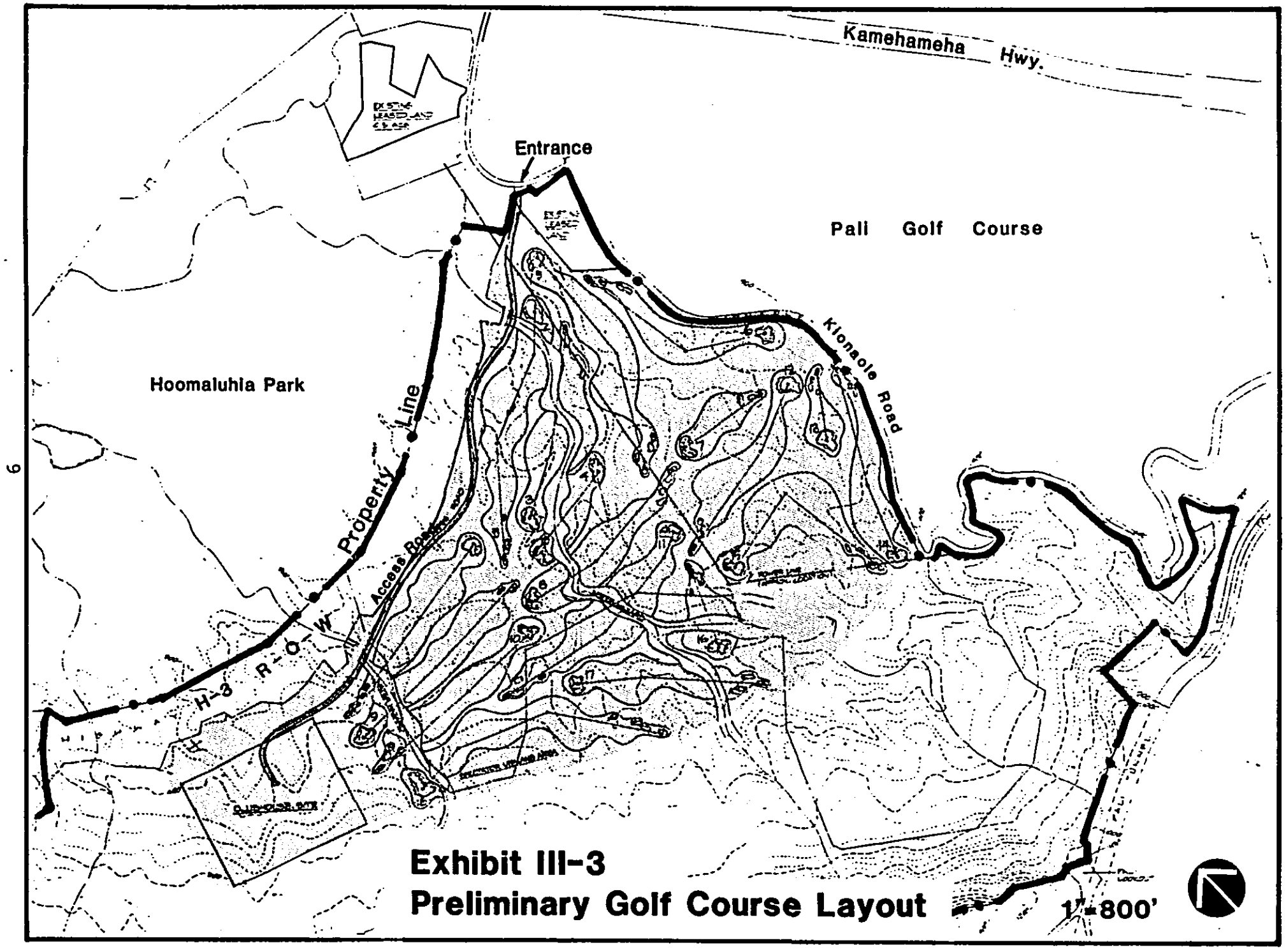


Exhibit III-3
Preliminary Golf Course Layout

1" = 800'

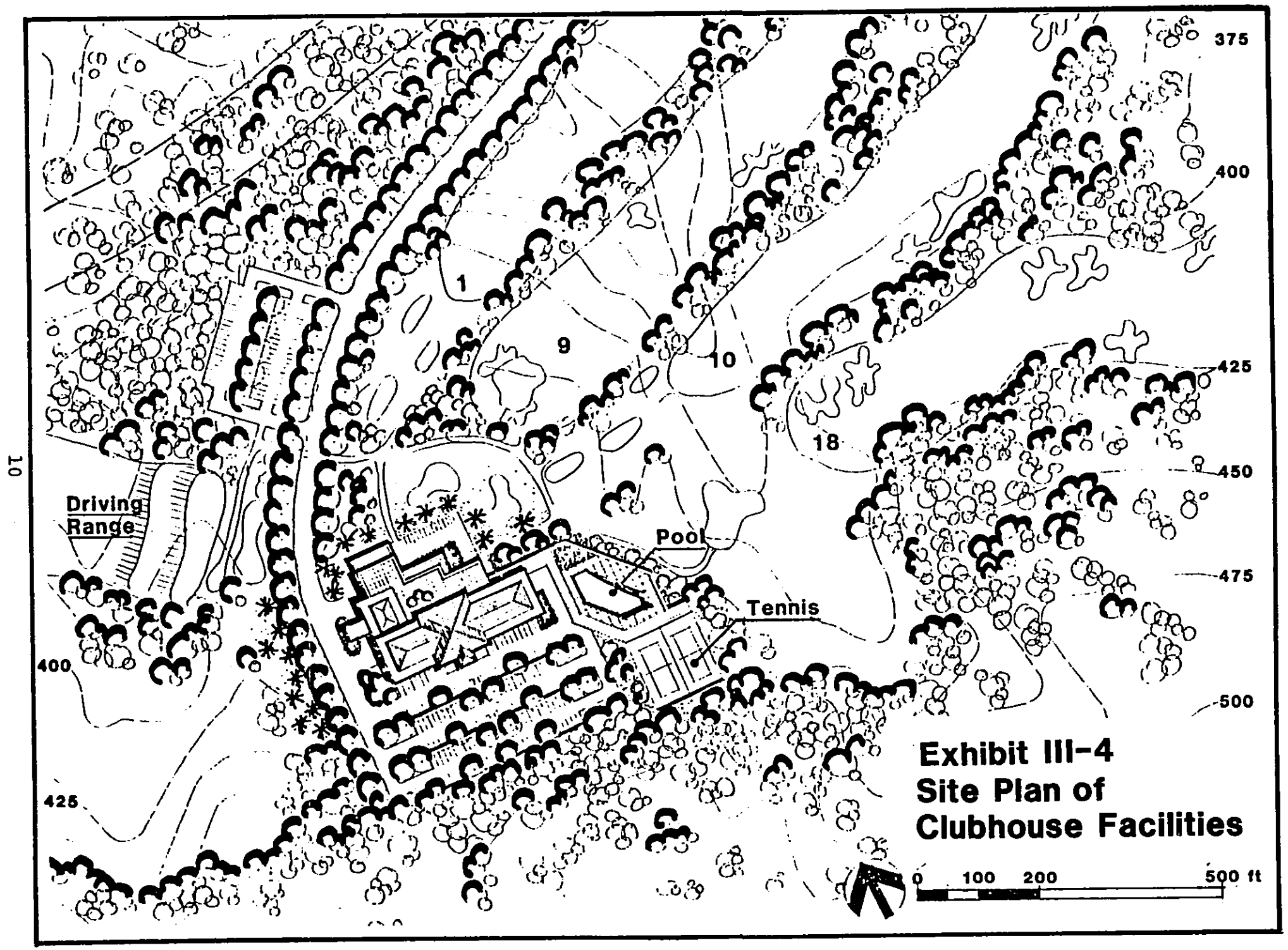
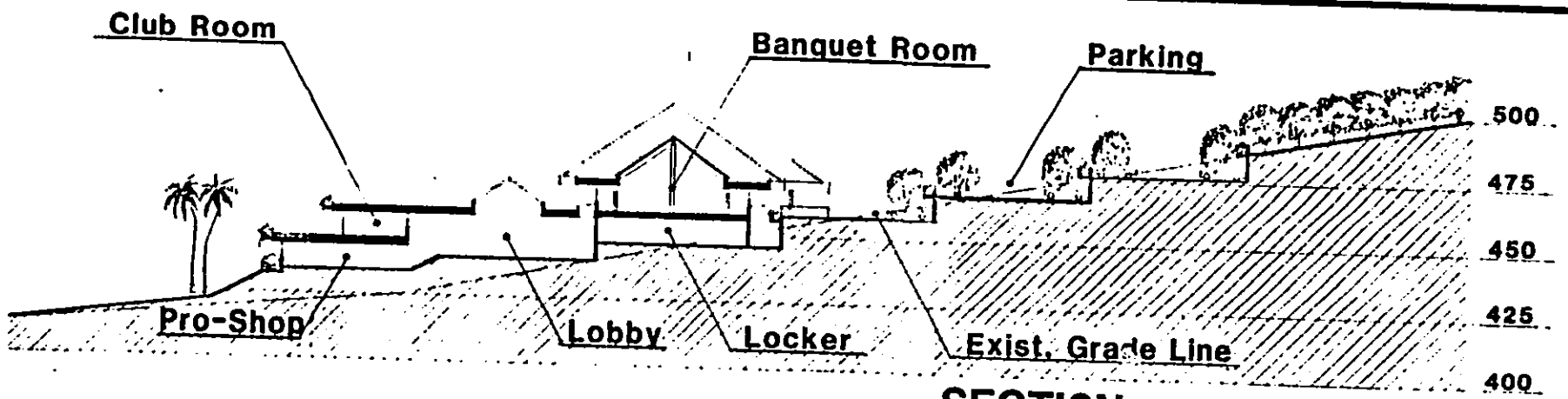
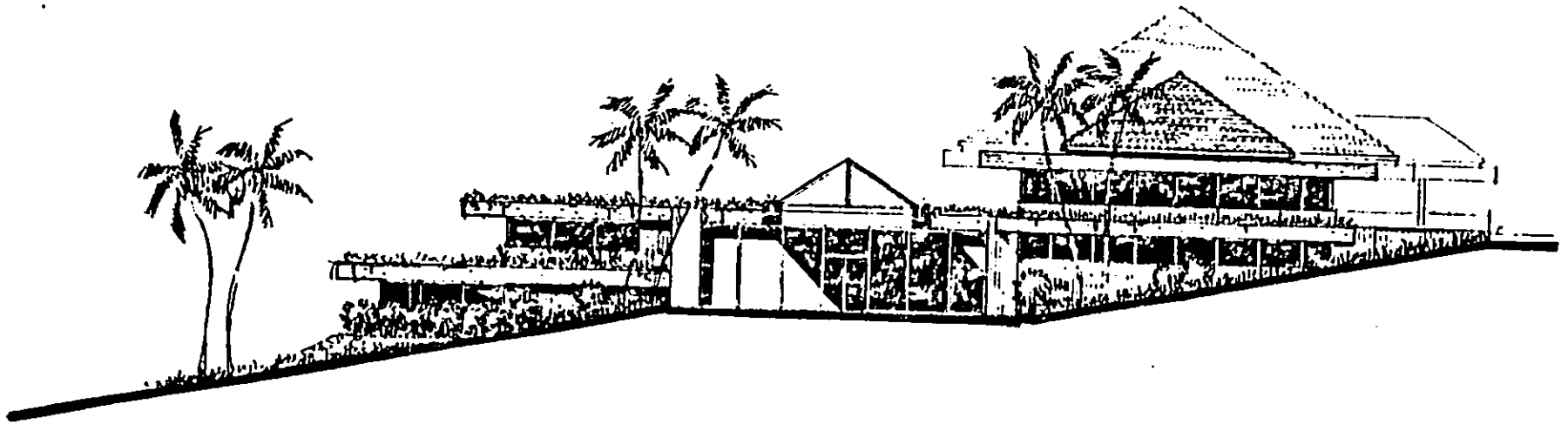


Exhibit III-4
Site Plan of Clubhouse Facilities

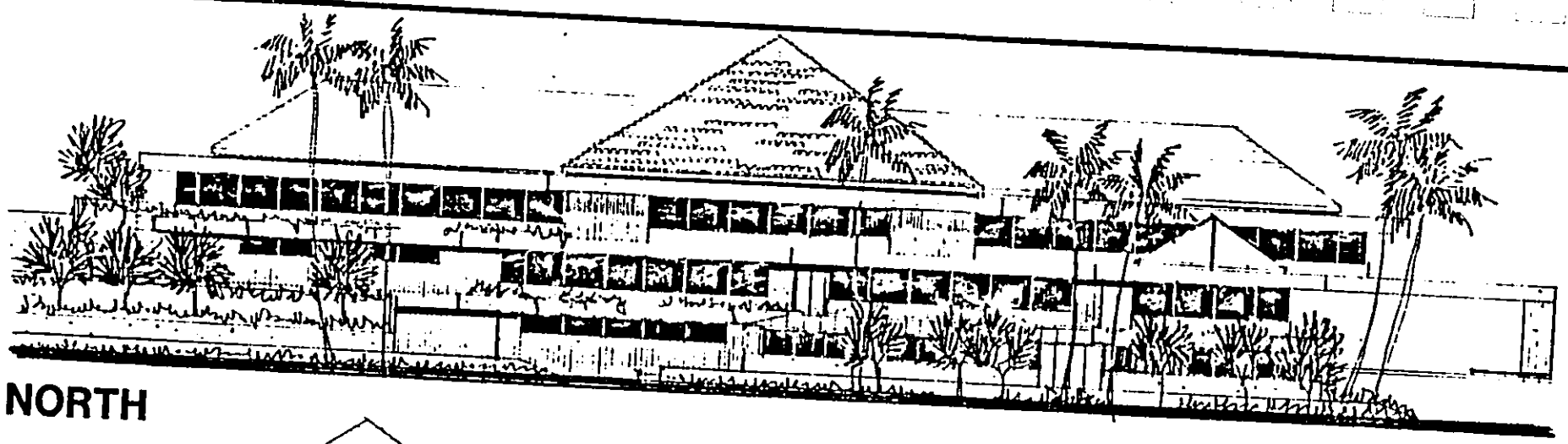


SECTION
CLUBHOUSE FACILITIES
0 20 50 100 200 ft.

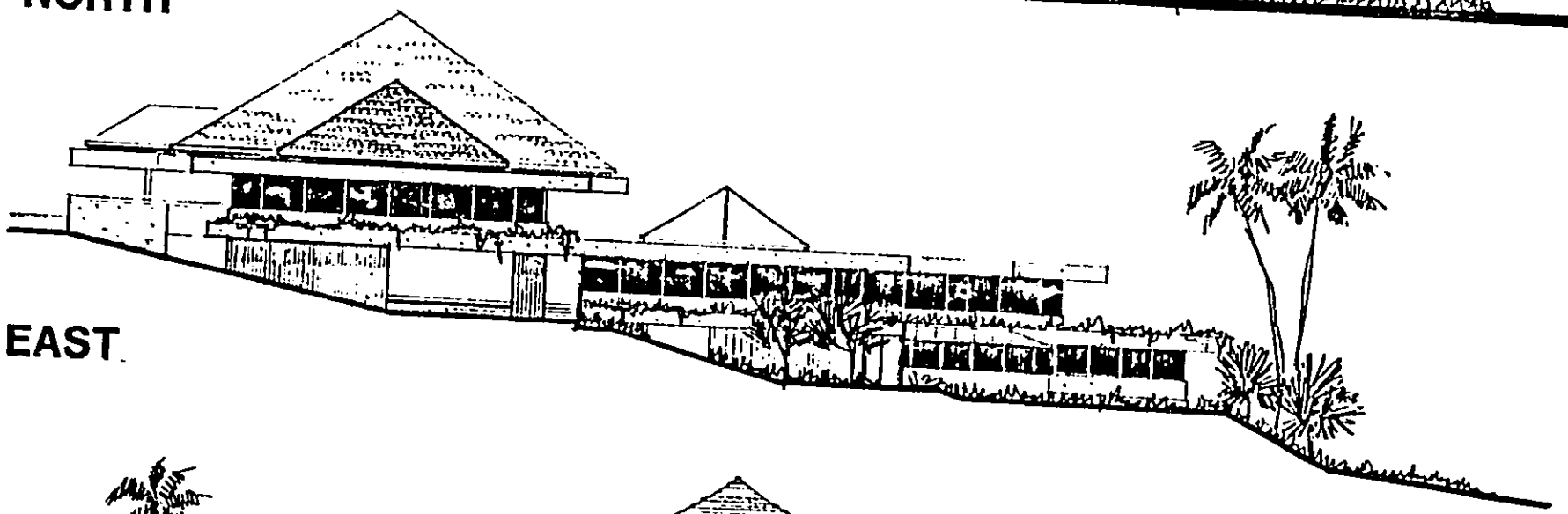


ELEVATION - WEST
CLUBHOUSE FACILITIES
0 10 20 50 100 ft.

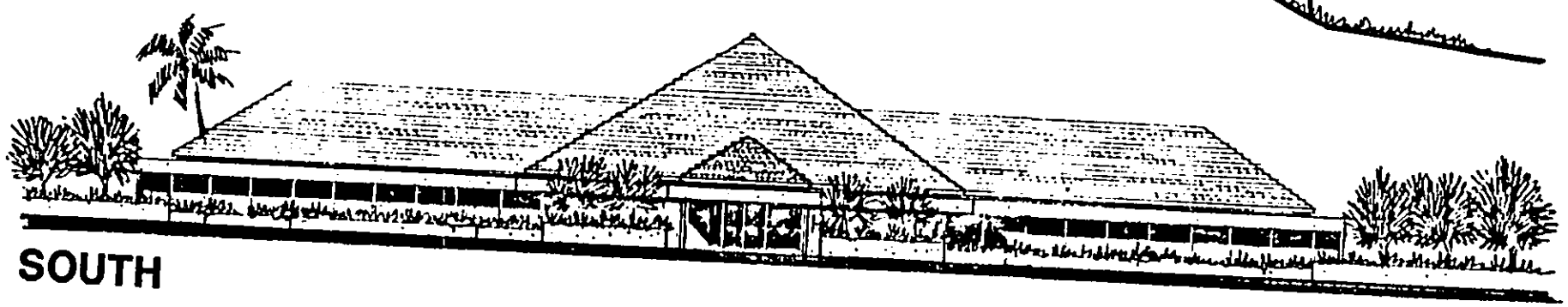
Exhibit III-5 Section and Elevation of Clubhouse



NORTH



EAST



SOUTH

Exhibit III-6 Elevations of Clubhouse

0 10 20 50 100ft.

3. Golf Driving Range

Plans include a golf driving range with 30 practice tees and putting green. It will be approximately 1-1/2 acres and will be located near the clubhouse area.

4. Access and Parking

The access road to the golf course will approximately parallel the proposed H-3 right-of-way from Kionaole Road at the northeast corner of the project area to the clubhouse site, a distance of about 3,400 feet. The road will have a paved asphaltic concrete finish approximately 22 feet wide. A second road to the maintenance facilities, with a paved width of approximately 18 feet, may also be provided. Its location is not specified yet.

About 150-200 parking stalls will be provided at the clubhouse, utilizing 1-1/2 to 2 acres of land. The parking area will be primarily at grade, however a partial structure may be used to incorporate the parking into the existing slope and to minimize grading.

5. Drainage

The golf course will maintain existing drainage patterns and will utilize overland flow to existing gulches and streams. Retention and sediment basins will be incorporated into the golf course design to minimize storm runoff, soil erosion, and sedimentation of the Loko Waimaluhia Reservoir in Hoomaluhia Park. (Exhibit III-7).

The planned drainage improvements include shallow swales/ditches in the clubhouse area and along the access road. Culverts are also planned at gully and stream crossings, unless existing terrain requires bridges across the Kamooalii and Hooleinaiwa streams. Drainage solutions for most crossings will be based on the 50-year storm runoff flows while the major stream crossings will be based on the standard project flood flows. Grading will be minimized by establishing greens, tees and fairway landings close to existing elevations.

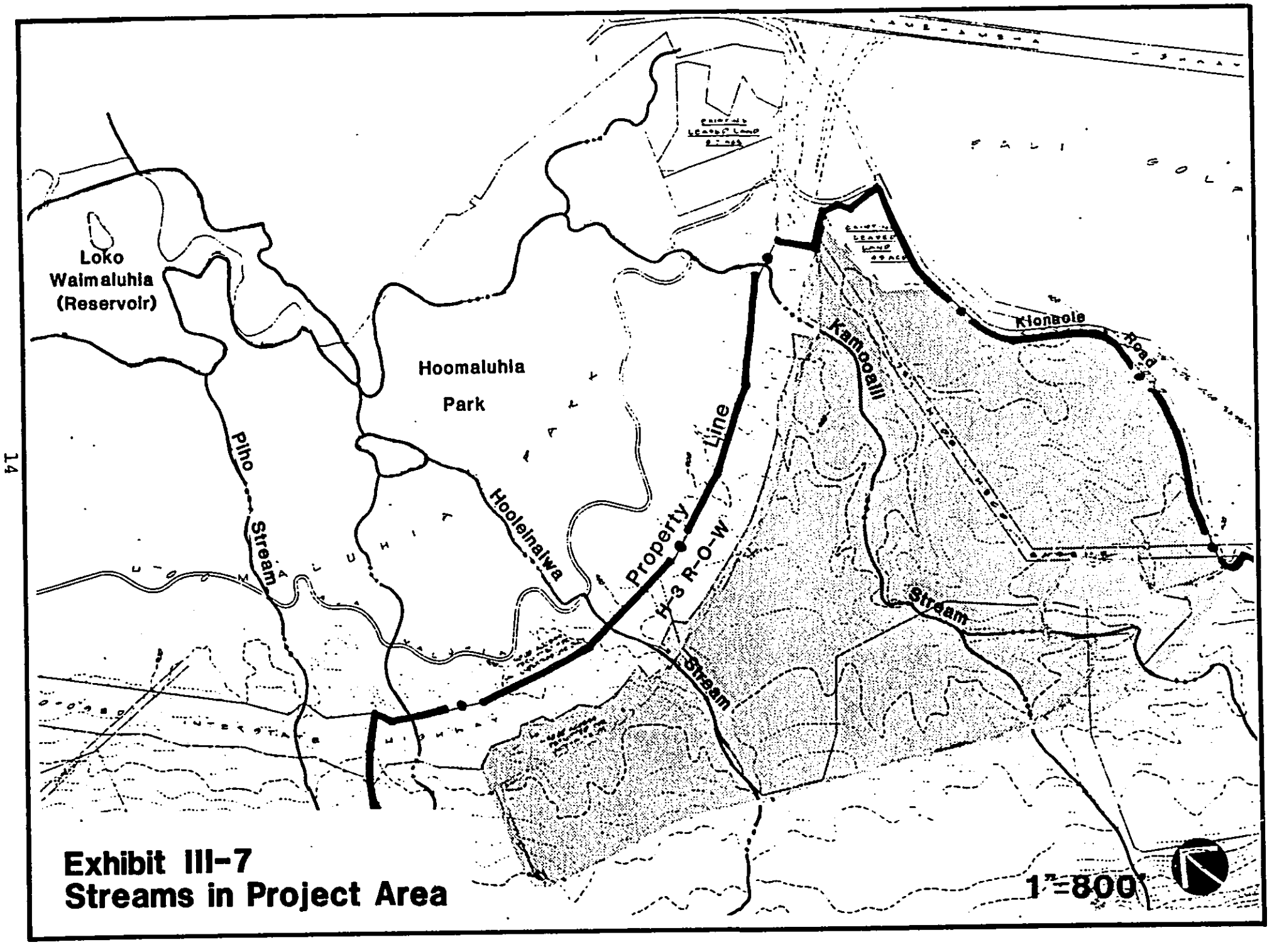


Exhibit III-7
Streams in Project Area

6. Utilities

Because the project site is currently vacant, it is not served by public utility systems. Proposed utility development is described below:

a. Water Supply

Water requirements for the project generally fall into three categories: potable domestic water, fire protection, and landscape irrigation. Depending on available water supply, 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. 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 or landscape irrigation.

(1) Potable domestic water alternatives. The estimated average daily potable water demand, primarily for the clubhouse, is approximately 20,000 gallons per day (gpd). Alternative water supply schemes are as follows:

o Scheme A

Tap the 12-inch Honolulu Board of Water Supply (BWS) main in Kamehameha Highway and install a meter and a 4-inch main along the access road to the clubhouse site, a distance of about 4,600 feet. Since the clubhouse will be situated above the BWS "500" water service zone,* a booster pumping station with a backflow prevention system will be required, together with a water tank located above the clubhouse for emergency storage and pressure stabilization (Exhibit III-8). Everything beyond the meter would be a private system to be operated and maintained by the developer.

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*The "500" water service zone is that area served by a reservoir with water elevation 500 feet.

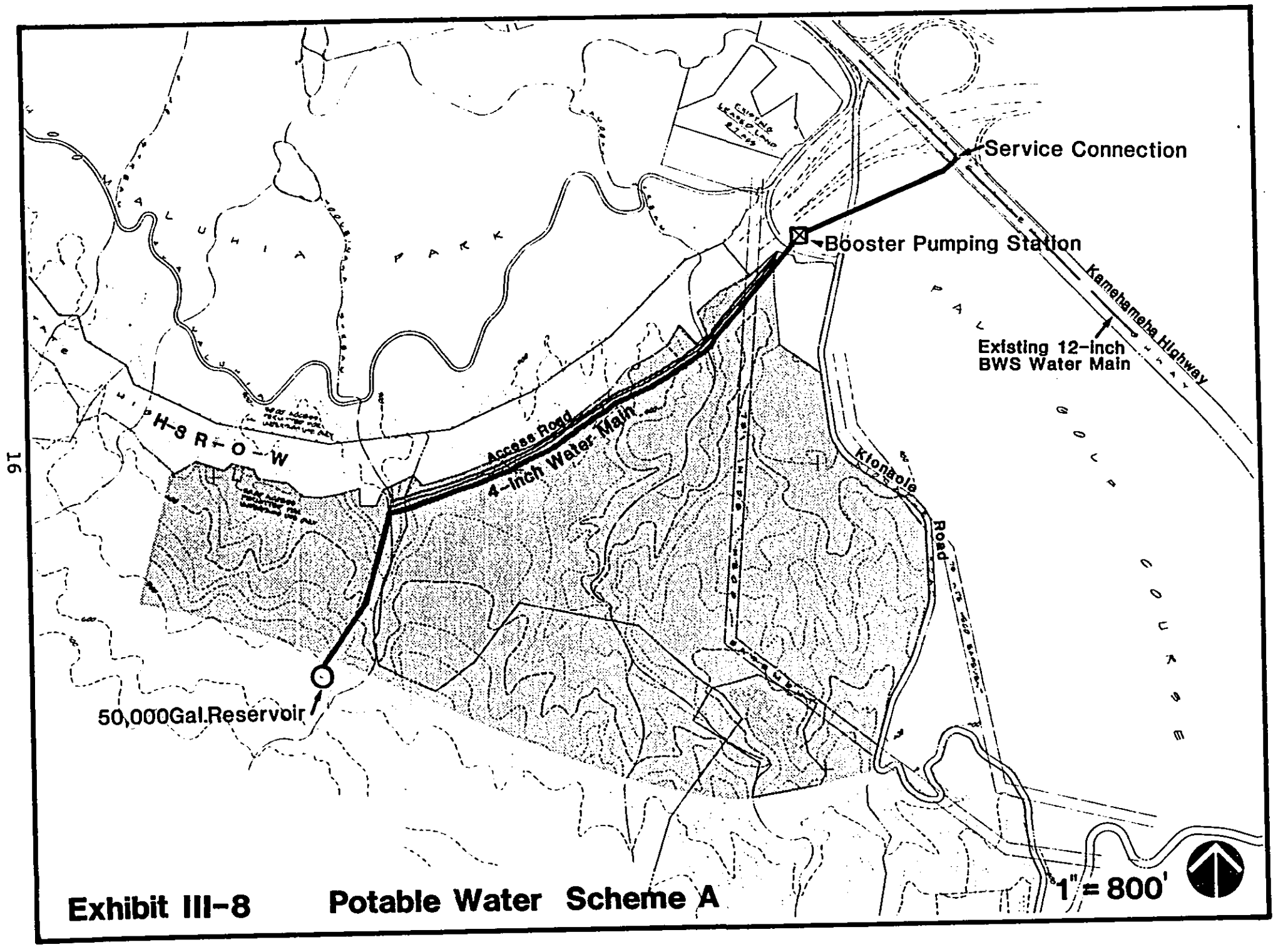

Exhibit III-8 Potable Water Scheme A

- Scheme B

  Utilize the new Kamooalii I Well drilled by BWS which has a capacity of 60,000 gpd - more than adequate for the potable water needs. A water tank located above the clubhouse will be required to provide emergency storage, pressure stabilization, and a 24-hour "live" system (Exhibit III-9). This system would be totally private and some arrangement must be negotiated with BWS to use the well.

- Scheme C

  Drill a new well near the clubhouse site (Exhibit III-10). If the yield of the new well is large, it could be used to satisfy all of the project water requirements. In addition, if the capacity significantly exceeds the project water demand, the well(s) may be dedicated to the BWS. If the new well yield is small, it could be used to supply just the potable water needs. In this event, the well and water must satisfy standards established for potable water sources, and the system will be private. As with other alternatives, a water storage tank will be required.

(2) Landscape irrigation and fire protection water alternatives. The water for landscape irrigation and fire protection need not be potable. The landscape irrigation demand is expected to average about 250,000 gpd during the year, and may increase to a maximum demand of around 500,000 gpd during dry periods. The 250,000 gpd annual average is based on information provided by the Pali Golf Course staff. For prolonged dry periods, a maximum application rate of 1-1/2 inches per week was assumed. Based on BWS standards, fire protection requirements for the clubhouse would be 2,000 gallons per minute (gpm) for a 2-hour duration or a reserve of 240,000 gallons. Alternative water supply schemes are as follows:

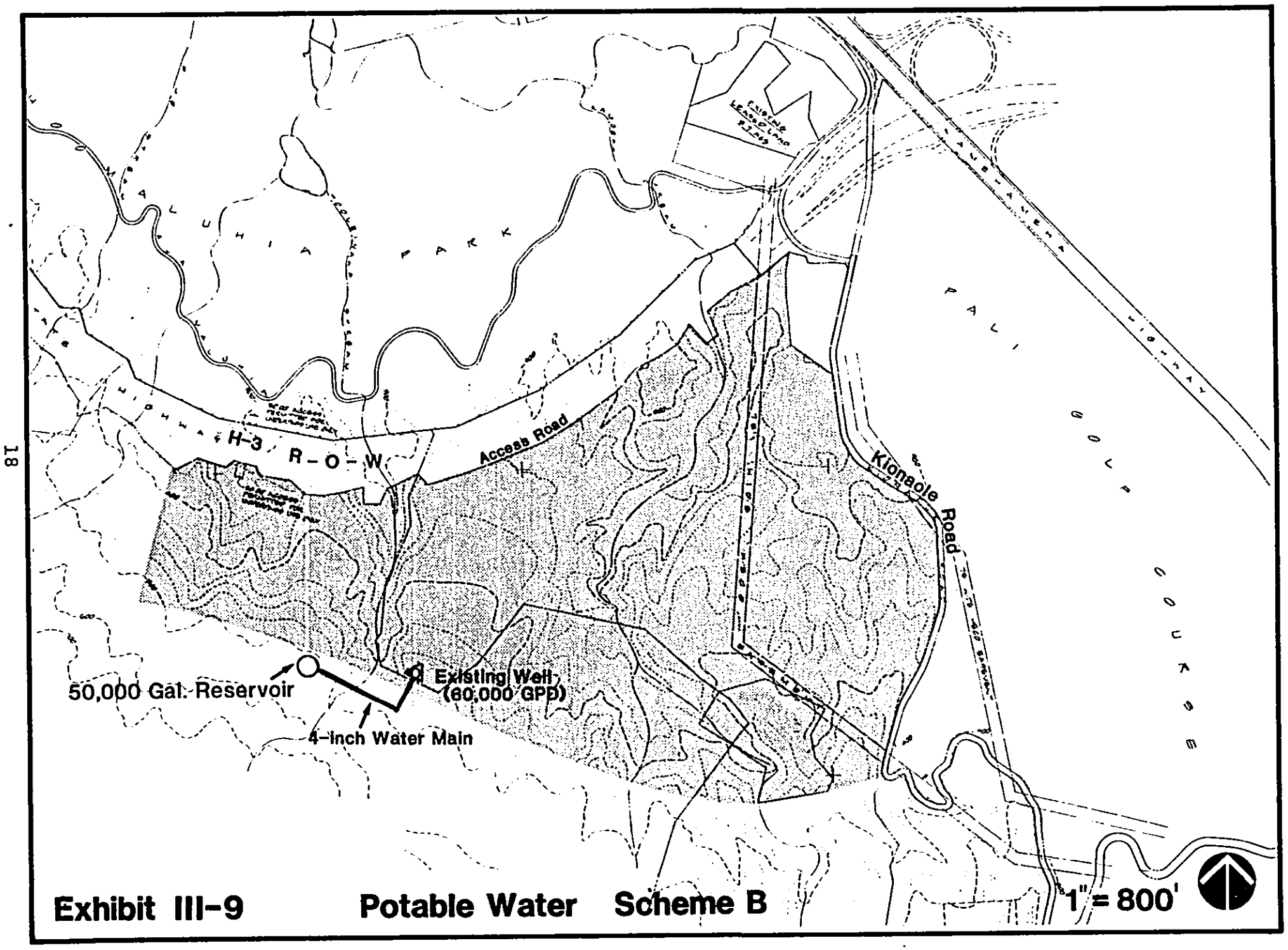

Exhibit III-9 Potable Water Scheme B

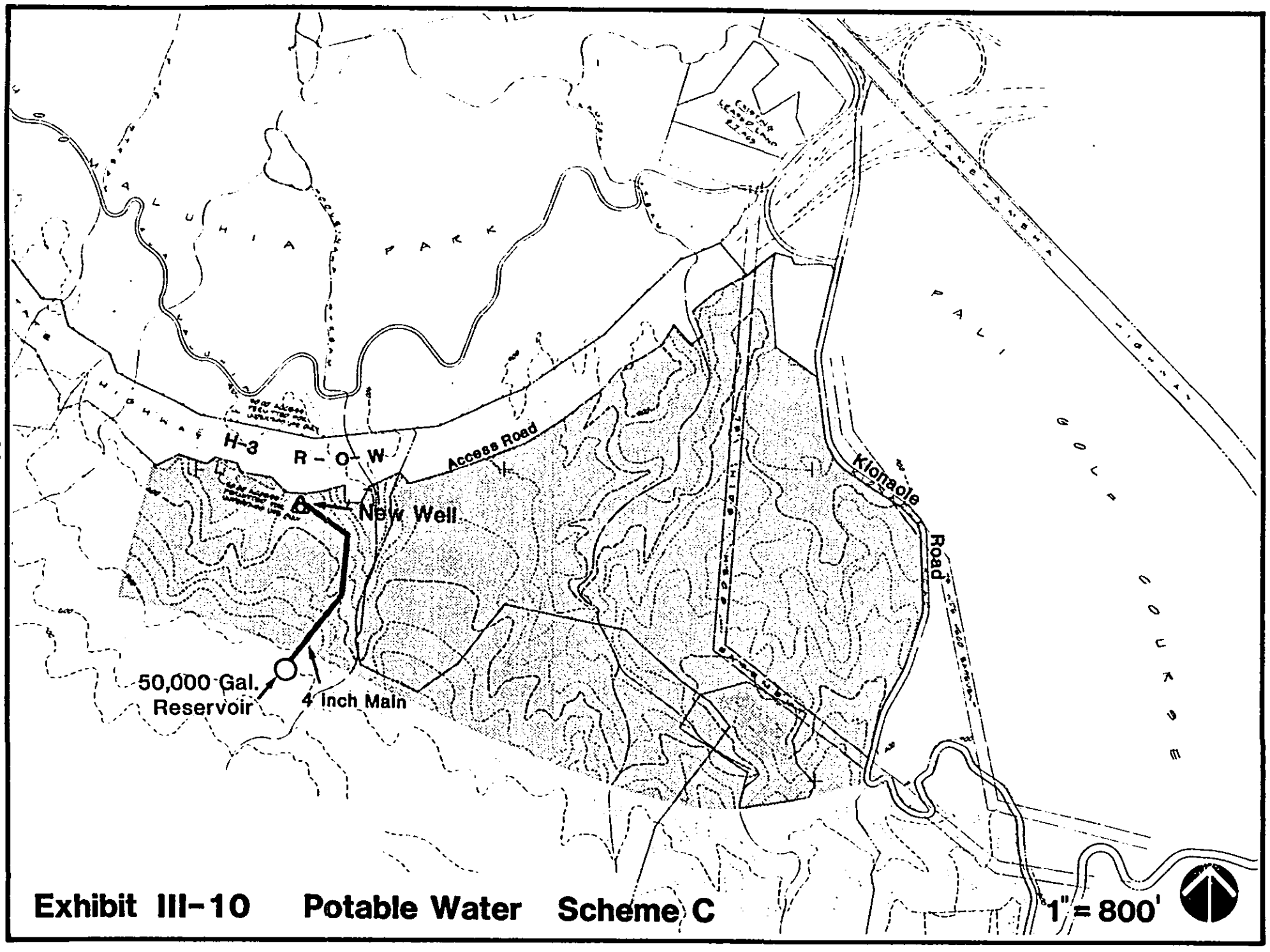

Exhibit III-10 Potable Water Scheme C

- Scheme 1

  Connect to the BWS system. Install pumping stations, transmission mains and water tank, as necessary. This scheme is similar to the Potable Domestic Water Alternative Scheme A. (Exhibit III-11).

- Scheme 2

  Drill new well(s) near the golf course or clubhouse to furnish the irrigation water and construct a water tank above the clubhouse. If the capacity of the well(s) exceeds the irrigation demand and meets BWS drinking water standards, the system may be dedicated to the BWS. If not, the system may be private and would not have to meet the drinking water standards. This scheme is similar to the Potable Domestic Water Alternative Scheme C. (Exhibit III-12).

- Scheme 3

  Utilize the existing wells located at the Halekou Interchange, with approval from BWS. Install new pumps and controls, construct a new water tank above the clubhouse, and install a 10-inch interconnecting transmission main. This system would also be the source for fire protection. The mains and storage tank must be sized to satisfy both the irrigation and fire protection requirements. (Exhibit III-13).

b. Wastewater System

To protect potential groundwater supplies, the Board of Water Supply and the State Department of Health have established the "pass/no pass" line above which cesspools or wastewater ground injection (leaching) disposal systems are not ordinarily permitted. Since the golf course and clubhouse are located above the "no pass" line, it will be necessary to collect the sewage generated by the clubhouse complex and to convey it to the City's wastewater system.

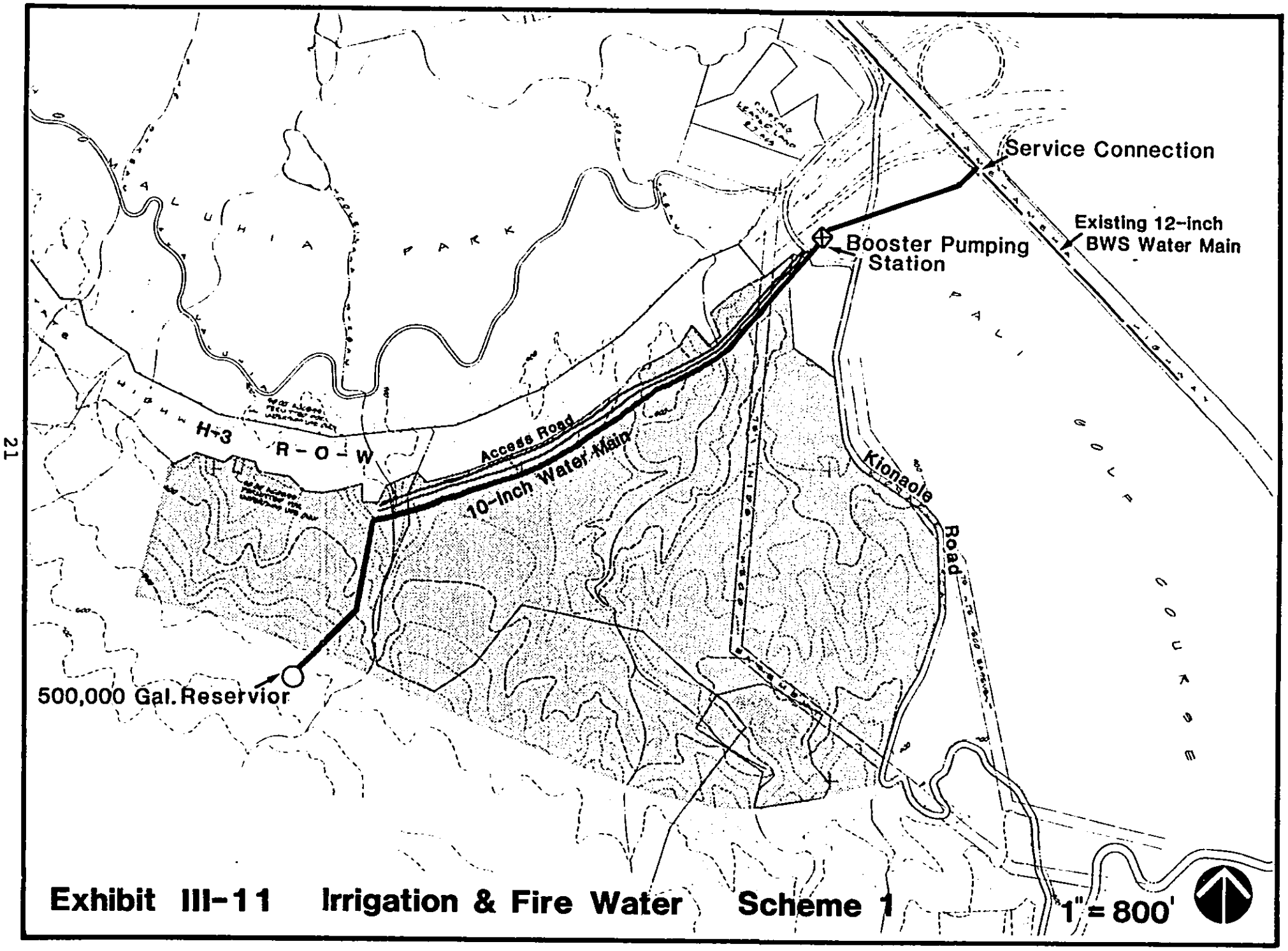

Exhibit III-11 Irrigation & Fire Water Scheme 1

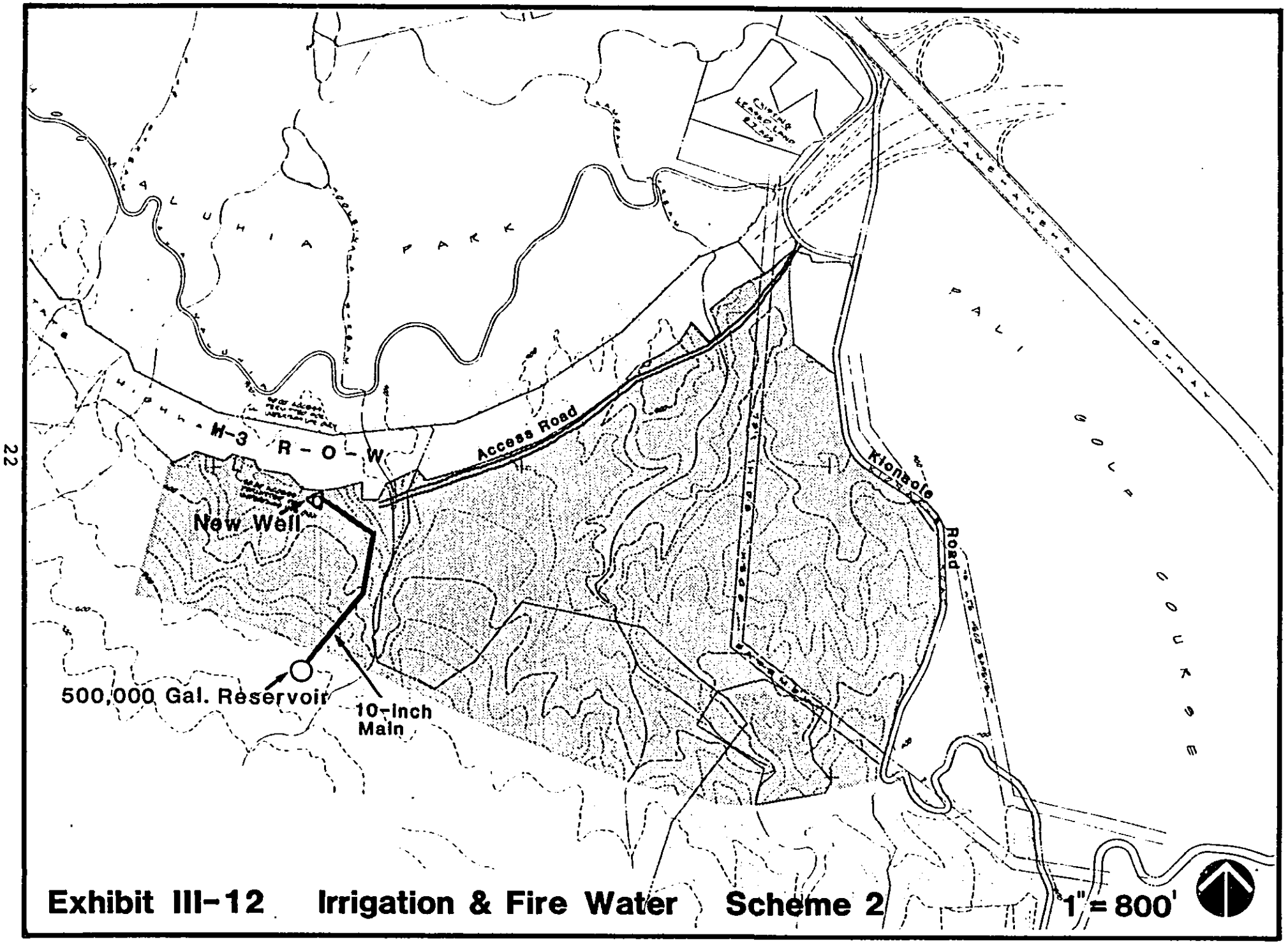

Exhibit III-12 Irrigation & Fire Water Scheme 2 **1" = 800'**

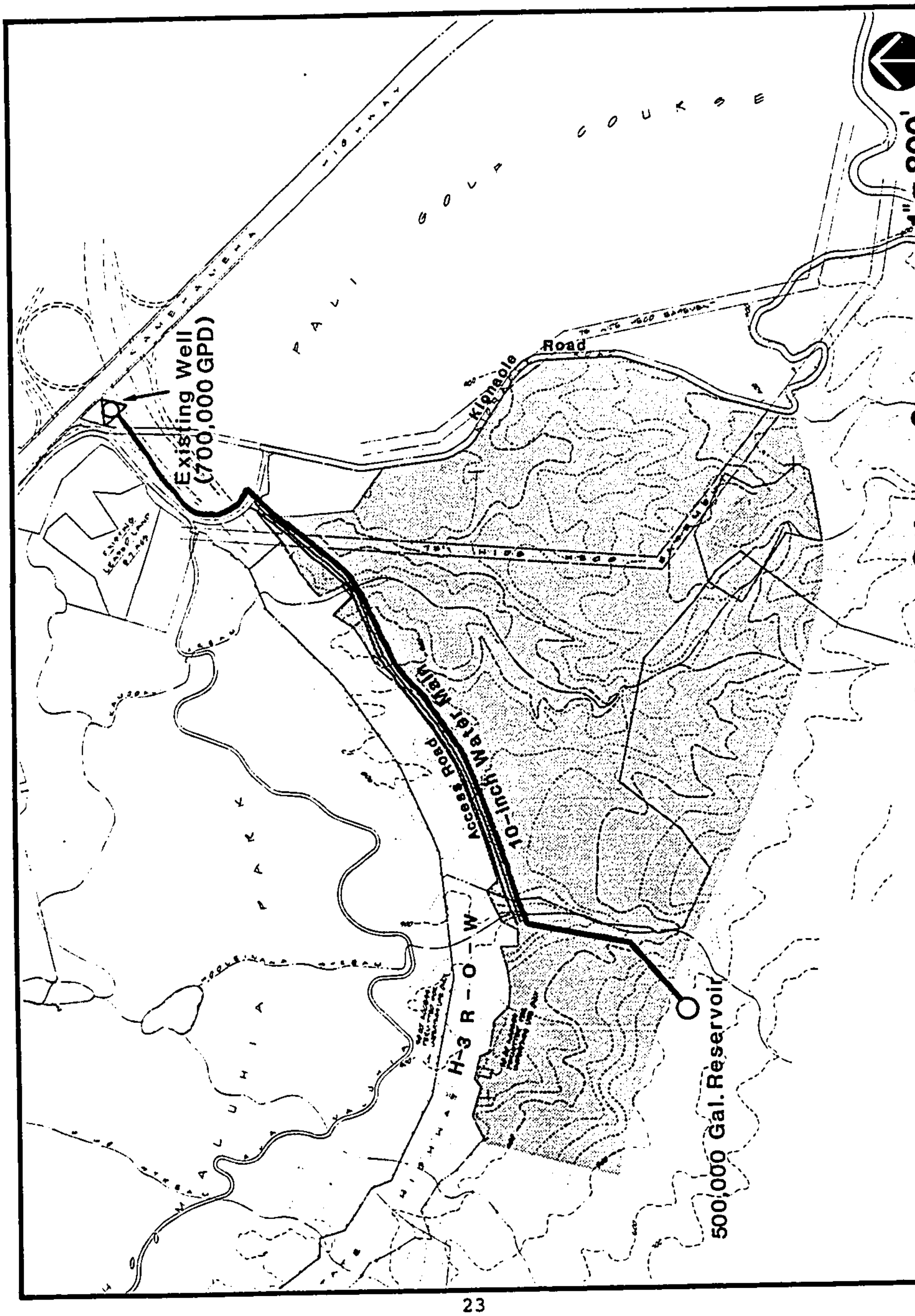

Exhibit III-13 Irrigation & Fire Water Scheme 3

The average daily wastewater from the Clubhouse is estimated to be approximately 20,000 gallons per day. The proposed system will consist of a six-inch gravity sewer from the clubhouse site to the existing city sewer in Ho'omaluhia Park across the proposed Interstate Route H-3, a distance of about 1,000 feet (Exhibit III-14). Design of the system will be coordinated with the Department of Parks and Recreation and the Department of Public Works, Wastewater Division. Easements for the private sewer will have to be executed with the City and County of Honolulu and the State of Hawaii within the park and H-3 right-of-way respectively. The developer will construct and pay for all improvements to the point of connection.

An alternative scheme would involve a wastewater pumping station located near the clubhouse with a long force main to convey the sewage to the existing municipal wastewater pumping station situated near the Kionaole Road intersection with Kamehameha Highway. This system is not an attractive solution, however, because of the high construction cost and the need for a pumping station that will incur perpetual operation and maintenance requirements.

c. Electrical and Communication Systems

Telephone service will be extended from the existing system in Kionaole Road. This system is part of the Kaneohe network.

Electrical service will be extended to the clubhouse area from an underground 12 kv power line in Kionaole Road. There is a manhole close to the proposed access road intersection with Kionaole Road. Lighting will also be provided along the access road and at the driving range. All improvements will be coordinated with Hawaiian Telephone Company and Hawaiian Electric Company.

D. DEVELOPMENT SCHEDULE

Construction of the project is scheduled to begin in June 1987 and to be completed in 2 years. The golf course will open about 6 months thereafter.

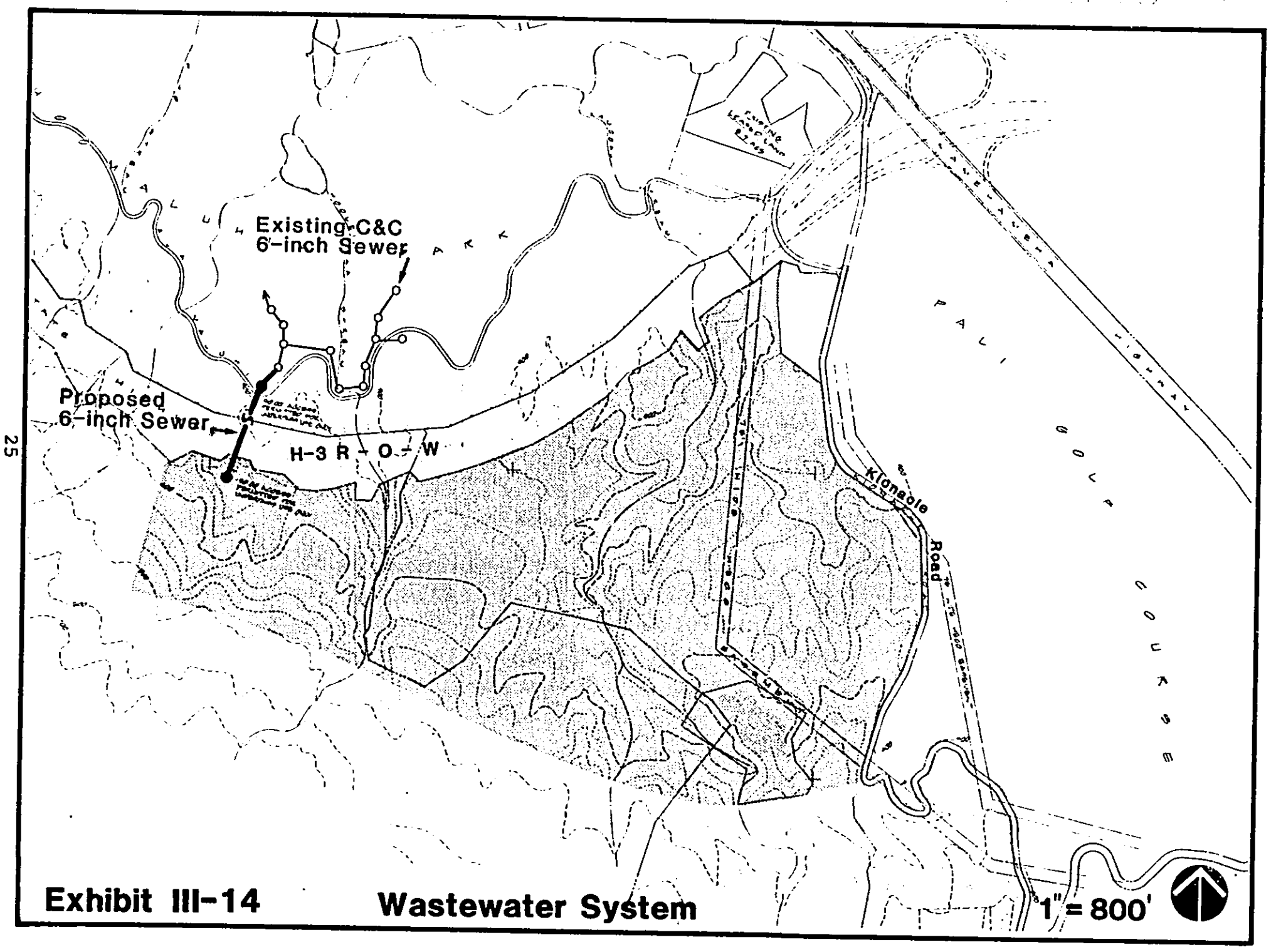

Exhibit III-14 **Wastewater System**

E. FUNDING

The total development costs for the golf course, buildings and infrastructure, including design and planning fees, are estimated to be in the range of $30 million. The cost estimate does not include costs of land, anticipated financing, general corporate overhead, or property and income taxes. The project will be primarily developed at the developer's expense.

CHAPTER IV

IV. EXISTING ENVIRONMENTAL SETTING

A. EXISTING LAND USES

1. Project Area

A 75' wide Hawaiian Electric Company (HECO) easement crosses through the eastern portion of the project area. (Exhibit IV-1). The easement contains steel lattice towers about 150' tall and 18' x 18' at the base supporting 138 kv and 46 kv transmission lines. **A second 25' wide easement containing wooden poles and 46 kv lines also crosses through the site.** The lines terminate at the Koolau Substation located north of the proposed H-3 R-O-W near Kamehameha Highway.

An 8.9 acre parcel of former life-estate leased land is included in the project area. The leasee passed away in early 1986, and the land was reverted back to Iolani School. However the caretaker is presently residing on the land.

2. Surrounding Area

The Pali Golf Course is on the Kailua side (east) across Kionaole Road. The Koolau Mountains and Kaneohe Forest Reserve are to the south and west. The H-3 right-of-way, Hoomaluhia Park, and single family dwelling units in Halekou Waikaluakai Homesteads are makai (north) of the project area, with the closest residences in the Homesteads being about 1/2 mile from the project. (Refer to Location Map Exhibit III-1).

The eastern edge of existing agricultural lease lands, known also as the "Luluku banana farms", is one-half mile northwest of the proposed golf course.

A 4.5 acre parcel of land on the northern end of the site, adjacent to Kionaole Road, is leased to Mr. Sakamoto who **raises flowers** on the land. (Exhibit IV-1). The golf course design allows it to remain intact.

B. GEOGRAPHIC CHARACTERISTICS

1. Topography

The elevation of the project area ranges from approximately 300-feet to 500-feet. (Exhibit IV-2). Slopes on the site range from 3% to an excess of 40%. Most of the golf course area has slopes between 0% and 20%, interrupted by ridges and valleys which form natural drainage ways and open space.

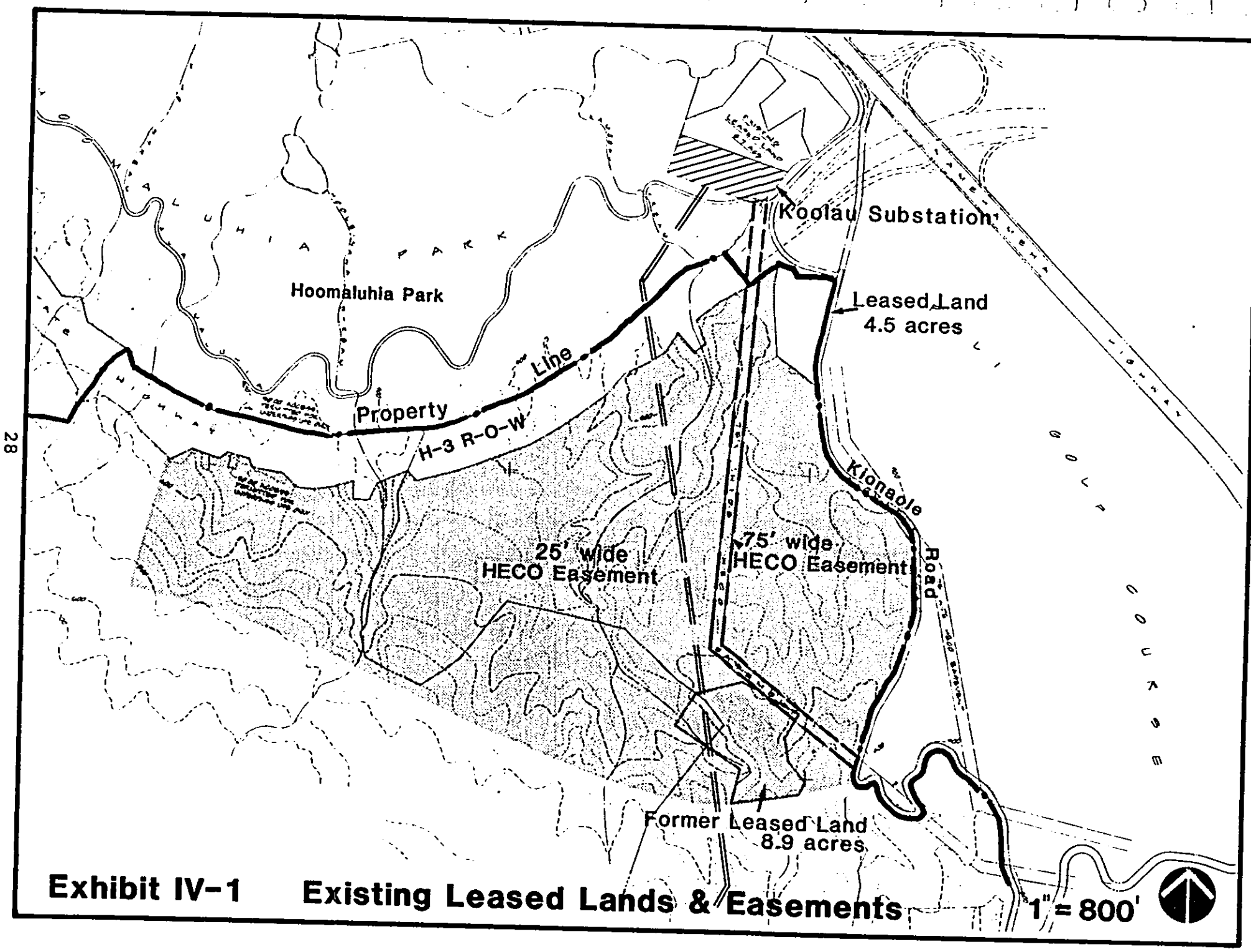

Exhibit IV-1 Existing Leased Lands & Easements

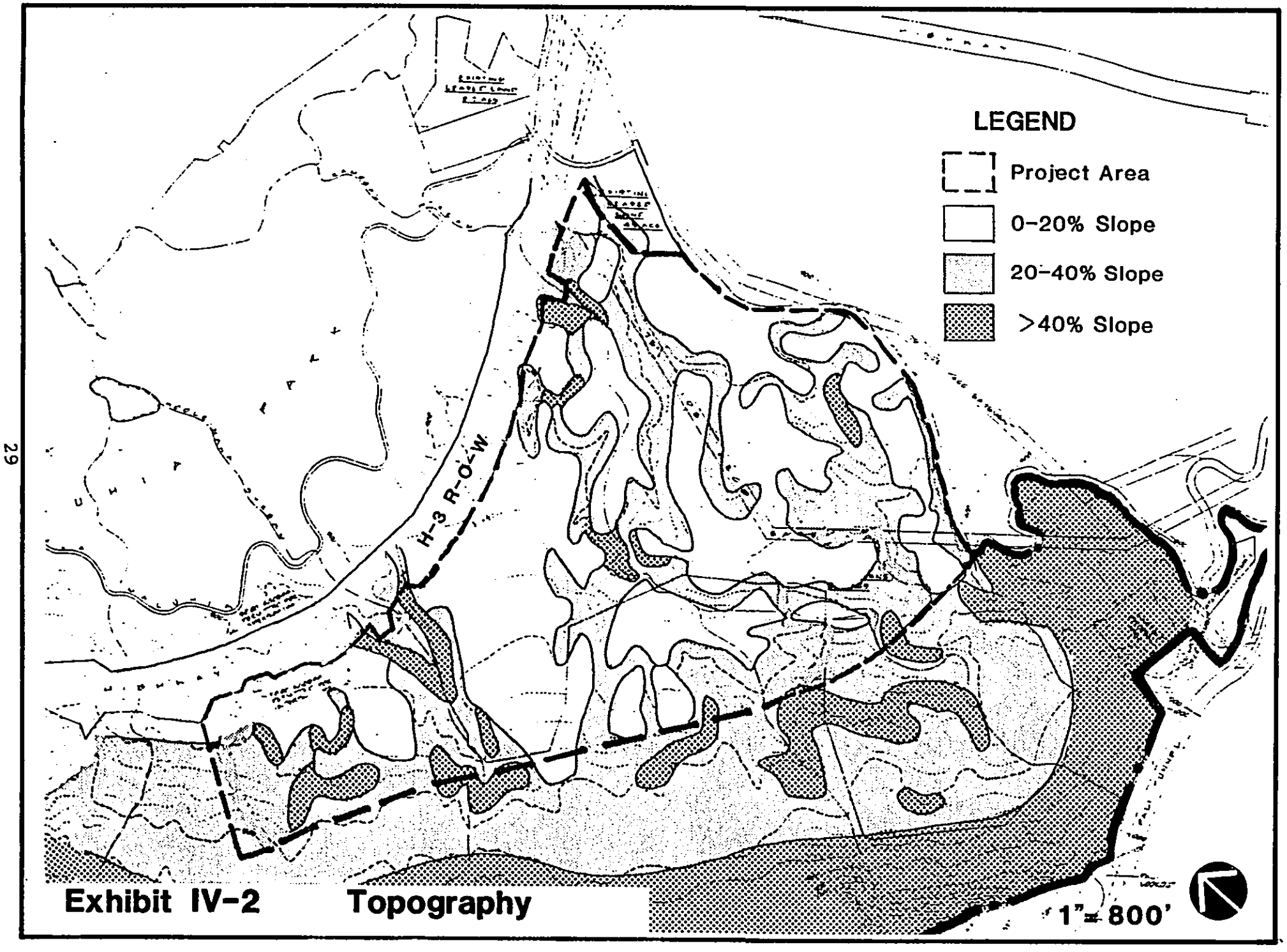

Exhibit IV-2 Topography

Geologically, the area was created by the Koolau volcanic series and is of basaltic origin. The terrain was shaped by extensive erosion and sedimentation, and the area is underlain directly by alluvium and possibly members of the Honolulu volcanic series.

2. Soils

a. Types (Exhibit IV-3).

According to the Soil Survey of the Soil Conservation Service* the project area includes the following soil types: Lolekaa, Hanalei and Kaneohe. The predominant soil in this area is the Lolekaa series. Following is a description of these soils.

Lolekaa Series (LoB, LoC, LoD, LoE and LoF): 46% of the project area. These are well-drained soils found on alluvial fans and terraces that developed in old, gravelly colluvium and alluvium. They have gentle (LoB) to very steep (LoF) slopes.

These soils are often used for pastures, home sites, orchards and truck crops. The natural vegetation consists of guava, Christmas berry, californiagrass, holograss and ricegrass.

Lolekaa soils have Capability** Subclasses of IIe-VIe which indicates that the soils have moderate to severe limitations that reduce the choice of plants or that require moderate or special conservation practices. These soils are also subject to moderate to severe erosion if they are cultivated and not protected.

Kaneohe Series (KgB and KHOF): 38% of the area. This series consists of well-drained soils on terraces and alluvial fans which developed in alluvium and colluvium derived from basic igneous rock. In a few places they developed in volcanic ash and in material weathered from cinders.

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*Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (Soil Conservation Service, U. S. Department of Agriculture, August 1972).

**Capability groupings measure the suitability of soils for most kinds of crops.

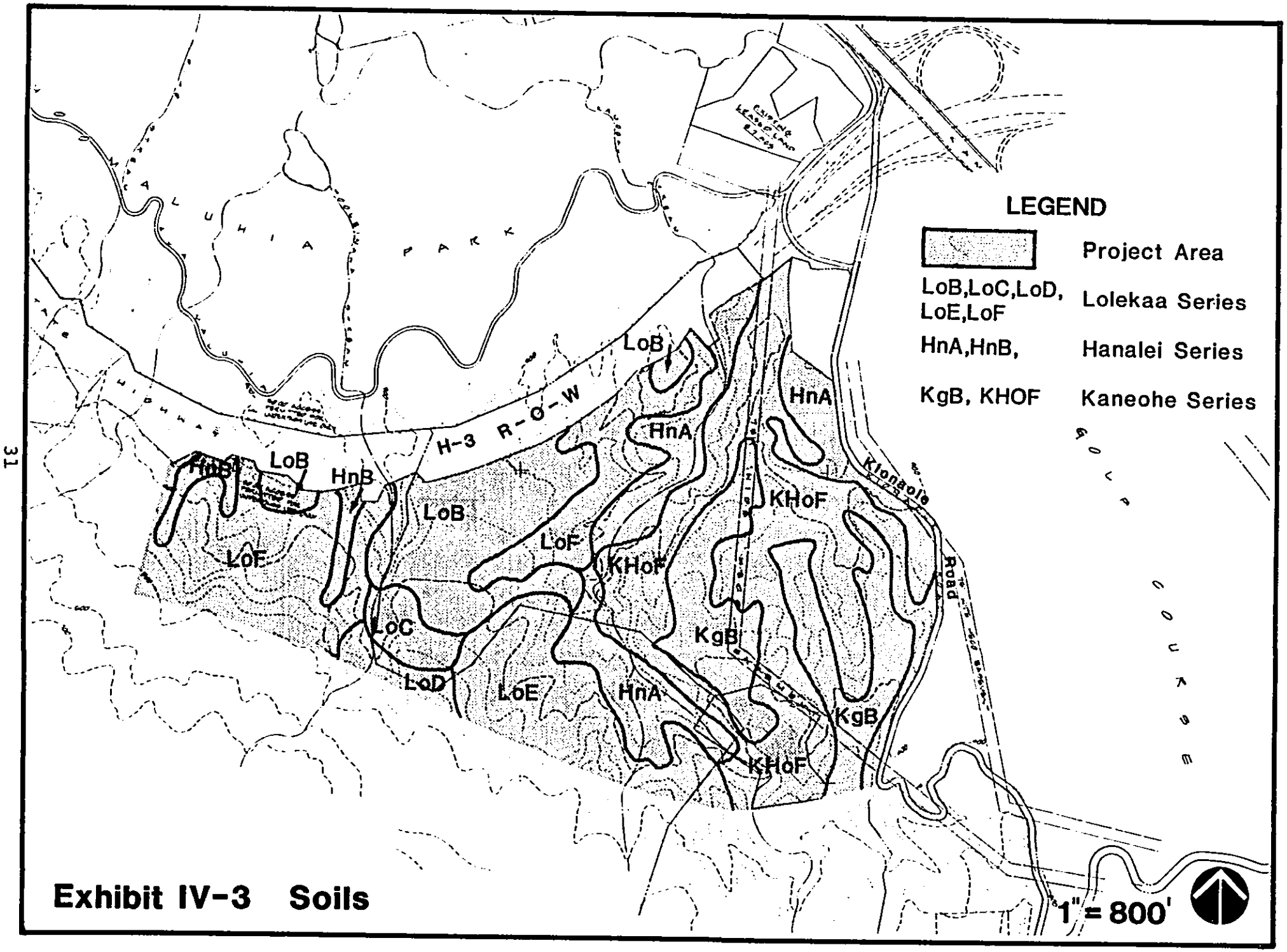

Exhibit IV-3 Soils

These soils are typically used for pasture, homesites and urban development. The natural vegetation consists of guava, Boston fern, sensitive plant, glenwood grass and hilo grass.

The KgB soils (3 to 8% slopes) have a Capability Subclass of IIe, meaning they have moderate limitations that require moderate conservation practices and are subject to moderate erosion if they are cultivated and not protected. They are used for pastures and golf courses. The KHOF soils (30-65% slopes) are classified as VIIe which means they have very severe limitations that make them unsuited to cultivation and that restrict their uses largely to pasture or range, woodland or wildlife.

Hanalei Series (HnA, HnB): 16% of the project area. This series consists of somewhat poorly drained to poorly drained soils on stream bottoms and floodplains. They developed in alluvium derived from basic igneous rock, and are level to gently sloping.

These soils are often used for taro, pasture, sugarcane and vegetables. The natural vegetation consists of paragrass, sensitive plant, honohono, Java plum and guava.

HnA and HnB have a Capability Subclassification of IIw. This means that they are poorly drained, subject to seasonal flooding, and have moderate limitations due to excess water. Runoff is very slow and the erosion hazard is slight. These soils require moderate conservation practices.

b. Productivity (Exhibit IV-4)

The Land Study Bureau* gives the project area overall Productivity Ratings of "C" and "E" for suitability in agriculture use. The Bureau's ratings range from A (the highest productivity) to E (the lowest productivity). By this method of classification, the project area has fair to poor productivity potential for vegetable, forage, grazing and orchard uses.

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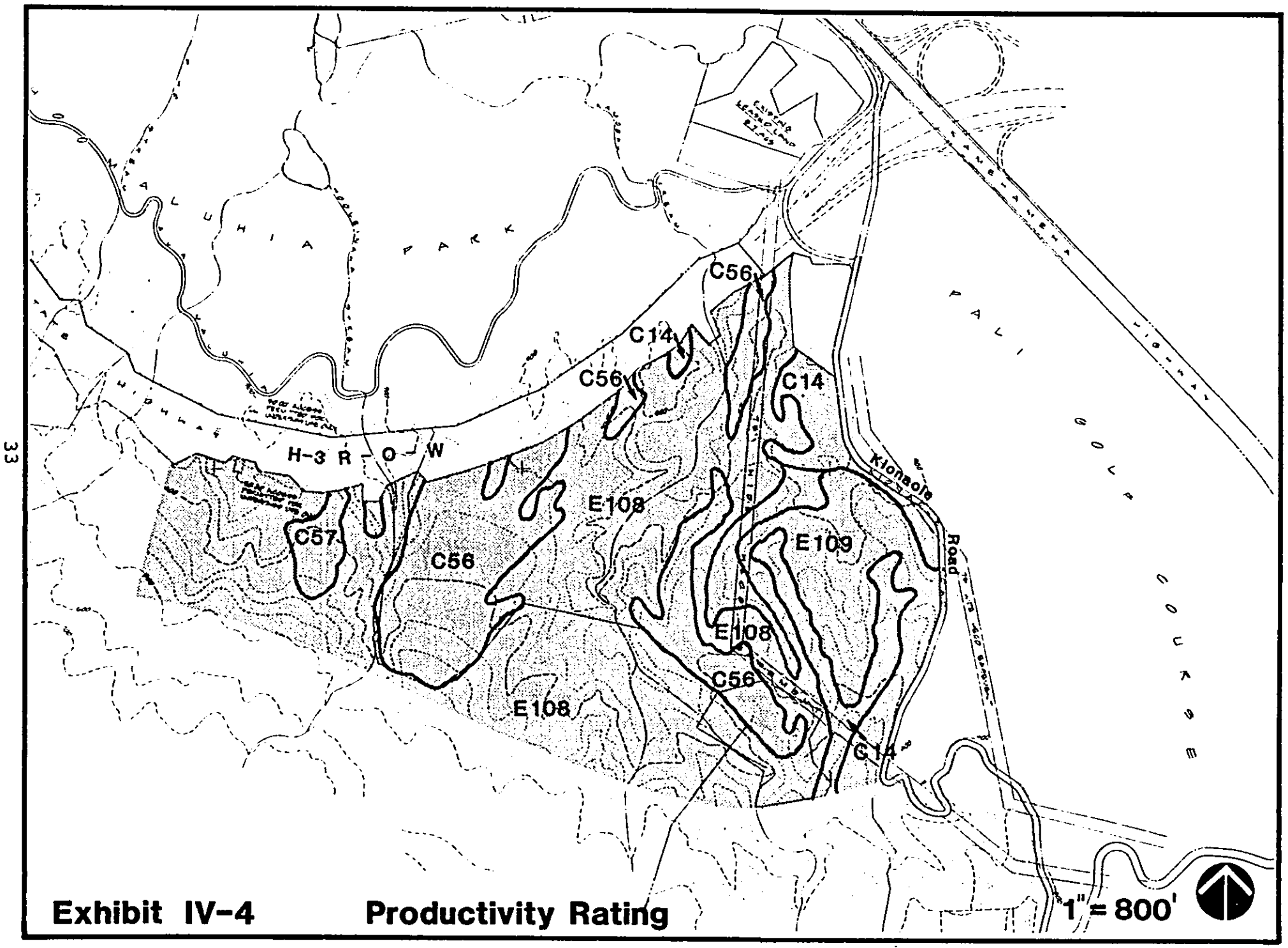
*Detailed Land Classification (Land Study Bureau, University of Hawaii, December 1972).


H-3 R - O - W
C56
C14
C56
C14
E108
C57
C56
E109
E108
C56
E108
C14
Kionaole Road
Exhibit IV-4 Productivity Rating
1" = 800'

c. ALISH (Exhibit IV-5)

Approximately 30% of the project site is classified as "Prime Agriculture Lands" by the ALISH (Agricultural Lands of Importance to the State of Hawaii) classification system of the Department of Agriculture. 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.

The site also contains a small area of lands classified as "Other Important Agriculture Lands". Although defined as having statewide or local importance for the production of food, feed, fiber and forage crops, these lands exhibit properties such as seasonal wetness, erodibility, limited rooting zone, slope, flooding or droughtiness.

C. CLIMATIC CHARACTERISTICS

1. Rainfall

Annual rainfall in the project area is between 75 to 100 inches. By comparison, the annual rainfall at Honolulu International Airport is about 23 inches. Fifty percent of the rainfall at the project site is concentrated during the five month period between November through March.

The neighboring Pali Golf Course receives about the same amount of rainfall as the project site and is closed an average of 8 to 12 days a year due to rain. The Hawaii Kai Golf Course and Waialae Country Club Golf Course receive between 20"-30" of rain per year, and Oahu Country Club Golf Course receives between 75"-90" of rain annually. The Hawaii Kai Golf Course is closed approximately two days per year because of rain. Staff at Waialae Country Club and the Oahu Country Club golf courses stated that they never close due to rain.

2. Wind

The prevailing wind, 90 percent of the year, is the northeasterly tradewind. Staff at the Pali Golf Course indicated that the winds in the area may affect a player's game, but they are never so strong that the course is closed. Staff at the Hawaii Kai, Waialae and Oahu Country Club golf courses also said they have not experienced winds which force the courses to close.

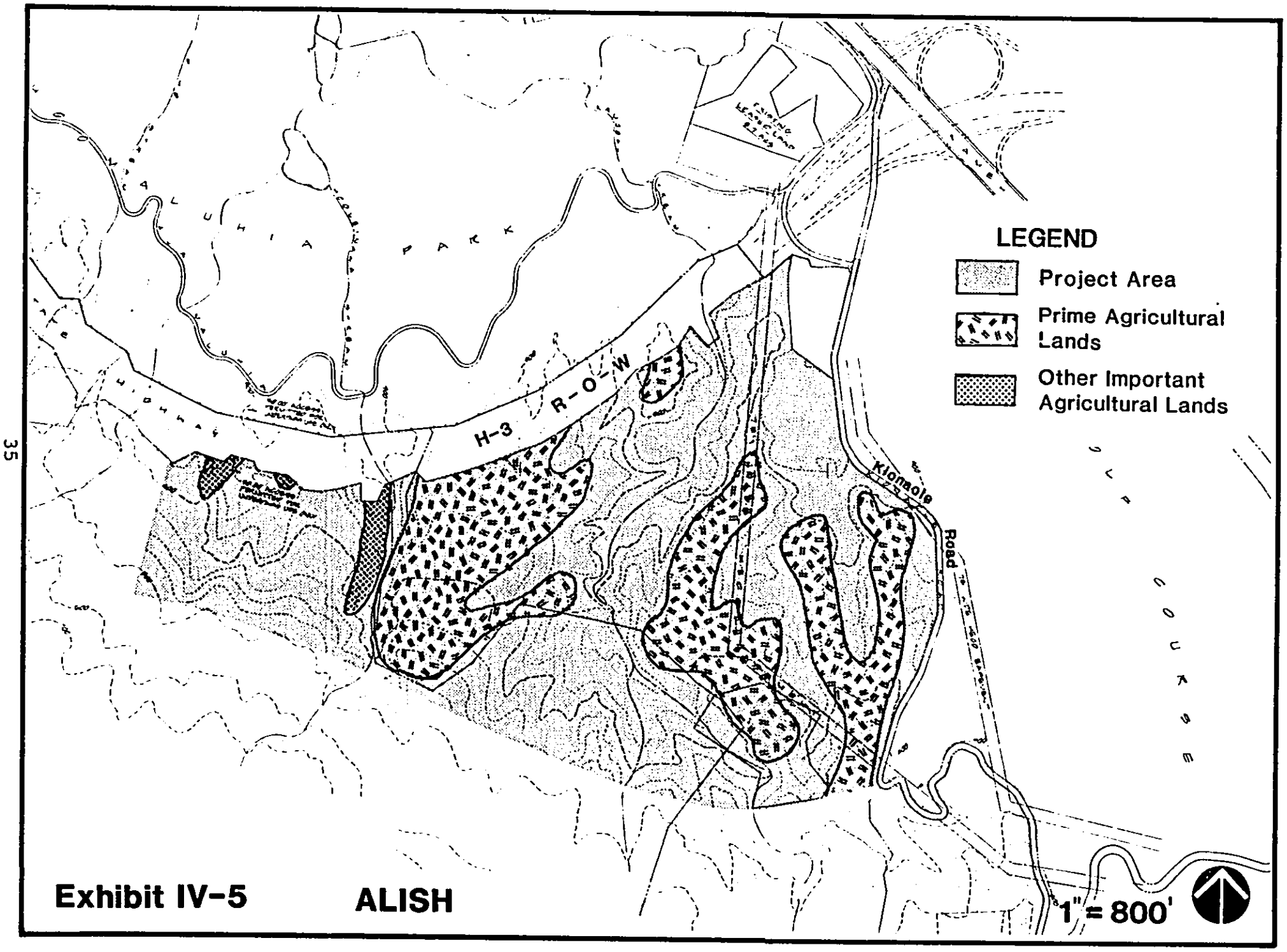


Exhibit IV-5 **ALISH**

3. Temperature

The temperature in the subject project area generally varies between 68 and 80 degrees. The mean annual average temperature is about 74 degrees. Extreme temperatures may range from as low as 58 degrees and as high as 90 degrees.

D. HYDROLOGICAL CHARACTERISTICS

1. Streams

The project site is situated at the base of the Koolau Mountain Range within the Kamooalii Stream watershed in Windward Oahu. Two of the tributary streams, Kamooalii and Hooleinaiwa, flow through the project site before joining together in Ho'omaluahi Park and discharging into the Loko Waimaluhia Reservoir, and ultimately to Kaneohe Bay via Kamooalii Stream and Kaneohe Stream. (Exhibit IV-6). All streams that empty into the Bay are subject to State Department of Health (DOH) Class 2 standards and are to be protected for recreational purposes, propagation of fish and aquatic life, and agricultural and industrial water supply. Kaneohe Bay has been classified as AA by DOH in recognition of its high natural and recreational values (Chapter 54 of Title II, Administrative Rules, DOH).

Kamooalii and Hooleinaiwa Streams are considered perennial, and like most perennial streams in Windward Oahu, they depend on the discharge of dike-impounded groundwater as the primary source of their dry weather base flow. The spring-fed headwaters of Kamooalii Stream are located near the 2,500-foot elevation. The streams also receive rain surface runoff and ground seepage from rainfall stored in the unconsolidated surface alluvial material during inclement weather.

2. Groundwater

In high-rainfall areas such as the windward side, a significant percentage of the rainfall percolates below the ground surface to become groundwater. The groundwater in the Koolau Range is stored in the permeable basaltic lava flows between relatively impervious basaltic dikes. These dikes were formed by molten rock which solidified in the fissures of the volcano.

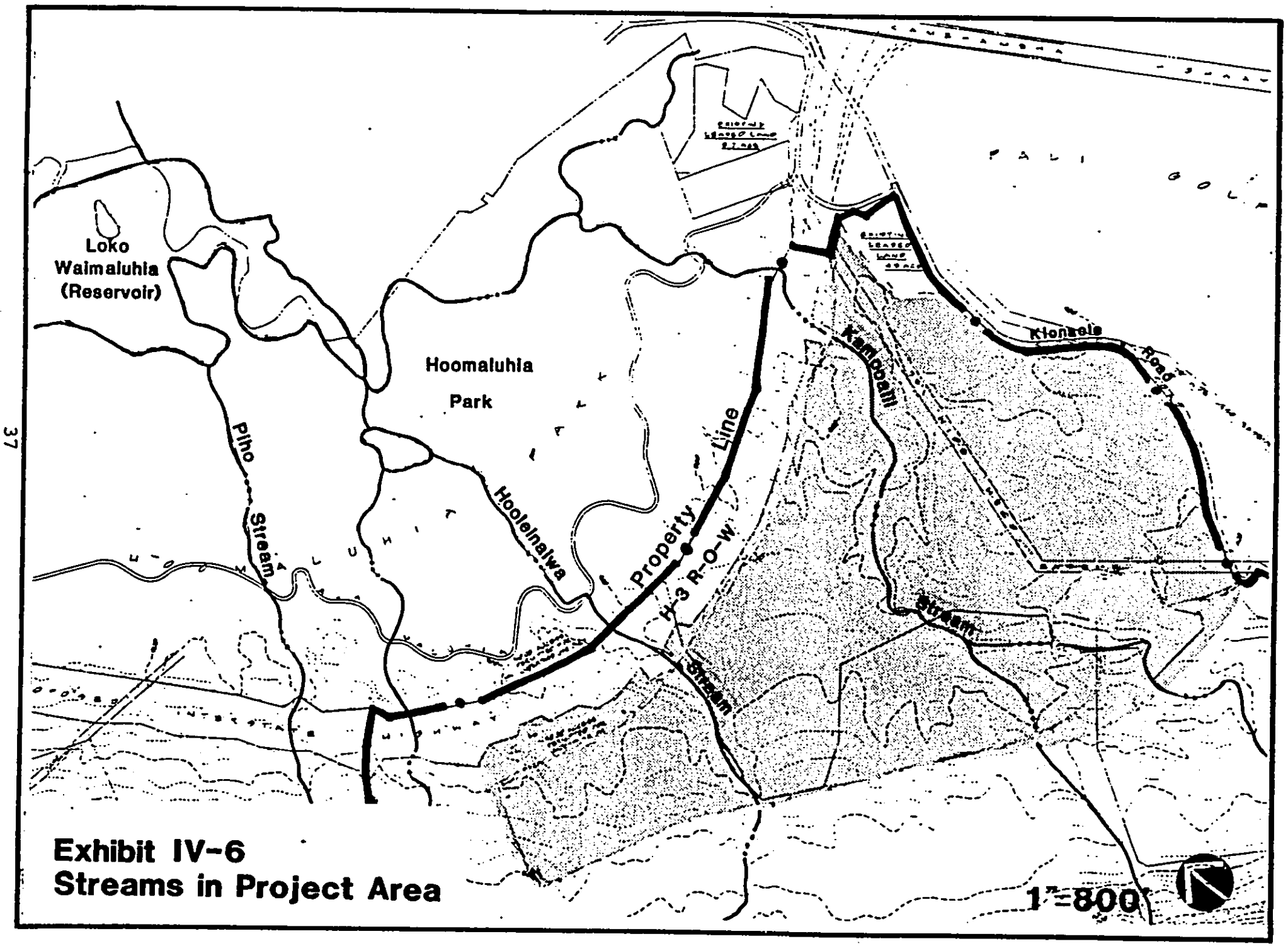


Exhibit IV-6
Streams in Project Area

Generally, the underground flow pattern of the groundwater is toward the ocean as higher level groundwater moves into lower head compartments either by flowing over the top of dikes or by leaking through fractures in the dikes. Ultimately the groundwater in this region is either withdrawn through wells and tunnels, is lost to evapotranspiration, or is discharged into the ocean via streams and offshore/coastal springs.

3. Drainage

There are no constructed drainage facilities in the project site. Currently, storm drainage is by overland flow to nearby Kamooalii and Hooleinaiwa Streams. The streams then discharge the runoff into the Loko Waimaluhia Reservoir located in Hoomaluhia Park. This open reservoir was created by constructing a 76-foot high, 2,000-foot long dam across Kamooalii Stream as part of the Kaneohe Flood Control Project. The dam was designed by the U. S. Army Corps of Engineers to accommodate a standard project flood as determined from an evaluation of the most severe regional storms of record in the area.

Due to the steep terrain, streamflow in this area increases rapidly in response to high-intensity precipitation. Studies by the Corps of Engineers indicate that the streams peak within an hour after a heavy downpour of rain. The standard project flood (SPF) runoff flows recommended by the Army Corps of Engineers were adopted by the State of Hawaii Department of Transportation Highways Division in the design of major drain crossings for the proposed Interstate Route H-3, to maintain design compatibility between the two agencies. However, the 50-year storm was used to design other roadway drainage facilities. Drainage basin areas which contribute runoff to the H-3 project site and corresponding runoff quantities for the 50-year storm and SPF calculated by the Highways Division, are shown in Exhibit IV-8 and Exhibit IV-7 respectively. Since the proposed Interstate Route H-3 is just makai and adjacent to the project site, the runoff flows would be applicable to the golf course project area, and would be the basis for the design of drainage system improvements.

EXHIBIT IV-7

DESIGN STORM RUNOFF QUANTITIES

DRAINAGE BASIN	AREA (ACRES)	RUNOFF (cfs) Q(50)	Q(SPF)
A	65.0	280	-
B	256.4	1,670	2,700
C	19.5	95	153
D	101.9	683	1,106
E	121.0	980	1,586

NOTES:

1. Source: Hydrologic and Hydraulic Report for Interstate Route H-3, prepared by the State of Hawaii Department of Transportation, Highways Division, October 1983.

2. Q(50) = 50-year storm runoff.

3. Q(SPF) = Standard Project Flood runoff adopted by the Army Corps of Engineers for the Hoomaluhia Park dam.

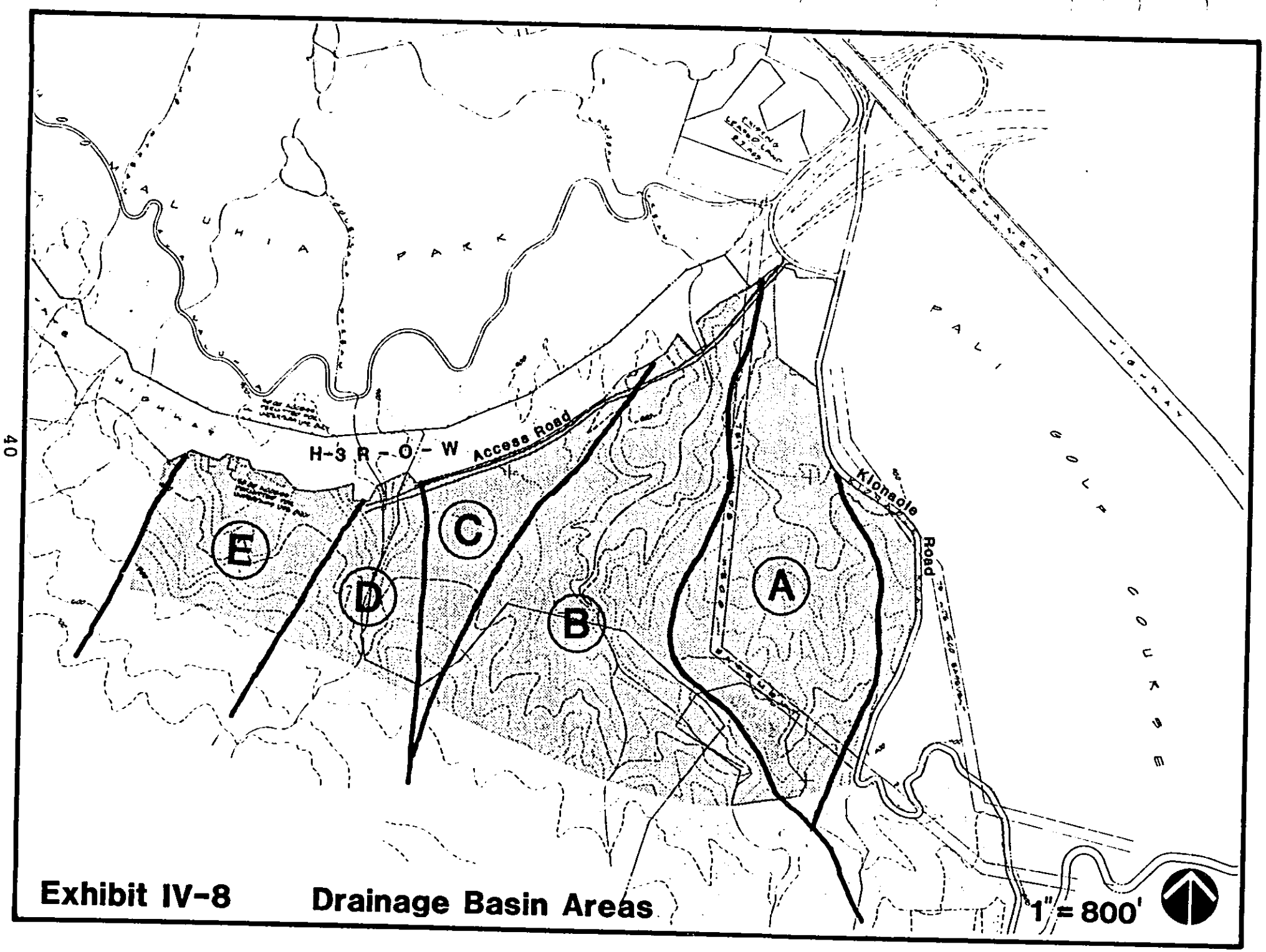


Exhibit IV-8 **Drainage Basin Areas**

E. BIOLOGICAL CHARACTERISTICS

1. Vegetation

A botanical survey of the project area was conducted by Winona P. Char in September 1986 (Appendix B). The study was conducted to inventory the flora, describe the major vegetation types, search for threatened and endangered species, and identify areas of potential environmental problems or concerns. This study supplemented several previous biological surveys on the adjacent Hoomaluhia Park and H-3 right-of-way, as well as a study by Char in 1982 on a large portion of the Iolani School lands*.

Four major vegetation types were identified within the golf course project area, and no endangered or rare plant species were found. (Exhibit IV-9). The vegetation consists primarily of introduced species, with a few native species found mostly on the steeply sloping areas and in the open scrub. The vegetation has been greatly disturbed in the past (see Section F. Archaeological Resources) and the varied history of past land use by man has resulted in a mixture of different vegetation patterns.

a. Mixed forests

The forests consists of several introduced tree species, Java plum being the most common. Other tree species include rose apple, African Tulip, Octopus tree, kukui, and hala. Clusters of mango trees also exist and large thickets of hau occur in drainage areas throughout the mixed forests. Understory vegetation consists of seedlings of the tree species present and shade tolerant species such as basketgrass and the wood ferns.

b. Grassland

The grassland vegetation occurs principally on the broad, gentler slopes in the area. California grass is the dominant cover, but broomsedge is also found. Intermixed with the grassland are molassesgrass. Glenwoodgrass, Hilo grass, swordfern, Java plum, Asiatic pennywort, and kyllinga.

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*Char, Winona P., A Botanical Survey of Iolani School Lands Proposed for Residential Development, Kaneohe-Kailua, Oahu, January 1982.

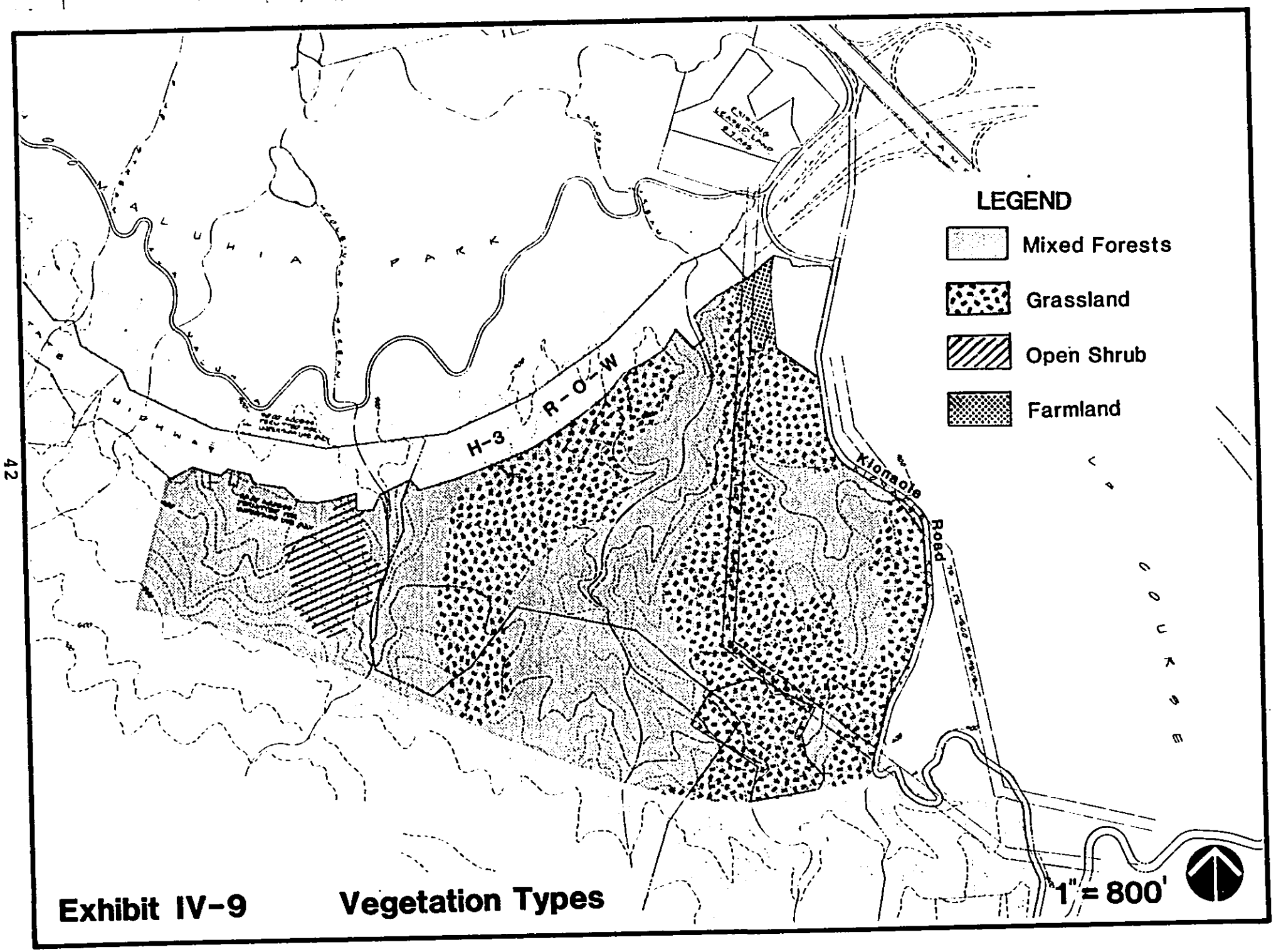

Exhibit IV-9 **Vegetation Types**

c. Open scrub

This vegetation type is found on the hilltops occurring among the mixed forests and is dominated primarily by the indigenous 'uluhe fern. Broomsedge and rice-grass may occur in patches. Open scrub also consists of scattered strawberry guava, guava, Java plum, and Christmas berry. Occasional native species native species include hala, 'ohi'a trees, 'akia, and neneleau.

d. Farmland

Farmland consists of foliage and flower crops such as ti leaf and red ginger as well as numerous weedy species associated with cultivated areas.

2. Birds and Mammals

Dr. Andrew J. Berger conducted a field survey of the project area and Hoomaluhia Park in September 1986 to inventory the birds and mammals inhabiting the area. (Appendix C). This study confirmed the findings of his previous study, done in 1981, of a large portion of the project area.*

a. Birds

No endemic forest birds were found in the study area and there is no suitable habitat for them on or near the project site since there is very little native vegetation. However, two endemic and endangered Hawaiian waterbirds have been sited at the Hoomaluhia Park reservoir. In July 1986, personnel of the State Division of Forestry and Wildlife counted two Koloa (Hawaiian Duck) and eight Hawaiian Coots on the reservoir. In 1982, 38 Koloa were released in the Park, but have since spread out to habitats they find more suitable. Also, it is likely that the Coots were using the reservoir for feeding and "loafing", not hiding and nesting, because Coots inhabit ponds and marshes with emergent vegetation. There is almost no emergent vegetation in the reservoir.

Dr. Berger did not see any Koloa or Coots during his field survey, and believes there is no suitable habitat for these waterbirds in the project area.

*Berger, A. J. Bird and Mammal Report, Iolani School Lands Project November 1981.

The Pueo, or Hawaiian Owl is a permanent endemic resident on all main Hawaiian Islands and is considered endangered on Oahu by the Division of Forestry and Wildlife. While the Pueo is listed as a bird that has been seen at Hoomaluhia Park, Dr. Berger has never seen it there or elsewhere in windward Oahu.

Two indigenous birds have been reported in the Study Area. Two Black-Crowned Night Heron (Aukuu) were seen in Hoomaluhia Park during the July 1986 waterbird census. Dr. Berger did not see any herons and states that they do not inhabit the project site. Golden Plovers frequent lawns in residential areas, golf courses, weedy pastures, open areas in the mountains, etc., and are common in the grassy areas of Hoomaluhia; but they do not occur in forested areas or in the project area.

Approximately 50 species of introduced birds have established breeding populations in the islands. The following 15 species occur on the Iolani School lands and adjacent areas including Hoomaluhia Park: Cattle Egret, Lace-Necked or Spotted Dove, Barred Dove, Barn Owl, Melodious Laughing Thrush, Red-Vented Bulbul, Shama, Japanese Bush Warbler, Japanese White-Eye, Common Indian Myna, Ricebird or Spotted Munia, House Sparrow, Cardinal, Red-Crested Cardinal and House Finch.

b. Mammals

The only endemic land mammal in Hawaii is the Hawaiian bat. Dr. Berger did not see any bats in the study area, and knows of no evidence of a resident population on Windward Oahu. The other land mammals found in the project area are introduced species and most have proven detrimental to man, buildings, agricultural crops, and/or to the native birdlife. These mammals include Roof Rat, Polynesian Rat, Norway Rat, feral cat, feral dog, feral pig, and small Indian mongoose.

3. Aquatic Fauna

Limnological surveys of Kamooalii Stream have been conducted before, during and after construction of the Hoomaluhia Park flood control dam which was completed in 1980.* The results indicate at least 13 species of macrofauna are or have been in the stream, including 6 fish, 4 crustacea, 1 mollusk, and 2 amphibia. Of these, only 3 species are endemic (found naturally in Hawaii only) and 2 are indigenous (found naturally in Hawaii and elsewhere). None of these species is considered rare or endangered. Exhibit IV-10 summarizes the macrofauna distribution and abundance findings of the most recent studies, and Exhibit IV-11 shows the location of the stream sampling stations.

Prior to construction of the Hoomaluhia flood control dam, an endemic and an indigenous O'opu species (Awaous stamineus and stenogobius genivittatus) were abundant mauka of the dam site in Kamooalii Stream (Station 7), and were common at the base of the dam site (Station 6). One endemic species of shrimp (Atyoida bisulcata) was abundant mauka of, and below, the dam site, while another endemic shrimp (Macrobrachium grandimanus) was rare. A variety of introduced species including mosquitofish, swordtail, guppy, mollies and Tahitian prawns were found in abundant populations.

During construction of the dam in 1979, the stream fauna survey by Amadeo S. Timbol for the Board of Water Supply found no endemic species of fish makai of the dam site. (The mauka portion of the stream was not sampled.) Otherwise, the abundance of introduced species was nearly the same as before dam construction.

In August 1983, about 3 years after completion of the dam, tilapia, guppy and mollie were very abundant and Tahitian prawn and crayfish were abundant at Sampling Station 2. However, the only native species found in the stream was the endemic o'opu nakea (Awaous stamineus).

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*VTN Pacific, City and County of Honolulu, Board of Water Supply, Revised Environmental Impact Statement for Kamooalii Watershed Wells, 1984.

EXHIBIT IV-10: MACROFAUNA IN KAMOOALII STREAM

++++ Very abundant (over 11)
+++ Abundant (5-10)
++ Common (2-4)
+ Rare (1)

SCIENTIFIC NAME	COMMON NAME	STATION 1	2	3	4	5	6	7
FISHES								
Awaous stamineus (e)	O'opu nakea		++		+		++	+++
Gambusia affinis	mosquitofish			++	++	+++		
Poecilia spp.	Guppy, Mollie	+++	++++	++++	++++	+++	+++	+++
Stenogobius genivittatus (i)	O'opu naniha						++	+++
Tilapia (Sarotherodon) spp.	Tilapia		++++					
Xiphophorus helleri	Swordtail	+++		+	+	+++	++	+++
CRUSTACEANS								
Atyoida bisulcata (e)	O'pae kala'ole				+		+++	+++
Macrobrachium grandimanus (e)	O'pae O'eha'a			+	+			
Macrobrachium lar	Tahitian prawn		+++	+		++	++	+++
Procambarus clarkii	Crayfish	++	+++	+	+++	+++	++	+++
MOLLUSK								
Melanoides sp. (i)	Pond snail	+++				+++		
AMPHIBIANS								
Bufo marinus	Toad					+		
Rana castebiana	Bullfrog					+		
SOURCE** YEAR		1979	1983	1978	1978	1979	1977	1978

(e) = endemic
(i) = indigeneous

*Modified from an unpublished source dated 1984.
**Refer to Bibliography.

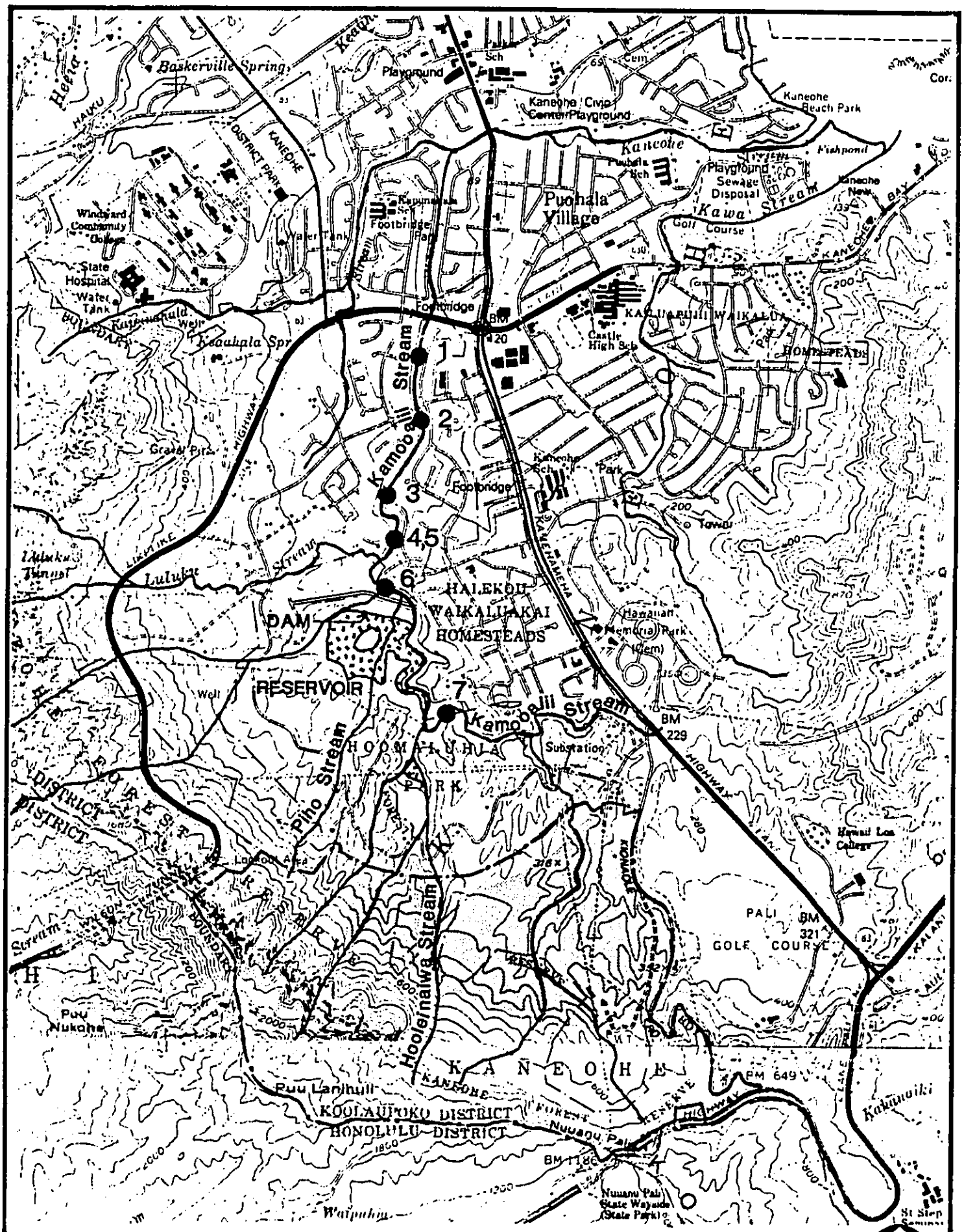


Exhibit IV-11 Stream Sampling Stations

1"= 2000'

The native o'opu and shrimp species of Hawaii are diadromous, meaning that passage to the ocean and back is essential to their reproductive success. A major factor in the considerable decrease of endemic fauna in the stream is the vertical tower of the dam, through which water exits from the Hoomaluhia reservoir. According to the Revised EIS for Kamooalii Watershed Wells,

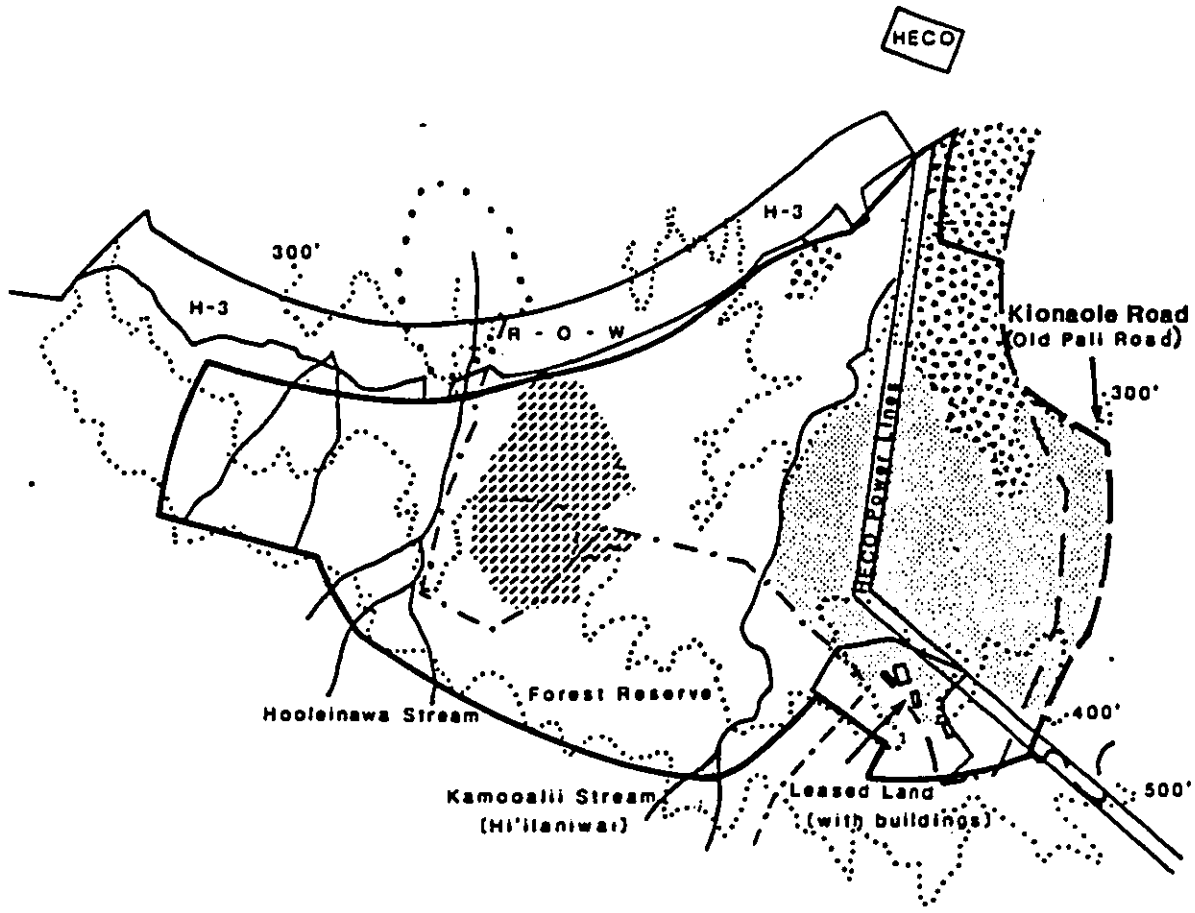
> This tower is a total barrier to upstream migration of juvenile Awaous stamineus (O'opu Nakea) and Macrobrachium lar (O'pae O'eha'a) and will eventually lead to the complete absence of these species mauka of the flood control dam. This may also be the case for Atya bisulcata (O'pae Kala'ole).....

F. ARCHAEOLOGICAL RESOURCES

An intensive land use study and archaeological field investigation were undertaken for the proposed golf course project area. (See Appendix D for the complete Archaeological Inventory Survey.)

Historical background research providing a perspective on past land uses on the parcel was conducted to aid in determining the distribution and nature of prehistoric and historic cultural activities, locations of sites and other details. The historical study provided no evidence suggestive of the parcel's importance for habitation, agriculture, or other activities by traditional Hawaiian communities. The earliest significant use of the parcel occurs after the turn of century when commercial activities developed. Between 1912 and 1914 a pineapple plantation was started in a large area, and probably shortly afterward another segment began to be used for grazing dairy cattle. Land used for truck farming is also documented in the 1920's. The portions of the project area that have undergone extensive surface and subsurface disturbance since the early 1900's are clearly definable in aerial and ground photographs taken during the period. Based on these photos, land use records, and other documentary sources, a detailed historical land use map accurately depicting the area affected by these activities was prepared, as shown on Exhibit IV-12. (See Appendix D for photographs).

The archaeological field survey was concentrated in the areas of minimal disturbance where sites, if present, would more likely be preserved on the surface. Only cursory inspections were made of the disturbed areas. The presumably undisturbed areas were primarily confined to the gullies, riverine areas, and portions along the upper elevation margins and western side of the project area.



LEGEND

- Pineapple Area ca.1915
- Animal Pasture Area ca.1920 & 1940
- Agricultural Truck Farming Area ca.1920
- Agricultural Terrace Area (McCoy, Sinoto survey)
- Project Area
- Kaneohe Forest Reserve
- Elevation Contour

Exhibit IV-12 Historical Land Use Map

Source: Patricia Price-Beggerly; See Appendix A.

1"=1200'

The survey confirmed historical findings, locating only four small sites of which at least two are probably historic. These sites include a small terrace complex, two charcoal kilns or seepage wells, a habitation complex, and a rock wall. Exhibit IV-13 shows the location of the sites and their permanent site numbers as provided by the Hawaii State Historic Preservation Office. Detailed descriptions of the four sites can be found in Appendix D.

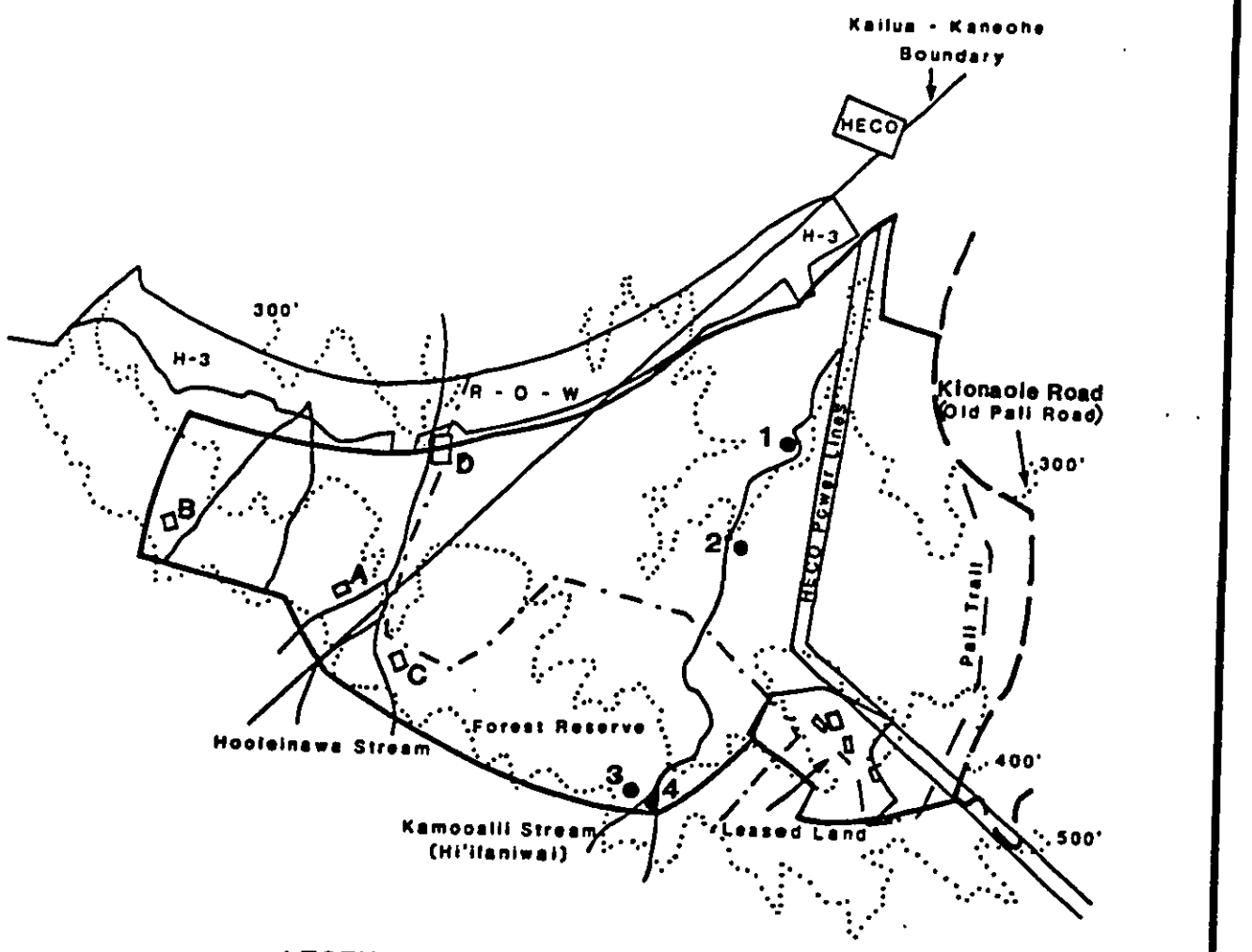
In addition, four possible site locations were found in the areas between the tributary stream beds and gulches at the upper and south portion of the project area. These locations contained a few boulders conceivably forming alignments and terraces; however erosional deposition, ground cover, and generally dense vegetation (particulary hau or hibiscus trees), made it impossible to discern whether or not these were sites or just natural features. These areas are marked with letters A, B, C and D on Exhibit IV-13. The area marked "D" is the approximate location of Site G5-78, as located by Streck (1982).

G. UTILITIES

1. Water Supply

There are two major sources of potable water near the project site serving the Honolulu BWS system in Kaneohe. These two sources are the Luluku Tunnel and the Kuou I Wells. (Exhibit IV-14). The two Kuou Wells have been in operation for about 30 years and evidently penetrate into an aquifer that is not perversely affected by secondary mineralization and closely spaced dikes. Both are artesian with a hydraulic head about 10 to 30 feet above ground level which is at elevation 274 and 293 feet. One well has a capacity of 1500 gallons per minute (gpm) while the other about half as much when pumping individually. A 16-inch transmission main from the Kuou I Wells feeds the BWS Windward "272" System. The Luluku Tunnel supplies the "500" High Service System via a 12-inch/10-inch transmission main.

The BWS is presently undertaking a water source development program to accommodate projected growth and increases in demand on the Windward side, and for added system reliability, primarily consisting of constructing new well fields within the watershed of Kamooalii Stream. These well fields are named Luluku, Kuou II, Kamooalii I, and Kamooalii II.



LEGEND

——	Project Area
—·—	Kaneohe Forest Reserve
·····	Elevation Contour
●	Archaeological Sites
1 ●	50 – 80 – 10 – 2938
2 ●	50 – 80 – 10 – 2939
3 ●	50 – 80 – 10 – 2940
4 ●	50 – 80 – 10 – 2941
A, B, C, D	Possible Site Locations

Exhibit IV-13 Archaeological Site Locations

Source: See Appendix A

1"=1200'

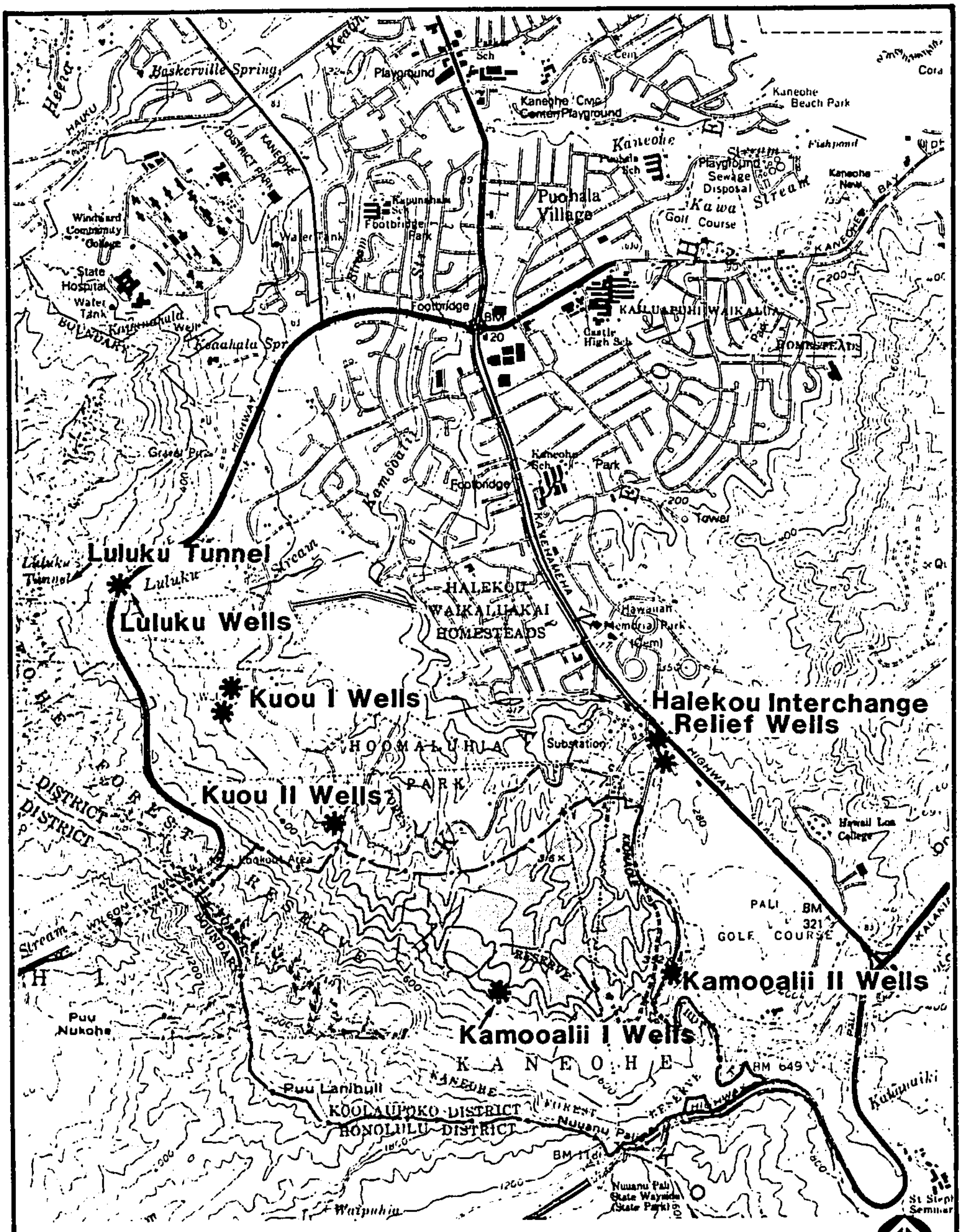


Exhibit IV-14 Kamooalii Watershed Wells

Source: VTN Pacific. EIS for Kamooalii Watershed Wells. Sept. 1983. 1" = 2000'

Wells have already been dug at the Luluku, Kamooalii I, and Kamooalii II sites and the results have varied. The Luluku well has proved to be very successful with a yield of approximately 1.0 million gallons per day (mgd). However, the well at Kamooalii II is non-productive and the Kamooalii Well I has a capacity of only 60,000 gallons per day (gpd). Although the production rate of the Kamooalii Well I is inadequate to qualify for a BWS system well, it is capped for protection and could be fitted with a permanent pumping unit for use with the proposed project. The BWS expects to drill the Kuou II Well in the near future. See Appendix E for more information on the existing wells.

In addition to the deep wells, there are three existing shallow wells in alluvium at the Halekou Interchange where H-3 intersects Kamehameha Highway. These wells have a total capacity of about 700,000 gpd. Although productive, these wells are not considered safe for potable water consumption, due to their relative location to Hawaii Loa College's wastewater treatment and disposal system. The water, however, should be satisfactory for landscape irrigation use.

There are no BWS water system facilities within the project site. The nearest BWS water main adequate to serve the proposed golf course complex is a 12-inch main running along Kamehameha Highway. This main is part of the BWS "500" High Service System.

2. Wastewater System

There are no existing sewer facilities in the immediate vicinity of the clubhouse. The closest municipal facilities are a sewer system in the Hoomaluhia Park and a wastewater pumping station located near the Kionaole Road intersection with Kamehameha Highway north of the project site.

The wastewater facilities in the Park are owned by the City and County of Honolulu Department of Parks and Recreation and are operated and maintained by the Department of Public Works. According to both departments, the park system would be able to accommodate the wastewater flows from the proposed golf course complex.

The wastewater pumping station located near the Kionaole Road/Kamehameha Highway intersection is currently not in operation although it is completed, because the integral sewer system is not completed yet. However, the pumping station will be in operation before the completion of the proposed golf course

clubhouse. According to the Department of Public Works Wastewater Management Division, this new system will be able to accommodate the wastewater flows from the project.

3. Electrical and Telephone Systems

Existing electrical and telephone systems are located along Kamehameha Highway, Kionaole Road and within the surrounding residential subdivisions. There are also several Hawaiian Electric Company overhead power lines (12 kv, 46 kv and 138 kv primary) traversing the project site in easement corridors from the Koolau Substation. Services to the project will be provided by the existing 12 kv power line and telephone system along Kionaole Road.

H. TRAFFIC AND ACCESS

There are three major highways serving the areas surrounding the project site. They are the Pali, Likelike, and Kamehameha highways. Of these three, primary access to the project site will be from Kamehameha Highway via the recently realigned segment of Kionaole Road (also known as the old Pali Road). (See Exhibit IV-15). Kamehameha Highway is a four-lane divided highway that intersects with Pali Highway-Kalanianaole Highway east of the project and Likelike Highway-Kaneohe Bay Drive to the west. It serves as a major route between the Windward Oahu communities of Kaneohe and Kailua, and between Windward Oahu and Honolulu.

The realignment of Kionaole Road and relocation of its connection to Kamehameha Highway are integral parts of the proposed Halekou Interchange which will connect interstate Route H-3 to Kamehameha Highway. Kionaole Road is a two lane rural roadway now serving a limited number of agricultural residents and the Pali Golf Course maintenance facilities. The portion of roadway between the project site and Kamehameha Highway is expected to become the major access route when the project is opened.

A minor secondary access route could be from the Pali Highway via Kionaole Road and their intersection near the Pali Highway - Kalanianaole Highway junction. However, on August 13, 1986, Resolution No. 86-280 was introduced in the City Council of the City and County of Honolulu, providing for the temporary closure (not to exceed 24 months) of this portion of Kionaole Road, as shown on Exhibit IV-15.

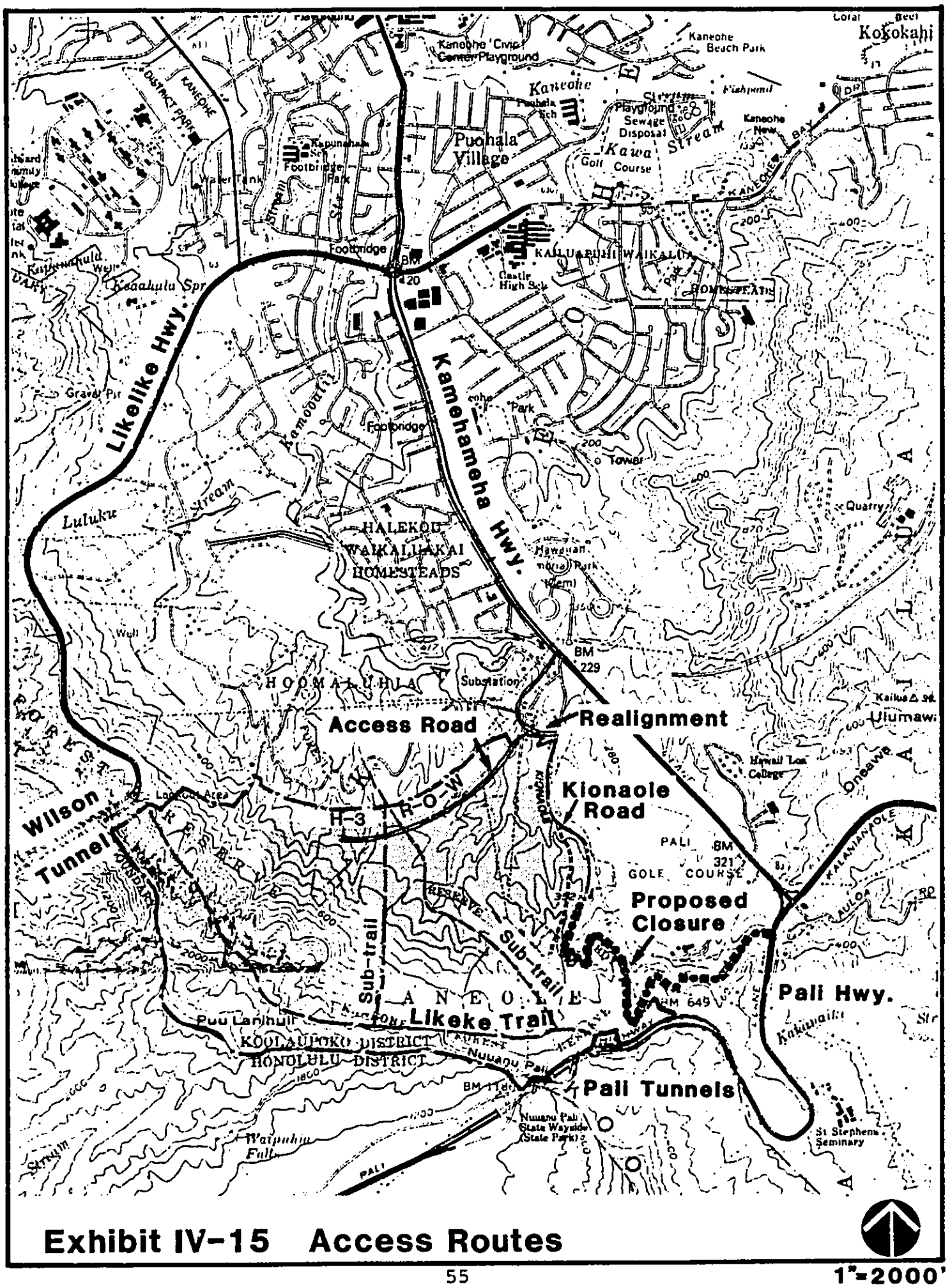


Exhibit IV-15 Access Routes

The Kionaole Road-Kamehameha Highway intersection is an unsignalized T with one inbound and one outbound lane on Kionaole Road. In addition to the two eastbound and westbound lanes on Kamehameha Highway, the westbound approach also has a left turn lane for vehicles turning into Kionaole Road. The median between the two roadways of Kamehameha Highway is sufficiently wide that a vehicle making a left turn from Kionaole Road can safely stop in the median while waiting for a gap in the westbound traffic. This intersection condition appears to be adequate for the present traffic in and out of Kionaole Road.

There are currently 2 pedestrian access trails through the project area from the Park to the Likeke Trail which is located mauka of the project area (see Exhibit IV-15). There is no existing physical barrier between the Park and the Iolani property.

I. AIR AND NOISE QUALITY

1. Air Quality

The State Department of Health maintains a network of air monitoring stations around the State to gather data on regulated pollutants. However, the nearest active air monitoring stations are located at Waimanalo and downtown Honolulu. While there are no active air monitoring stations in the project area, it seems safe to assume that present air quality is good most of the time, since there are no large stationary sources of pollution in the vicinity and the immediate area is not highly urbanized. The air quality is probably no longer pristine, however, due to the presence of three heavily used highways within a mile of the site.

2. Noise Quality

The existing traffic noise levels along Kamehameha Highway (the major roadway which would service this project) are high with a day/night sound level (Ldn) at approximately 65 to 70 decibels (dB), placing them in the "Significant Exposure, Normally Unacceptable" category based on Federal Department of Housing and Urban Development standards. This condition is typical along highways and major roadways of Oahu. (See Exhibit IV-16). Traffic noise levels along the first row of homes fronting a major roadway generally represent the worst case (or highest) levels for homes of a subdivision. Traffic noise levels at interior lots (second row of homes from the roadway, for example) are generally in the "Minimal Exposure, Unconditionally Acceptable" to "Moderate Exposure, Acceptable" categories, with 5 to 10 Ldn lower noise levels resulting from shielding and distance effects.

RANGE OF EXTERIOR BACKGROUND AMBIENT NOISE LEVELS

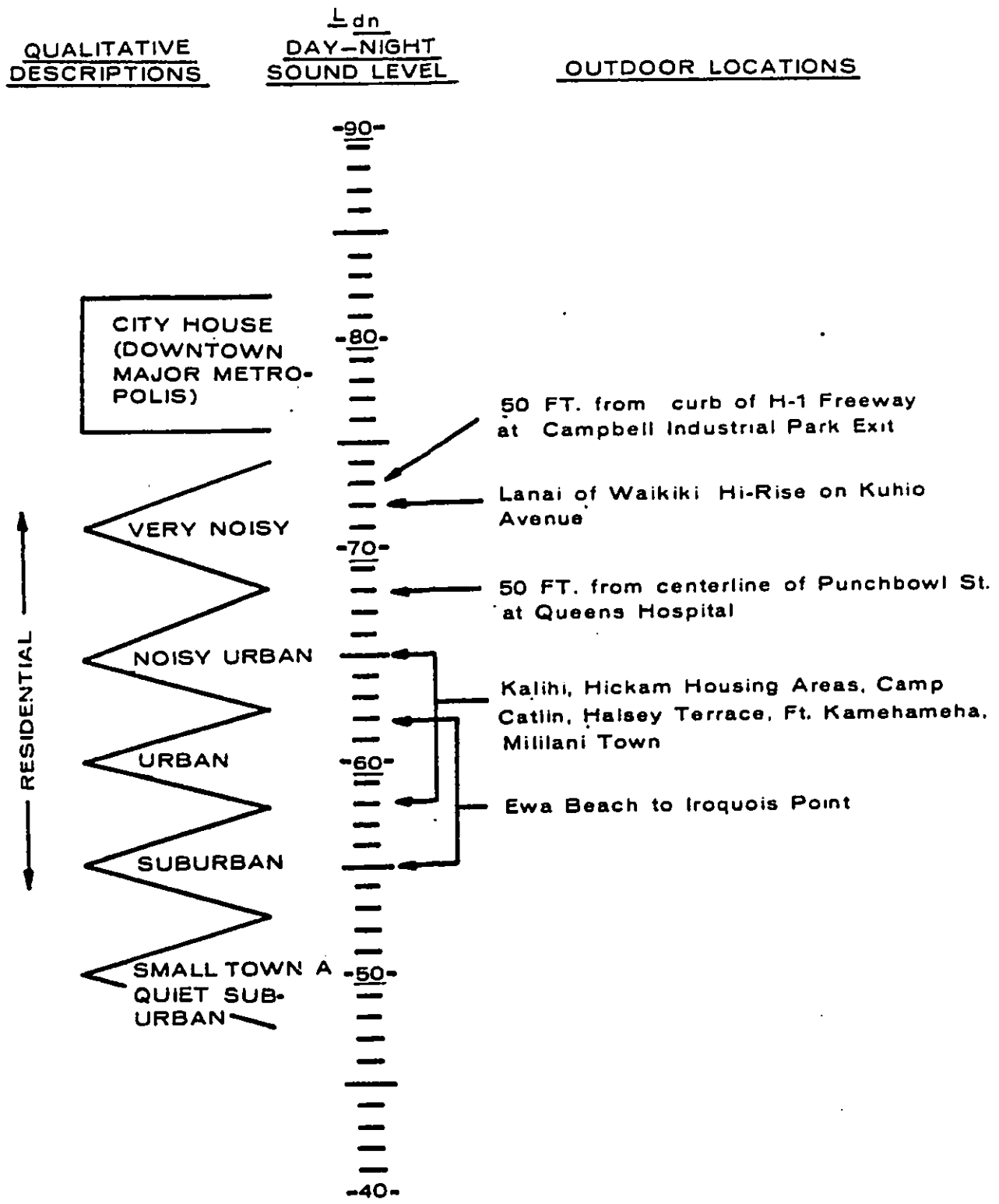


Exhibit IV-16 Background Noise Levels

The existing traffic noise levels along Kionaole Road are low, and in the "Minimal Exposure, Unconditionally Acceptable" category at less than 55 Ldn at a 50 feet distance from the roadway's centerline. Existing background ambient noise levels along this road are determined by the sound of birds, wind, and distant traffic, and range from 40 to 45 Leq(h) (Equivalent Noise Level or average noise level for an hour). Instantaneous background ambient noise levels (as read on a Sound Level Meter) range between 36 and 60 decibels (dB).

The existing background ambient noise levels within Hoomaluhia Park are approximately 40 to 45 Leq(h). These noise levels are typical of undeveloped lands on Oahu which are removed from major highways or urbanized areas. The noise levels in the proposed golf course area, **except at the clubhouse** are similar to that existing in the park. **The maximum noise level anticipated at the clubhouse from outdoor air conditioning equipment and/or band music is 64 dBA. Predicted maximum noise level in the Hoomaluhia Park at approximately 900 feet distance is 38 dBA.**

J. SOCIAL/ECONOMIC CHARACTERISTICS

The proposed golf course development area is not adjacent to existing residential developments. The nearest houses are in Halekou Waikaluakai Homesteads, north of Hoomaluhia Park, 2500 feet, or about 1/2 mile, from the project area.

The project area is located in Census Tract 103.02 and is within the "Kaneohe Neighborhood" as defined by the U. S. Bureau of the Census for the Neighborhood Statistics Program.* (See Exhibit IV-17).

1. Population Characteristics

The population of the City and County of Honolulu was approximately 805,300 as of July 1984 as compared with 762,565 at the time of the 1980 Census. The population growth rate for this period was 5.6 percent. In the Koolaupoko District (Waimanalo to Kualoa) the population increased 3.6 percent from 109,373 in 1980 to 113,269 in 1984.

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*All neighborhood statistics are from the 1980 census.

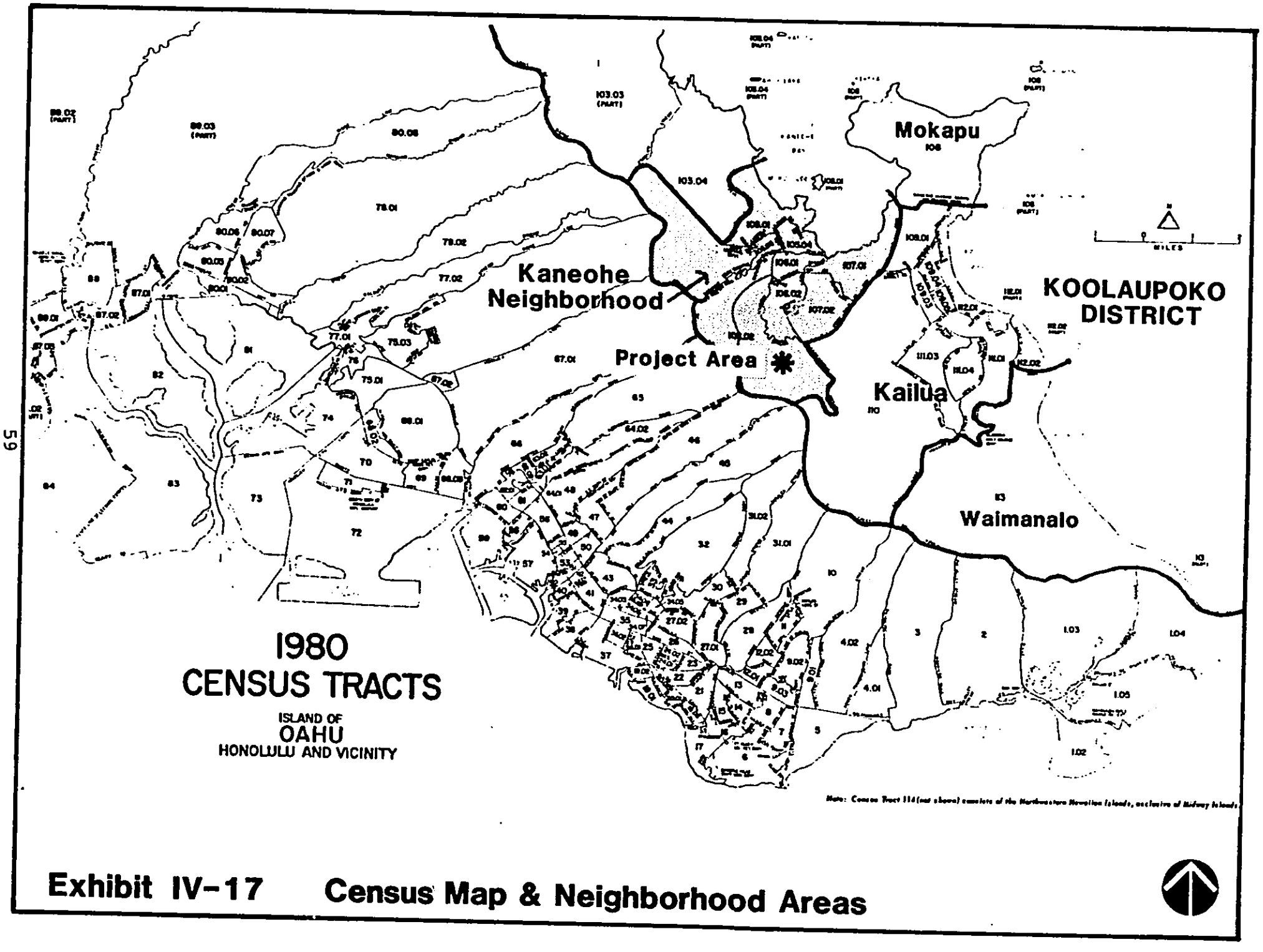


Exhibit IV-17 Census Map & Neighborhood Areas

The Kaneohe neighborhood grew 4.3% from 1980 to 1984. Within census tract 103.02, where the project area is located, the growth was a minimal 0.25%. This is due to the limited amount of land available for residential development. The census tract consists largely of Forest Reserve lands, Hoomaluhia Park, banana farms, the Pali Golf Course and the vacant land owned by Iolani. However, a portion of a new housing development, Castle Hills, has been built on the west side of Likelike Highway within census tract 103.02. It currently contains 34 completed housing units.

SUMMARY OF RESIDENT POPULATION

	1980	1984	% Growth
Oahu	762,565	805,300	5.6
Koolaupoko	109,373	113,269	3.6
Kaneohe	35,553	37,065	4.3
CT 103.02	3,232	3,240	.25

The age distribution in Kaneohe is consistent with that of Oahu (the City and County of Honolulu). The population is composed primarily of families, with adults in the 25-54 age range accounting for 42% of the population. Island-wide, this age group represents about 40% of the population. The median age for Kaneohe (28.6 years) is slightly higher than the Oahu median age of 28.1 years.

The racial mix of Kaneohe is very consistent with the island-wide mix, having 32% white and 64% Asian and Pacific islander compared with the Oahu average of 33% white, 60% Asian and Pacific islander.

The place of birth of residents in Kaneohe is markedly different when compared to the Oahu average. The percent of foreign born residents in Kaneohe is far below the island average while the percent of Hawaii-born residents is much higher.

DISTRIBUTION OF RESIDENTS BY PLACE OF BIRTH

Place of Birth	Kaneohe	Oahu
Oahu	72.5%	55%
Mainland	20.4%	27.5%
Foreign	5.6%	14.8%

2. Housing Conditions

Residents in Kaneohe are more likely to own their homes than residents on Oahu in general. 70 percent of the households own their residences as compared with the Oahu average of 46%. Likewise, the percent of single family detached homes is higher than the county average as well: Kaneohe, 72%; Oahu, 42%.

The median value of owner-occupied homes in Kaneohe is about $8,000 lower than Oahu average but the median rent is above the Oahu median.

	Kaneohe	Oahu
Owner-occupied homes, median value	$122,500	$130,400
Renter-occupied homes, median rent	$349	$279

Kaneohe has an average household size of 3.7 persons as compared with the Oahu average of 3.3 persons.

3. Employment and Income

There is no employment associated with the currently vacant project area.

The labor force profile in the area is similar to that for all of Oahu. Of the Kaneohe population, 68.7% are of employable age (16 years old or older) compared with 69.2% for Oahu. The area has a higher percentage of high school graduates than the island average and a lower percentage of unemployed in the labor force. The median income (1979 dollars) is above the Oahu median.

EMPLOYMENT AND INCOME

	Kaneohe	Oahu
% of Employable Age	68.7%	69.2%
% High School Graduates	80.0%	75.6%
% Unemployed	4.4%	4.6%
Median Income	$28,652	$21,077

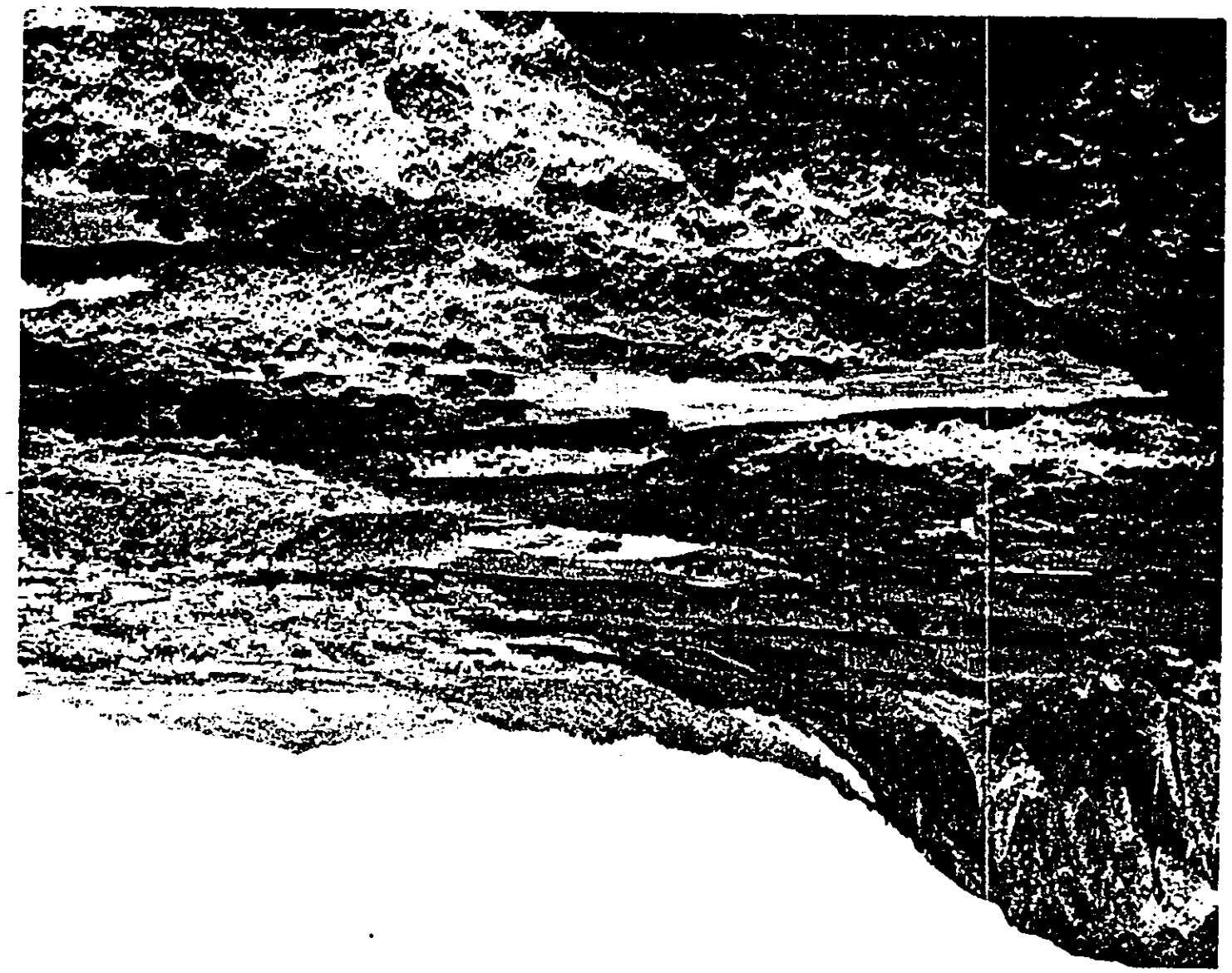
K. VISUAL QUALITY

The project area is highly visible to stationary observers at the Pali Lookout in Nuuanu State Park on the summit of the Koolau Range. It is occasionally visible to vehicular traffic from the Pali and Likelike Highways. From these vantage points, there is a panoramic view of the windward side. While overlooking the project area and the Koolau palis, one also sees the Pali Golf Course, Hoomaluhia Park, the commercial and residential development of Kaneohe town, and surrounding residential subdivisions. (Exhibit IV-18).

For the most part, the project area is not visible from Kamehameha Highway, Pali Golf Course or Hoomaluhia Park because views are obscured by the irregular topography and mature vegetation. From some vantage points, however, the upper elevations of the project area may be visible, particularly the proposed clubhouse area.

Exhibit IV-19 shows various sections through the area which indicate visible and non-visible lands based on existing topography, without considering existing vegetation. In most cases, mature vegetation within 1000' of the viewer, or at particular locations such as peaks and ridges, would effectively screen the entire project area from sight.

Exhibit IV-20 shows various views of the proposed golf course through various points on Ala Maluhia Road in Hoomaluhia Park, Pali Lookout and other locations. Potential views of the clubhouse (on the original site) are superimposed. For a comparison purpose, views of clubhouse on Alternative Sites No. 2 and No. 3 are also superimposed (see Chapter XI, Section C. Alternative Clubhouse Sites).



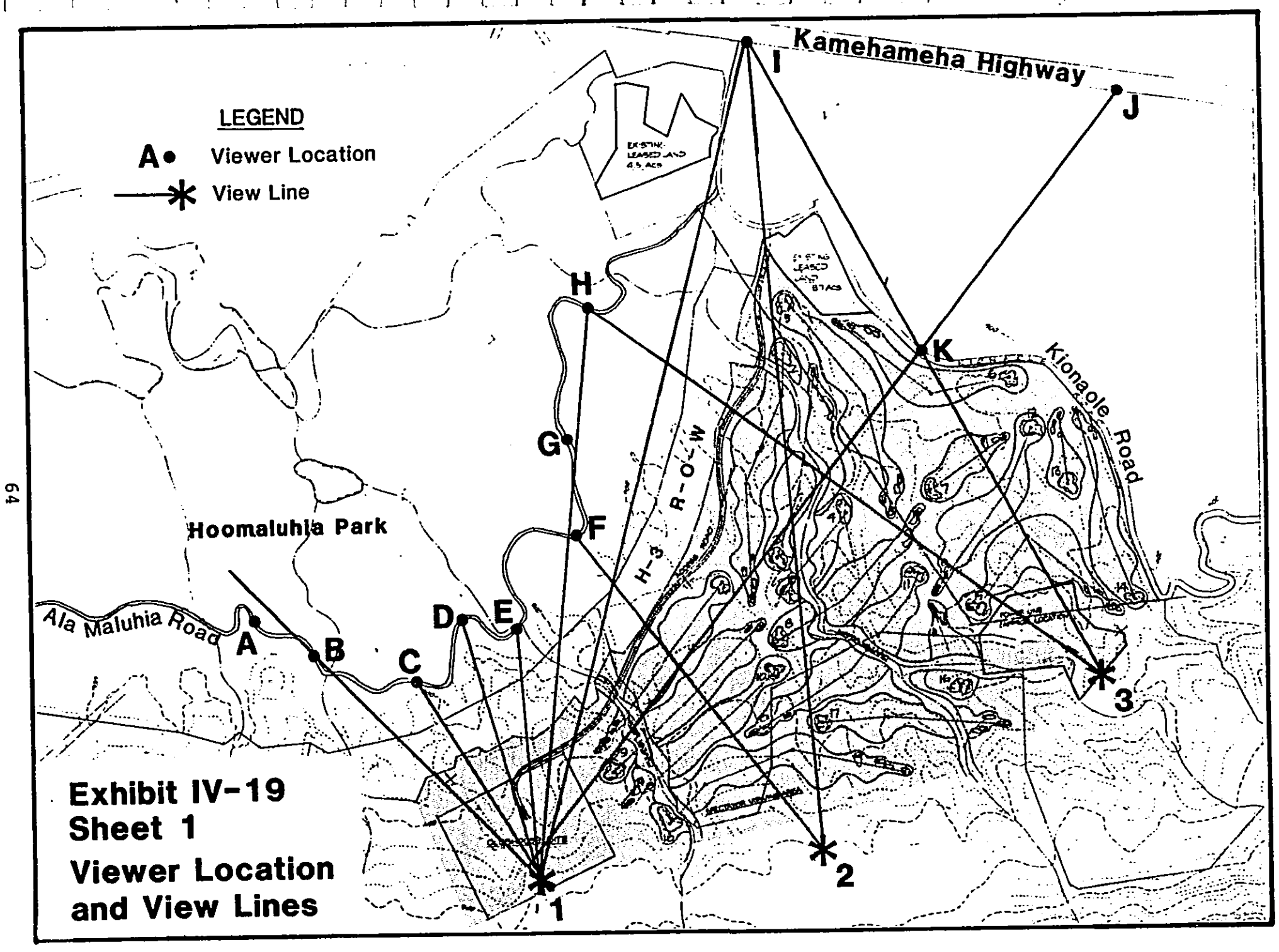
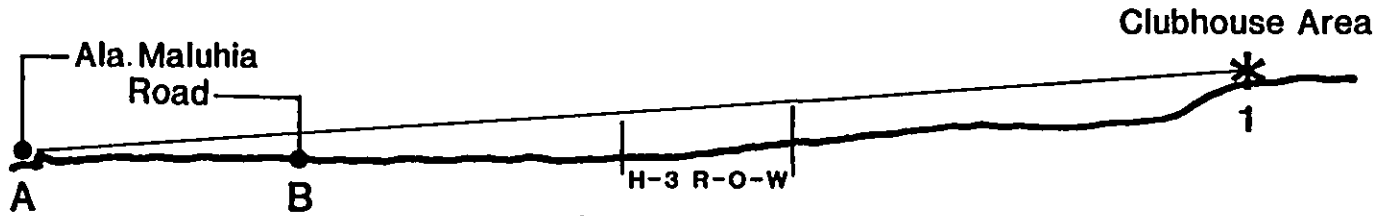
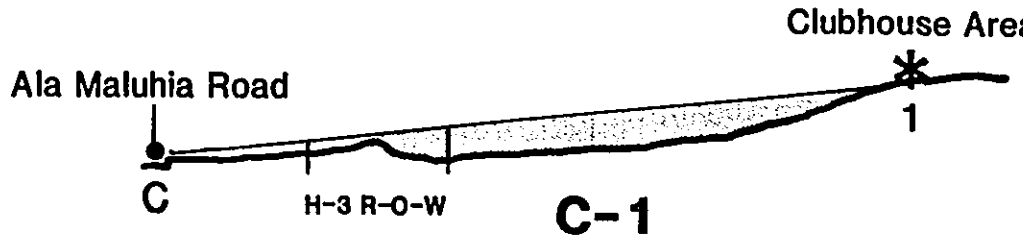


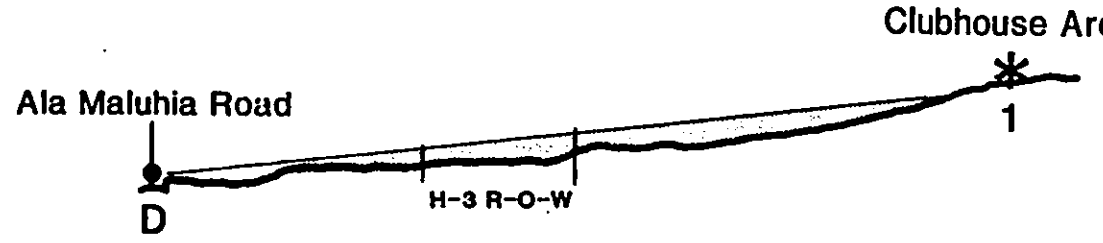
Exhibit IV-19
Sheet 1
Viewer Location and View Lines



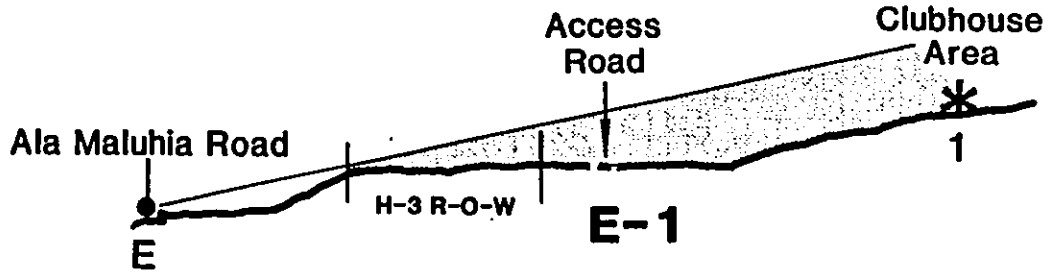
A & B-1



C-1



D-1



E-1

Area Screened from View

Exhibit IV-19 Sheet 2 **Sections along View Lines**

Horizontal & Vertical Scale
1"= 400'

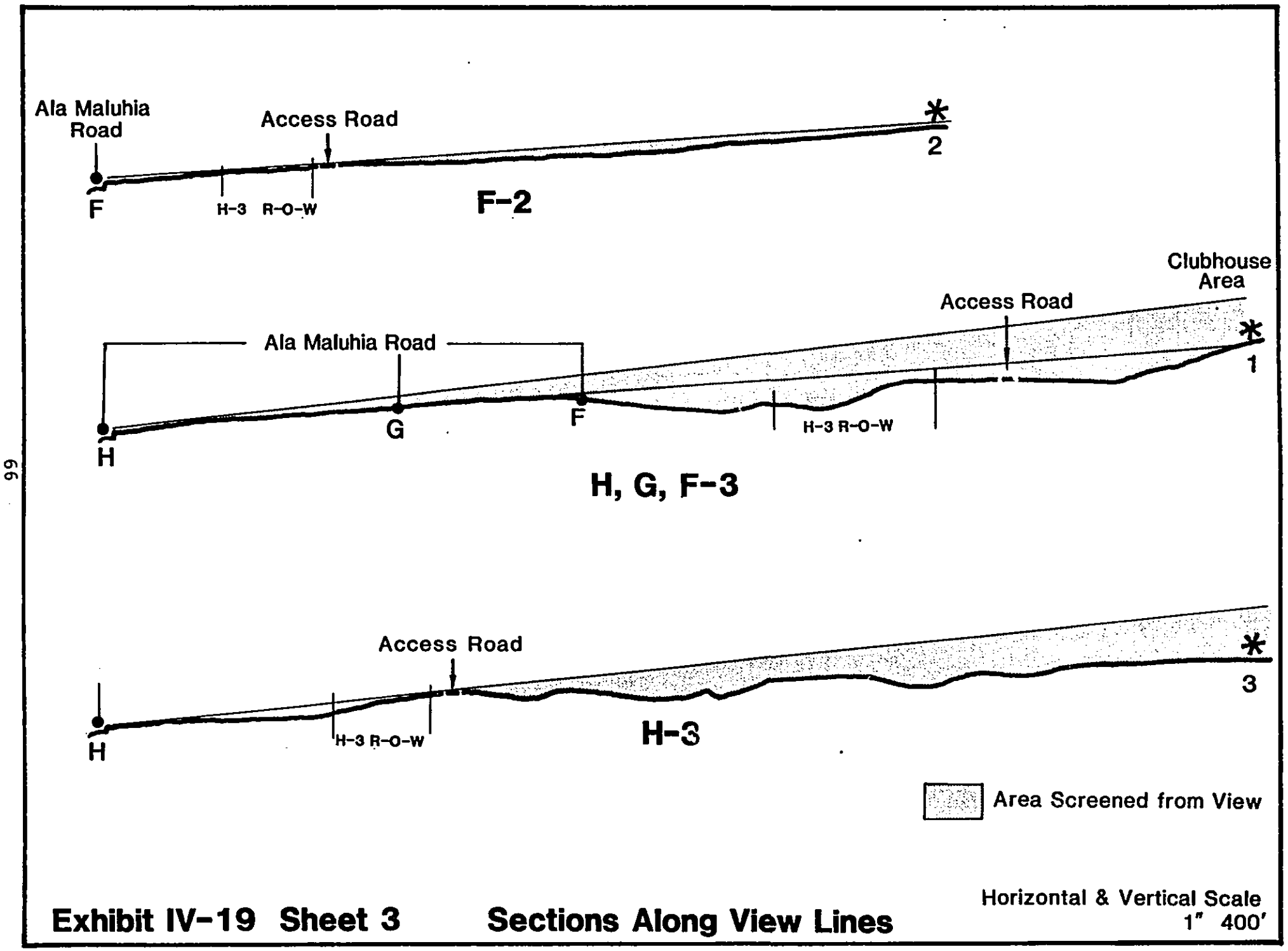


Exhibit IV-19 Sheet 3 **Sections Along View Lines**

Horizontal & Vertical Scale
1" 400'

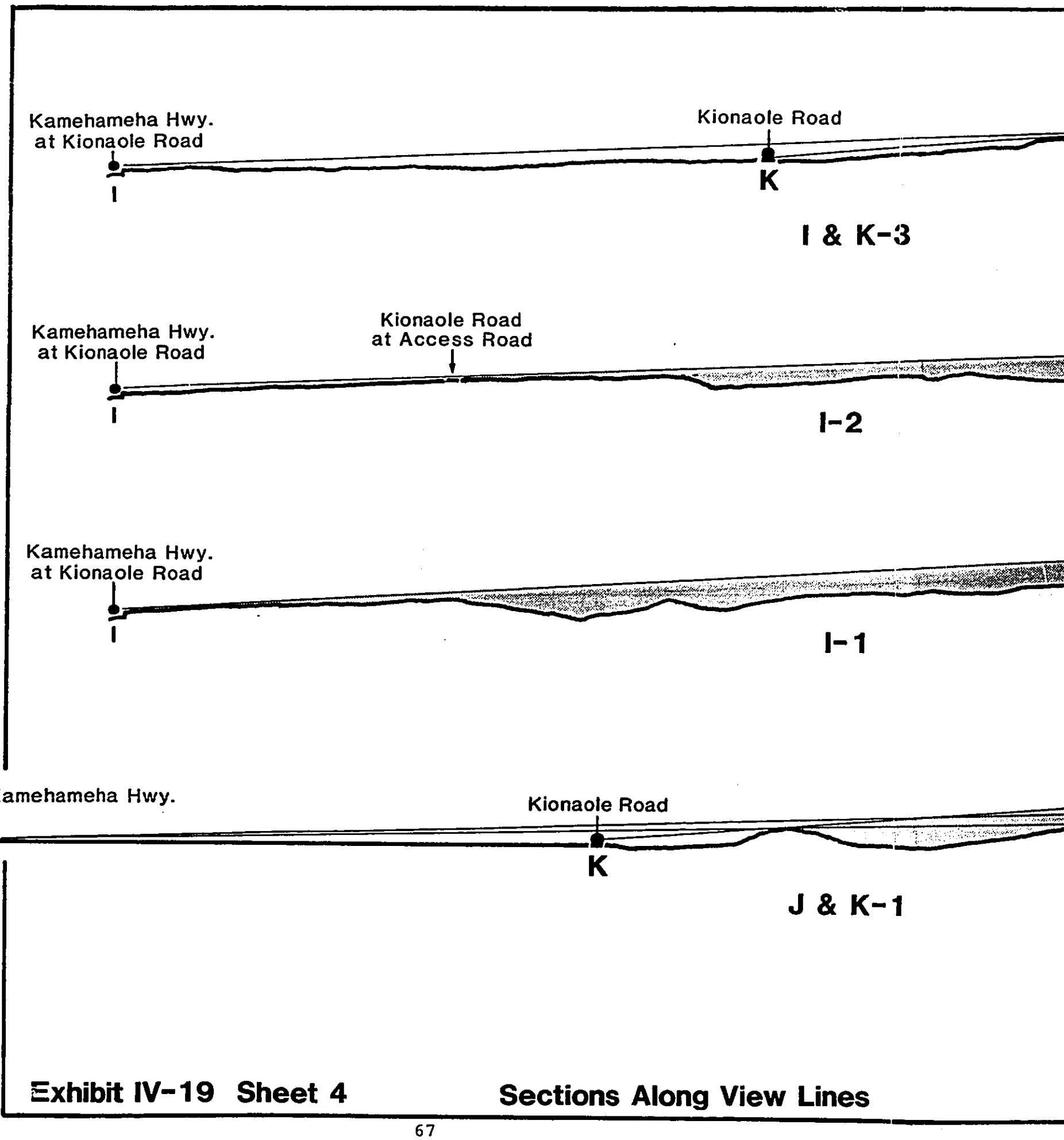
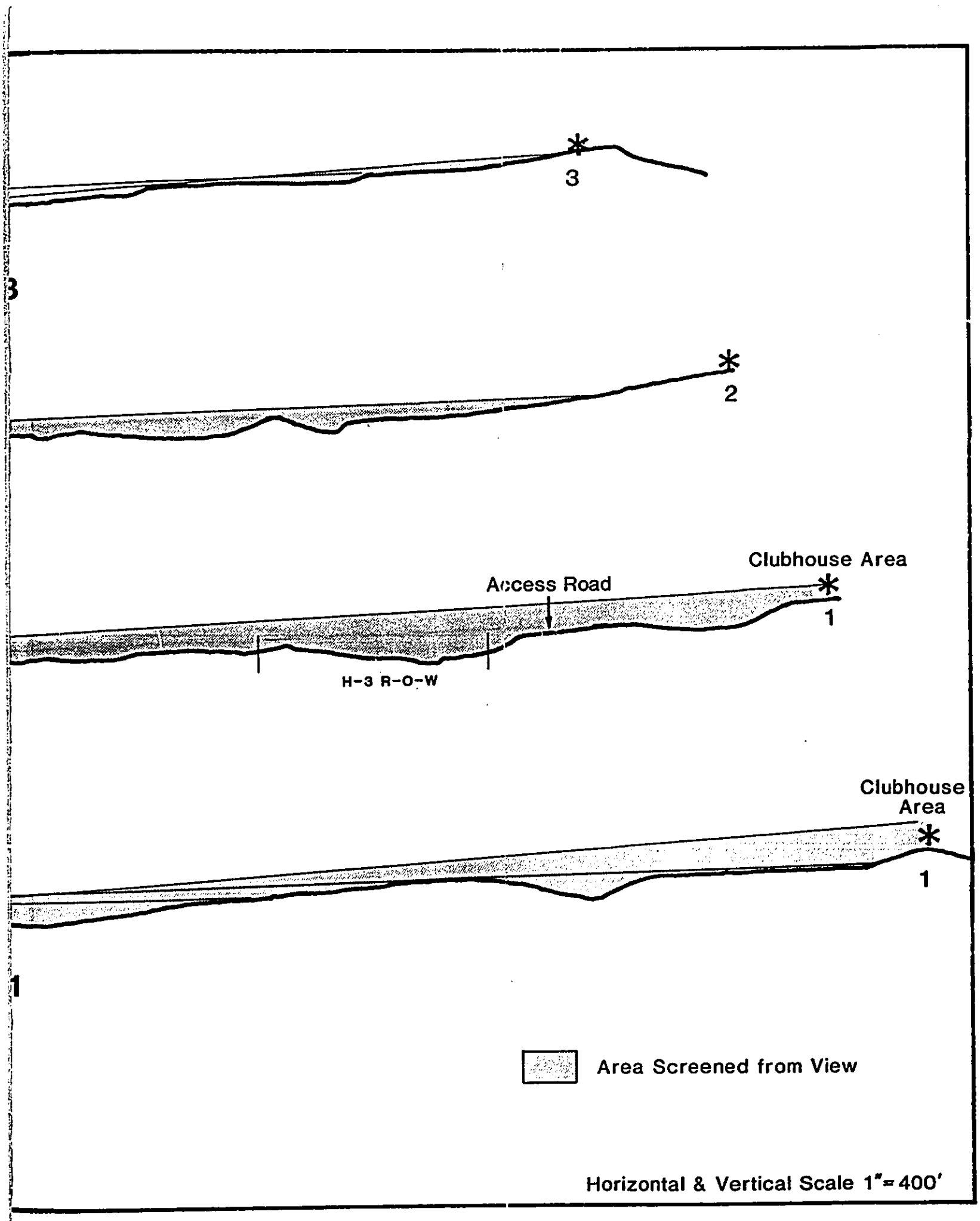


Exhibit IV-19 Sheet 4 **Sections Along View Lines**


3
2
Clubhouse Area
Access Road
1
H-3 R-O-W
Clubhouse Area
1
1
Area Screened from View
Horizontal & Vertical Scale 1"= 400'

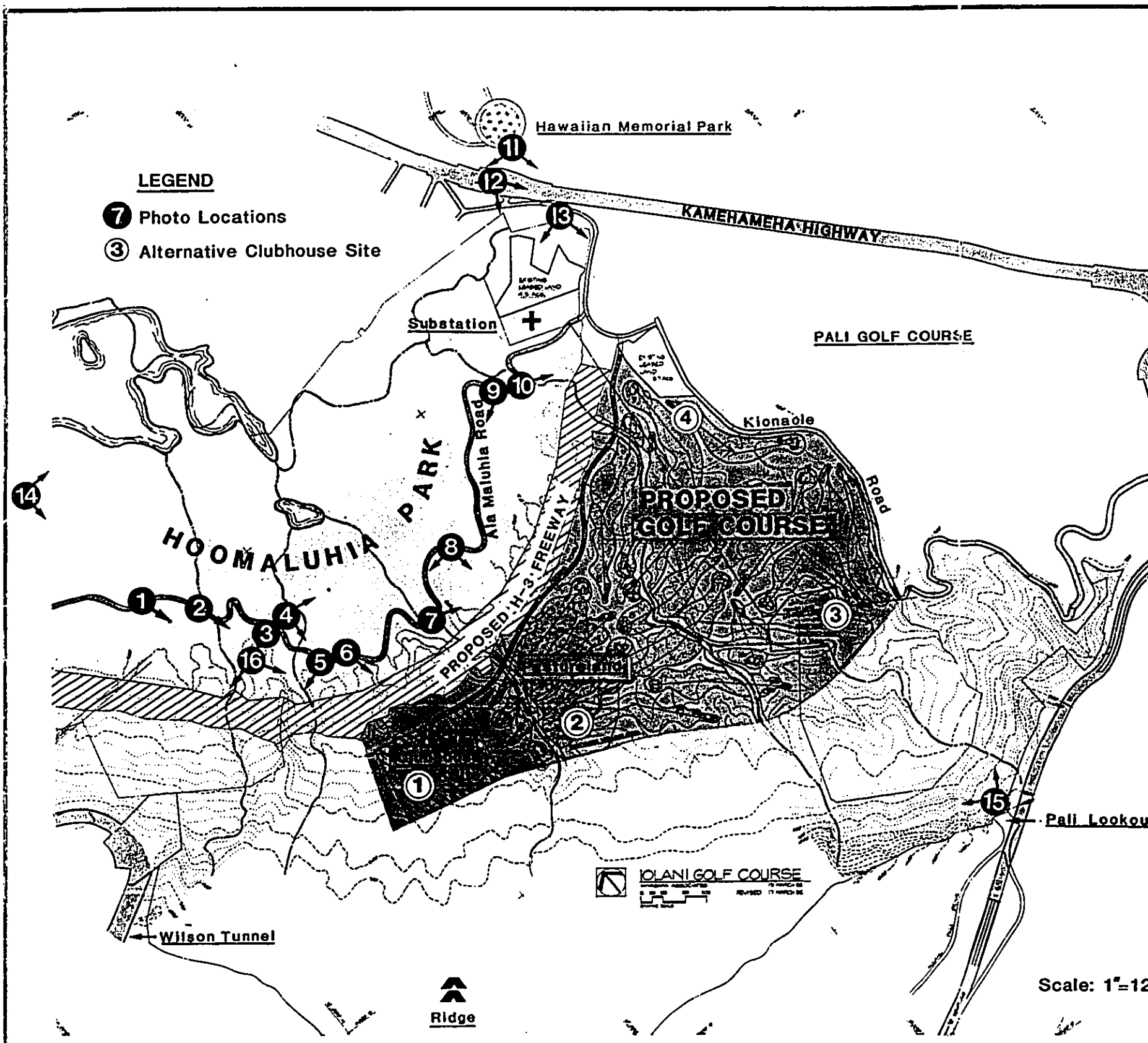
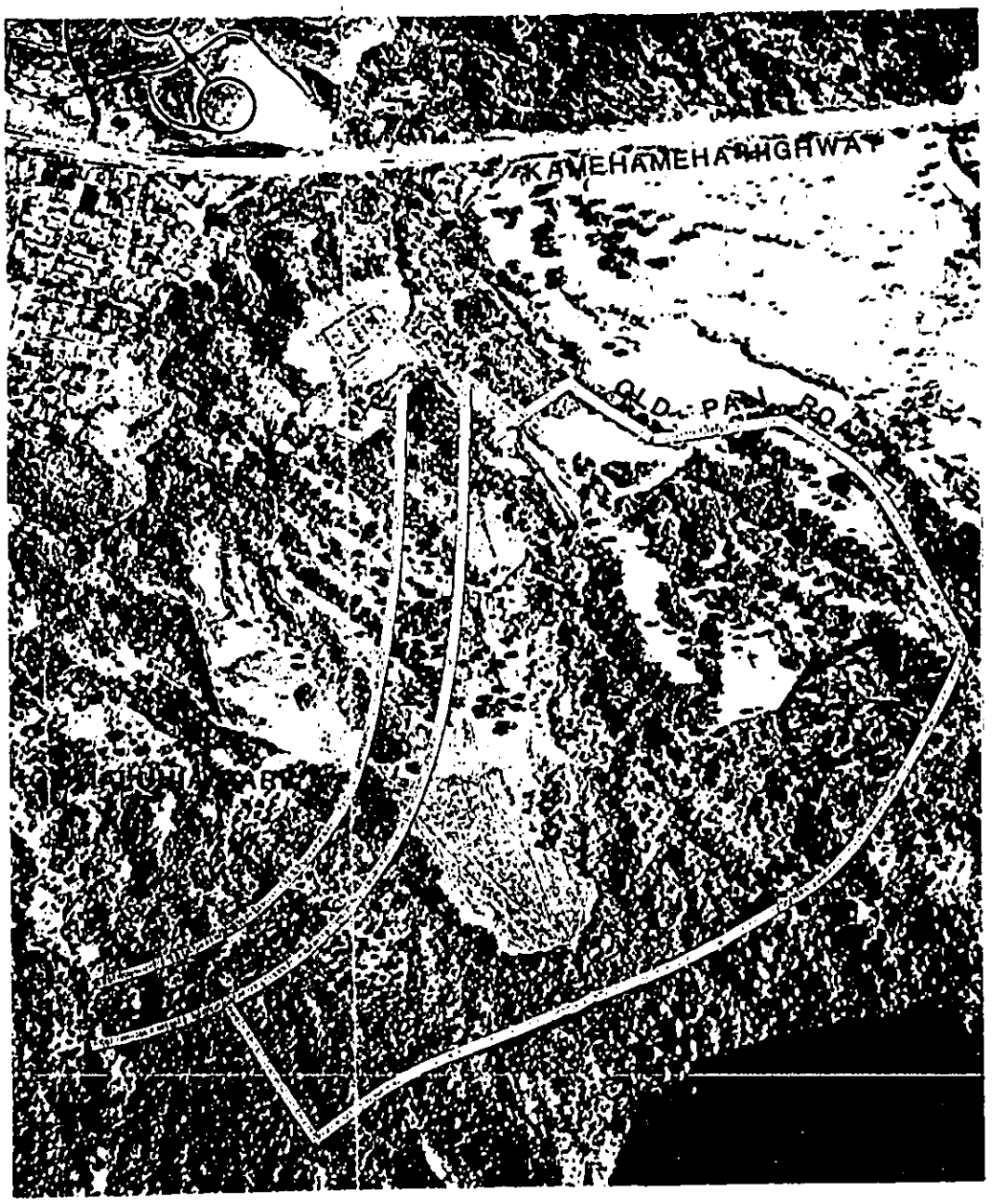
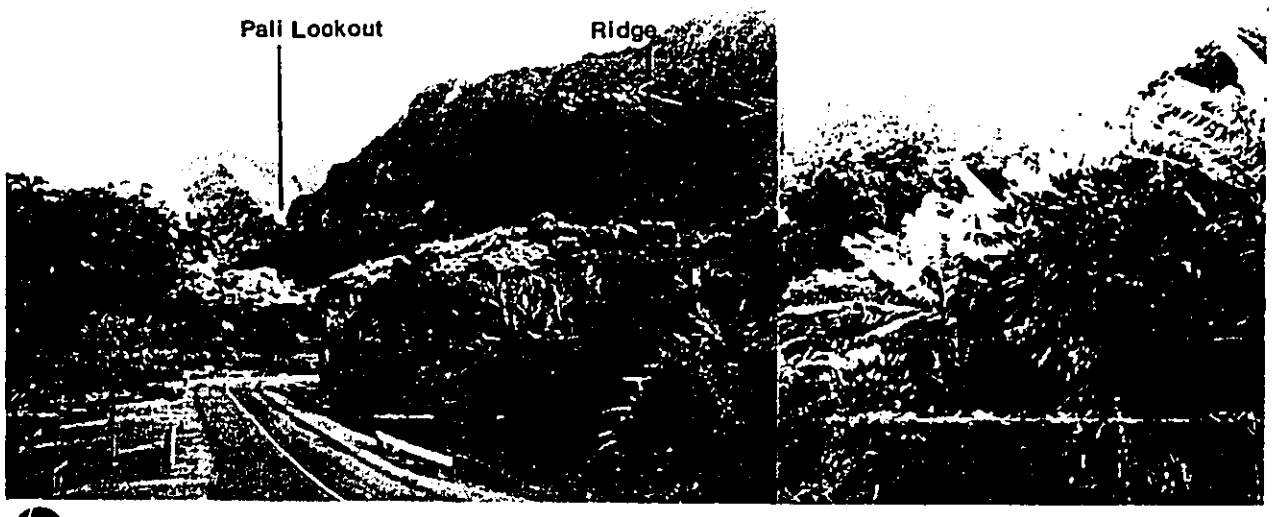


EXHIBIT IV-20 Preliminary Golf Course Layout and Photo Lo

Scale: 1"=1200'



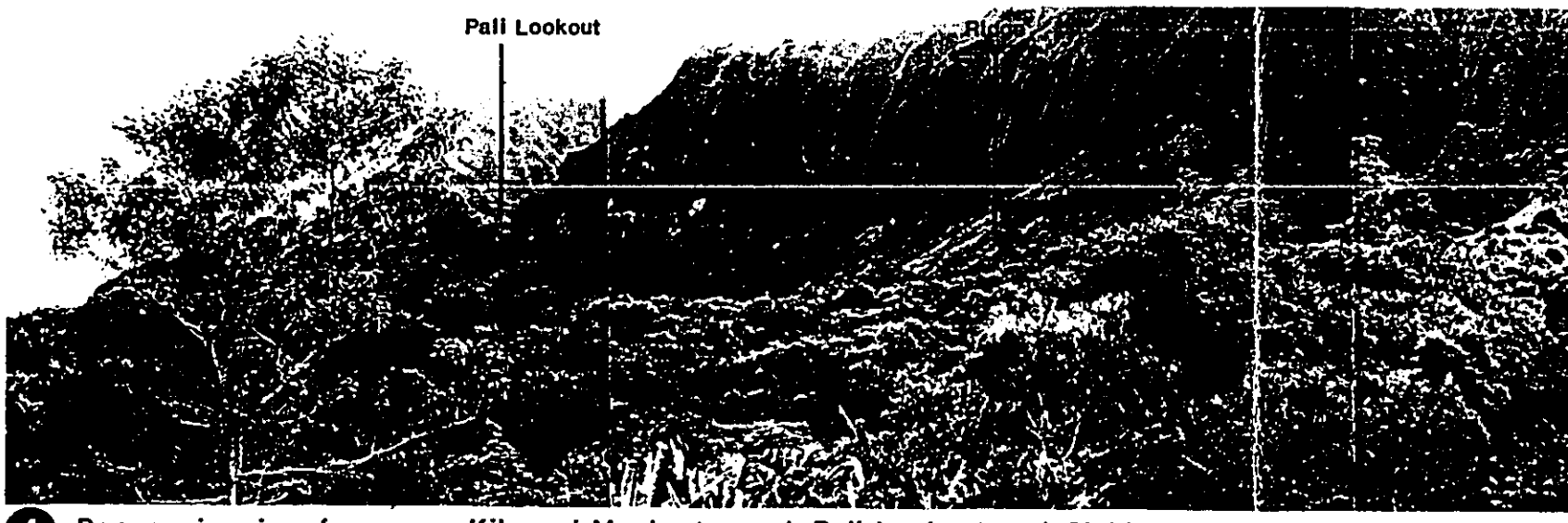
d Photo Locations / Aerial Photo of Project Area



1 View from Kahua Kuou toward Clubhouse area and Pali Lookout

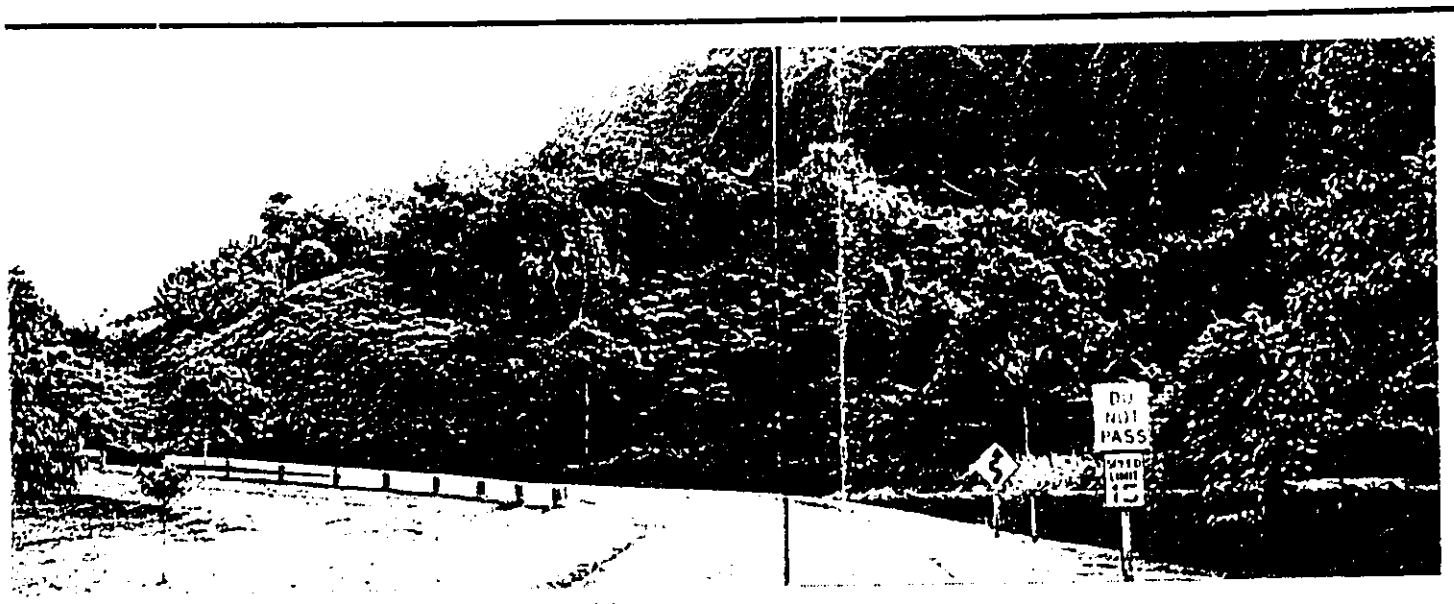
2 View from near Piho St

3 View from near Kilonani Mauka toward Wilson Tunnel



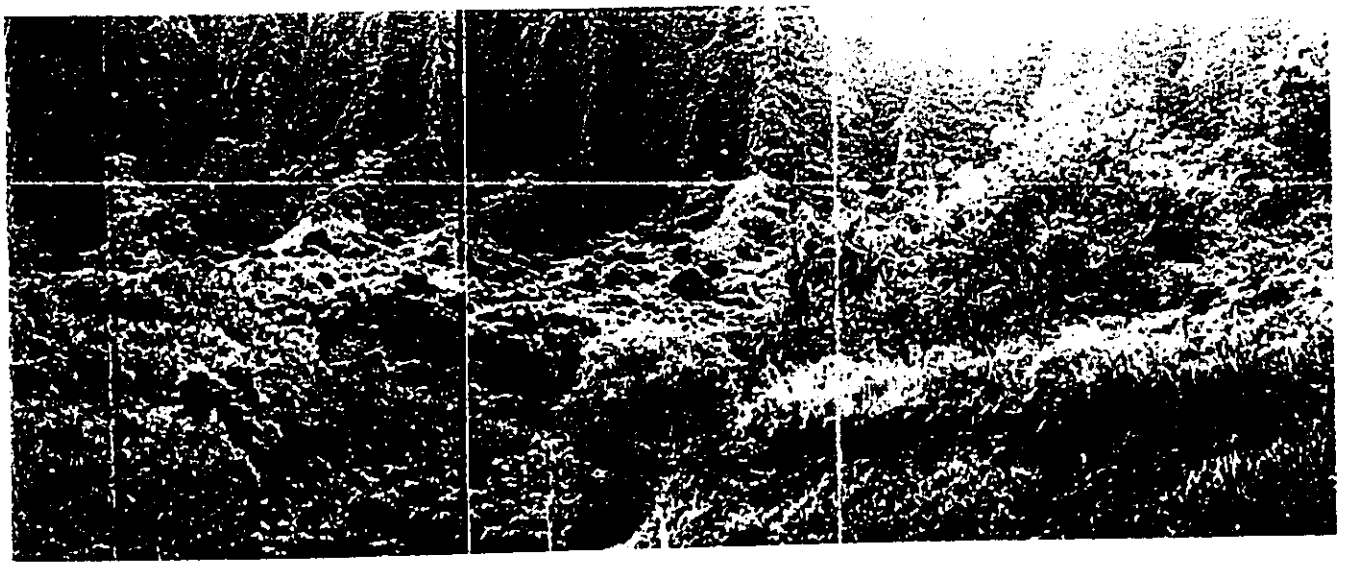
4 Panoramic view from near Kilonani Mauka toward Pali Lookout and Clubhouse area

EXHIBIT IV-20a Views from Ala Maluhia Road in Hoomaluhia Pa



ɔw from near Piho Stream toward Clubhouse area

son Tunnel

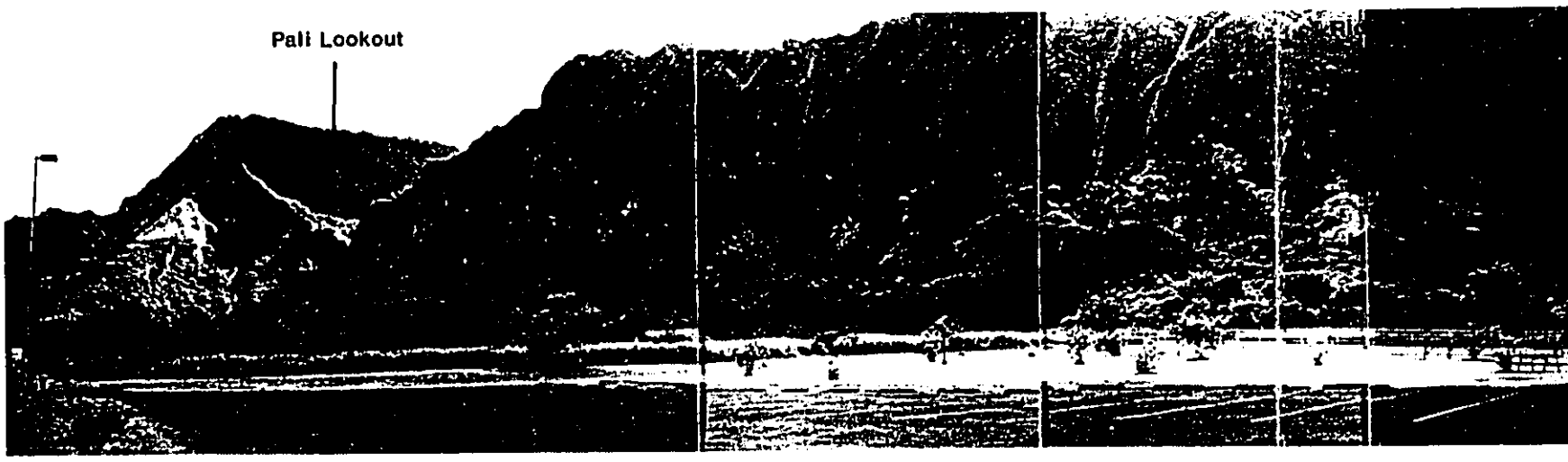


ɐa

oomaluhia Park

5 View from Kahua Kukui toward Wilson Tunnel

6 View from Kahua Kukui toward Clubhouse



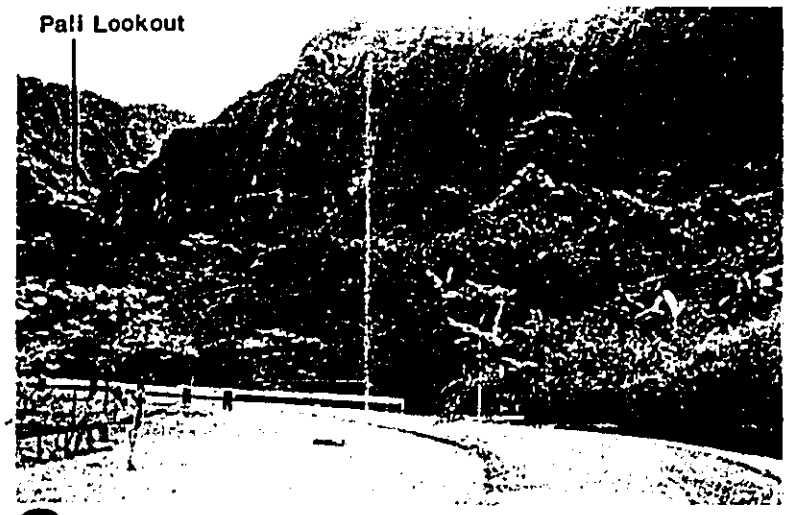
7 Panoramic mauka view from Equestrian area

9 View from near Kamooalii Stream toward Pali Golf Course

10 View from near Kamooalii Stream toward Pali Golf

EXHIBIT IV-20b Views from Ala Maluhia Road in Hoomaluhia P

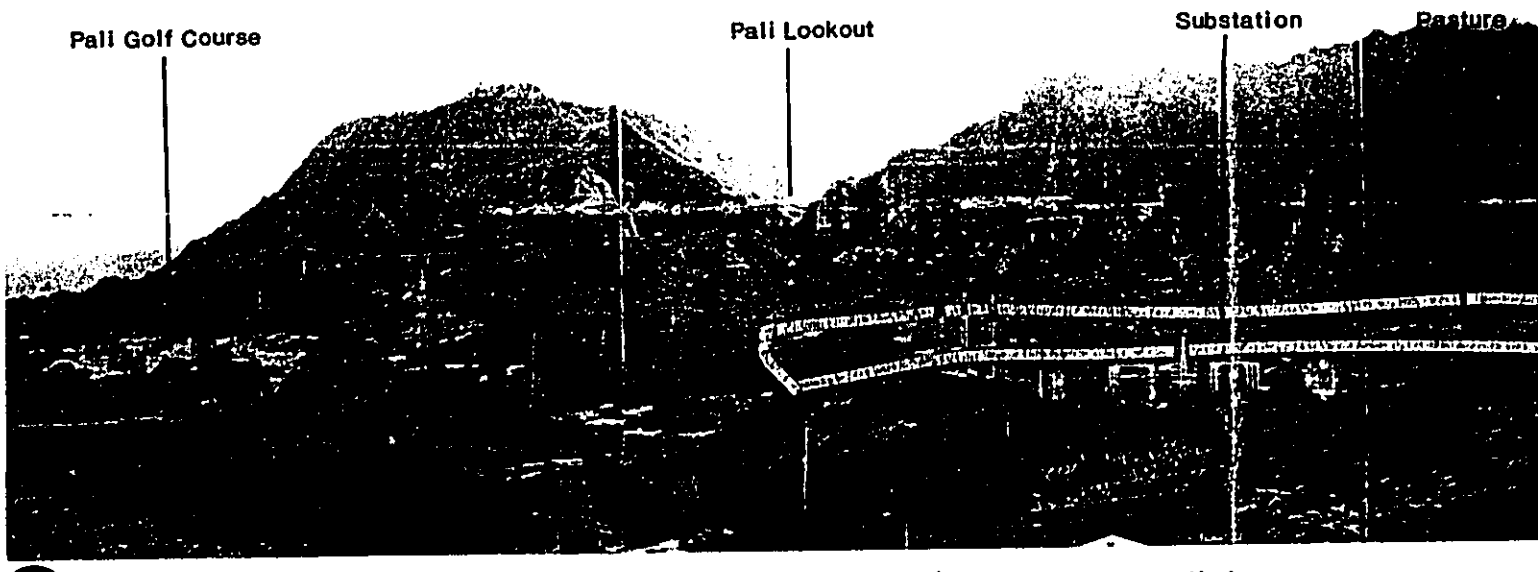
kui toward Clubhouse area



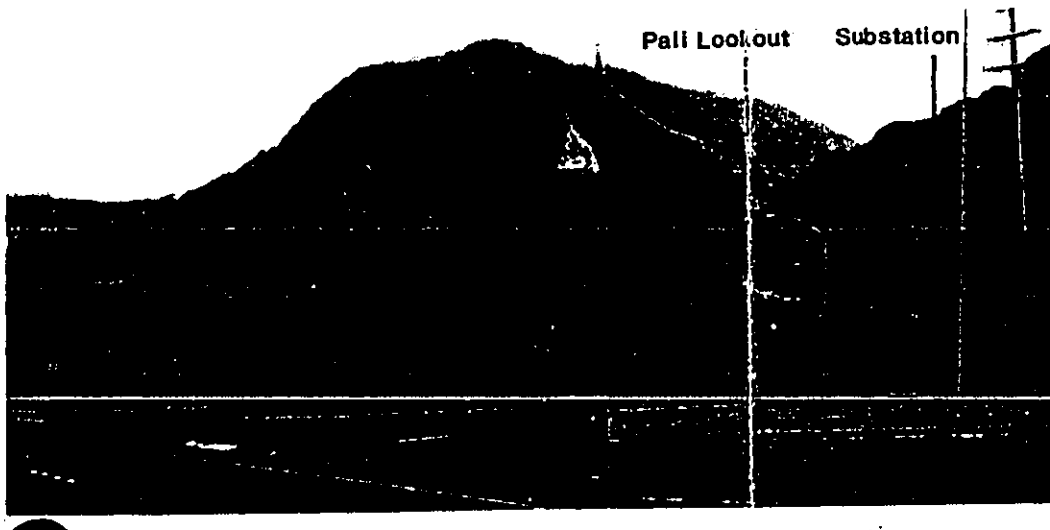
8 View from Hooleinaiwa Stream toward Pali Lookout

ream toward Pali Golf Course

ɔomaluhia Park

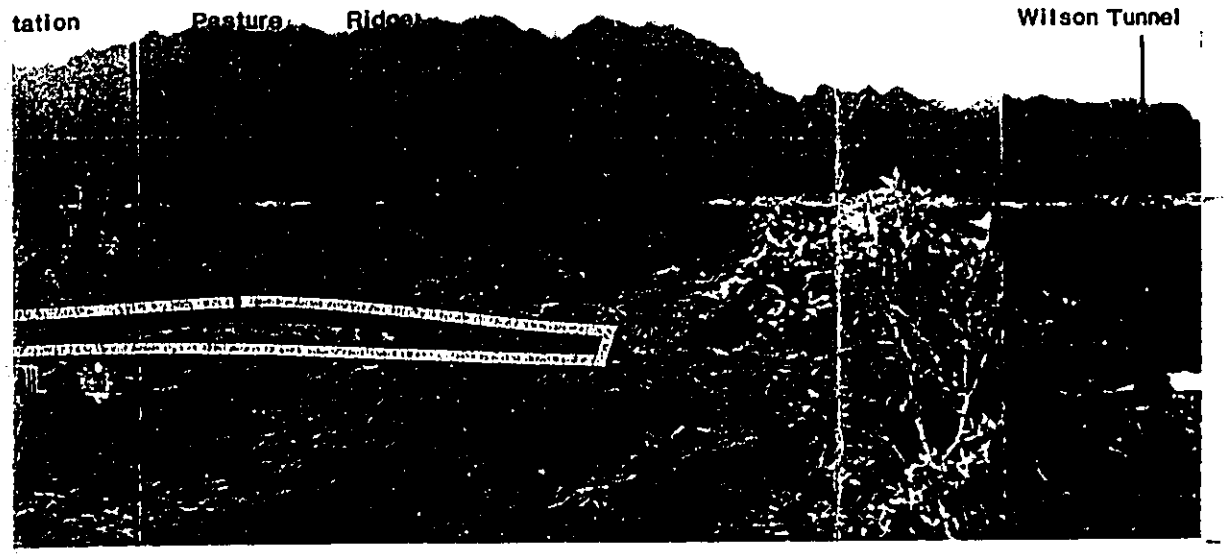


11 Panoramic mauka view from Hawaiian Memorial Park near Kam Highway



12 View from Kam Highway at Kionaole Road toward Pali G

EXHIBIT IV-20c Panoramic Views from Hawaiian Memorial Pa



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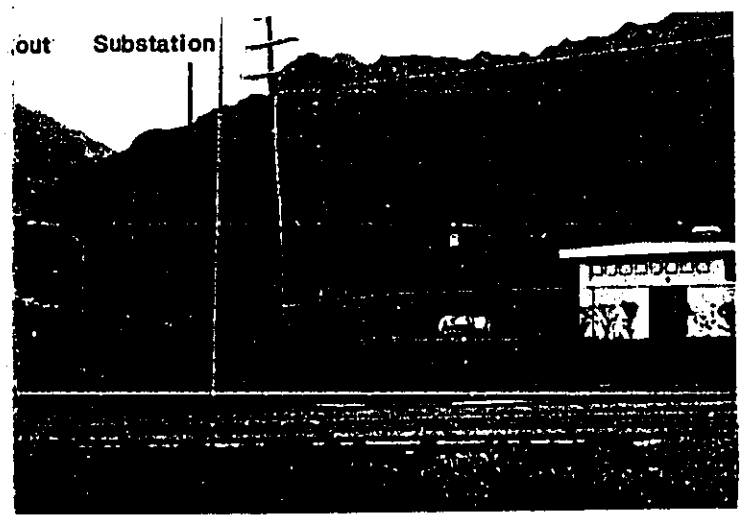

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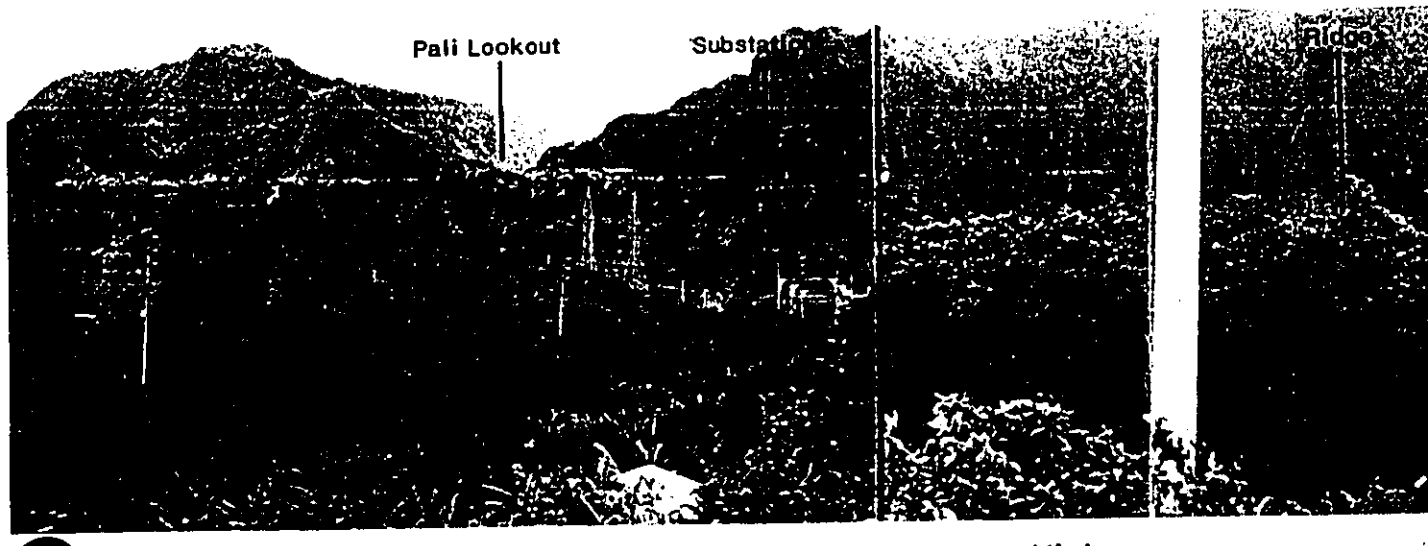
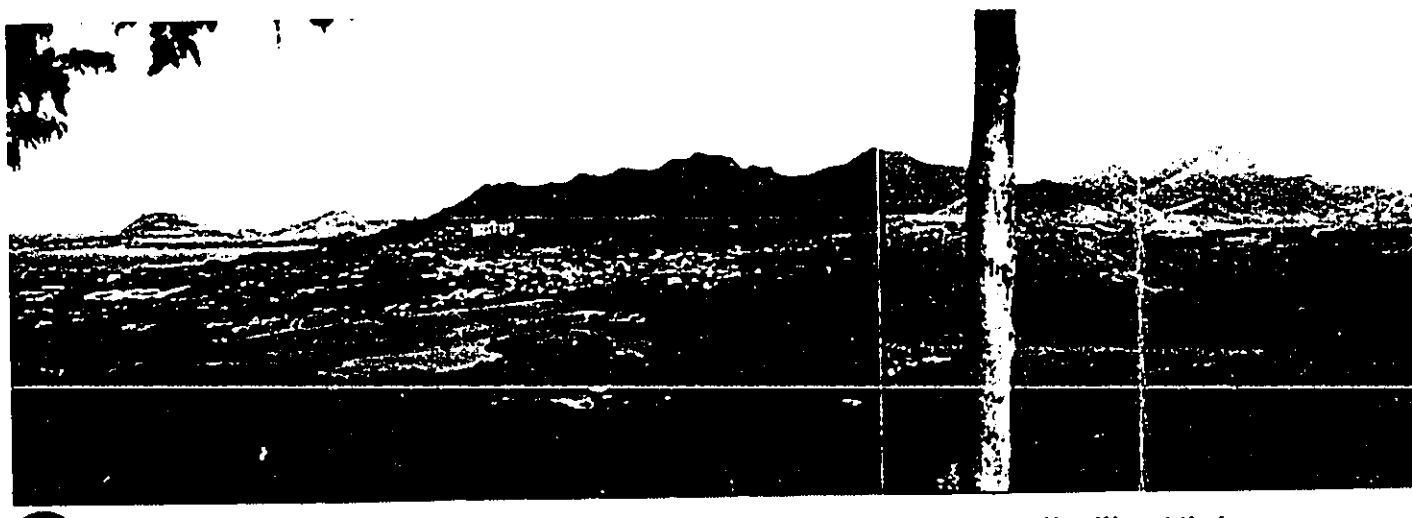


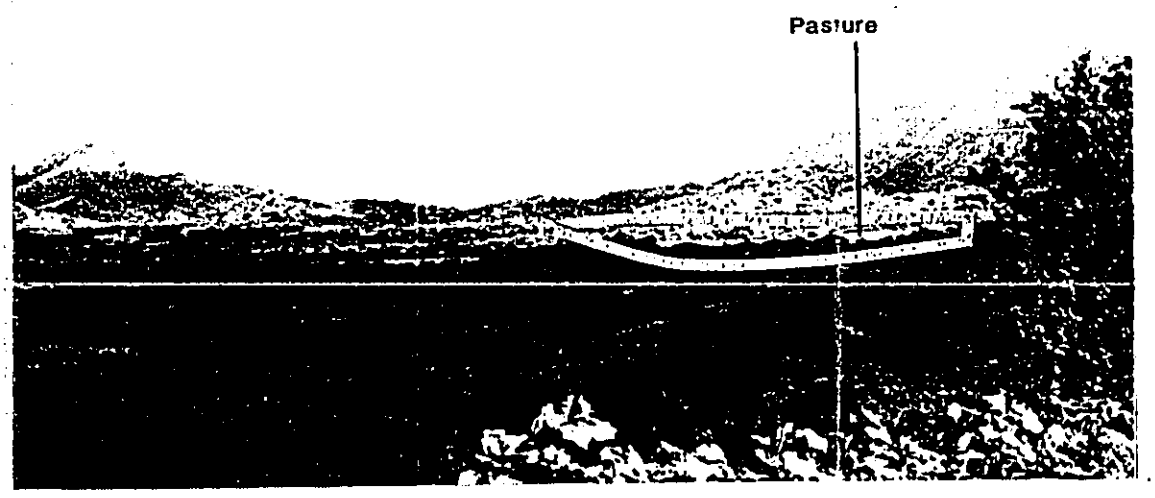
13 Panoramic mauka view from Kionaole Road near Kam Highway



14 Overview of Hoomaluhia Park and project area from Likelike Highway

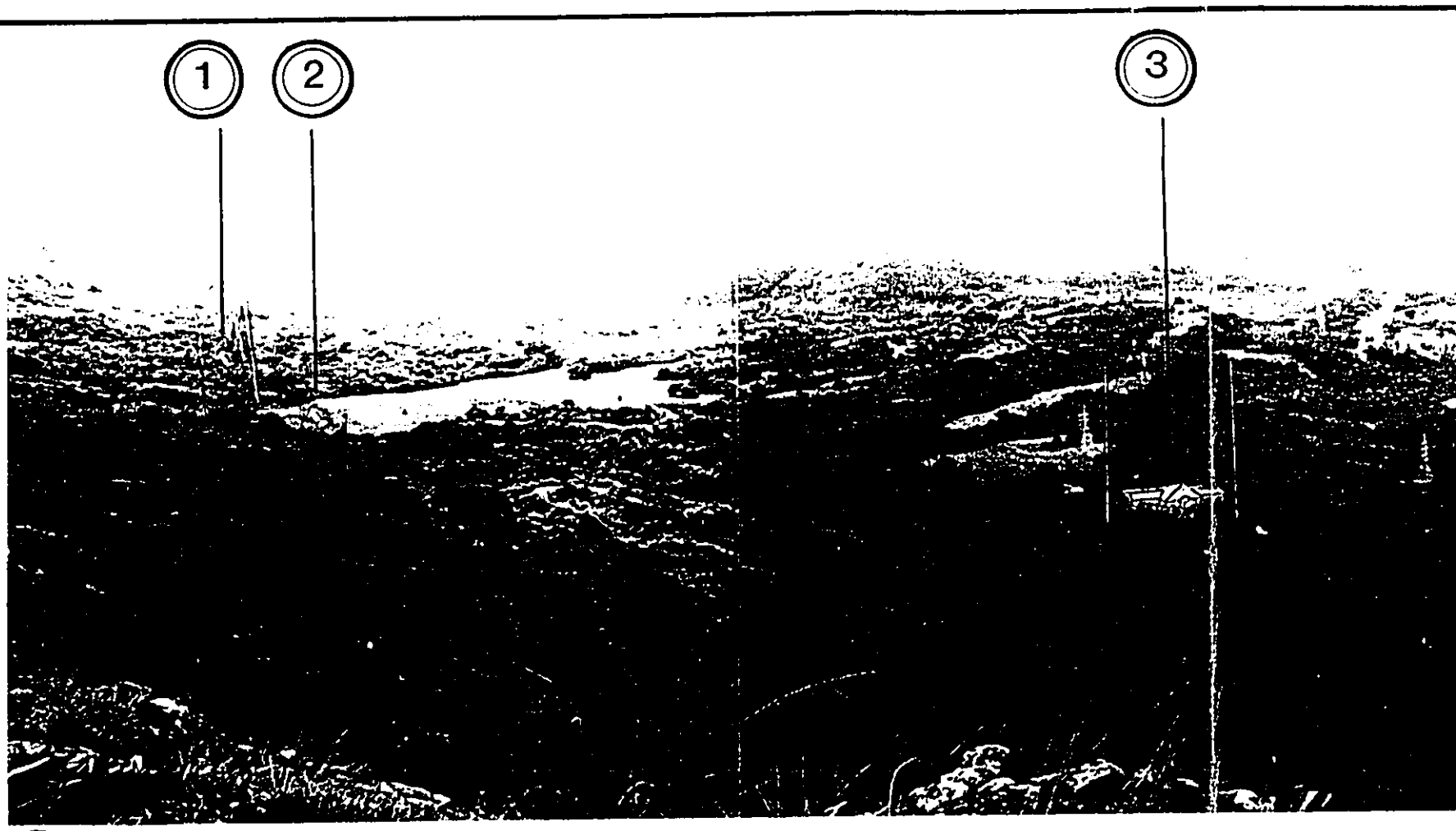
EXHIBIT IV-20d Panoramic Views from Hawaiian Memorial

y

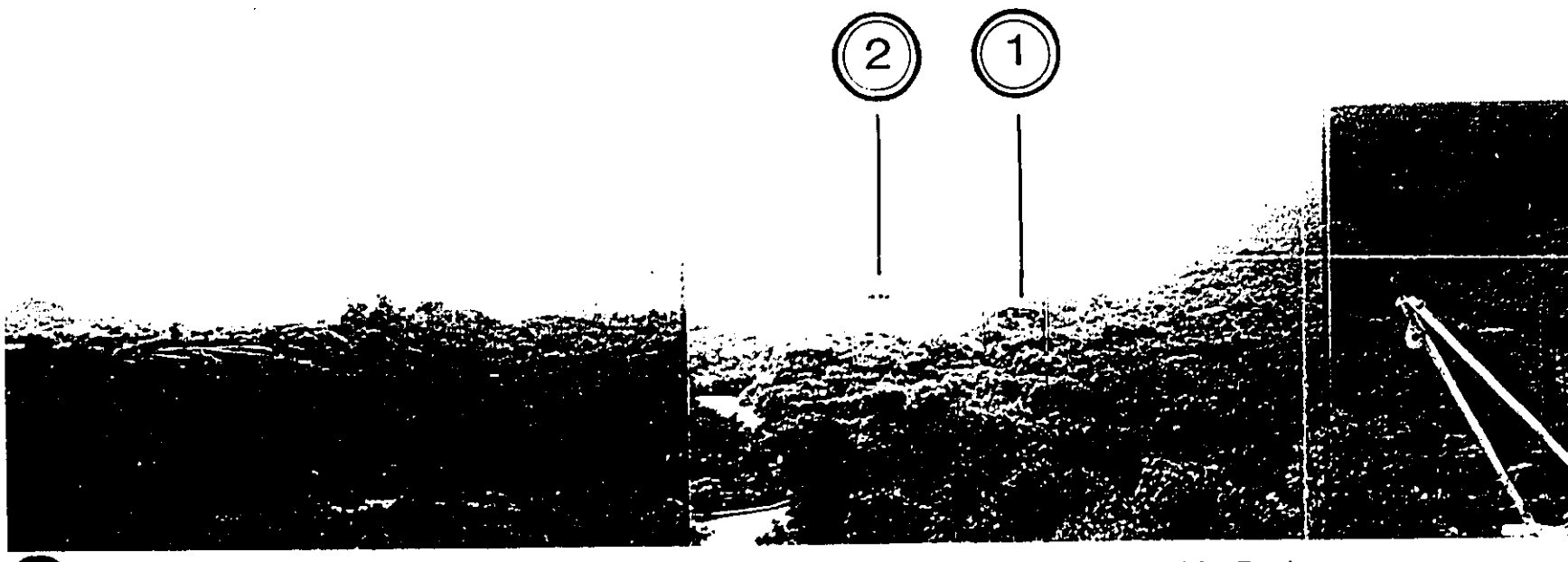


Highway

Memorial Park, Kam &Likelike Highways

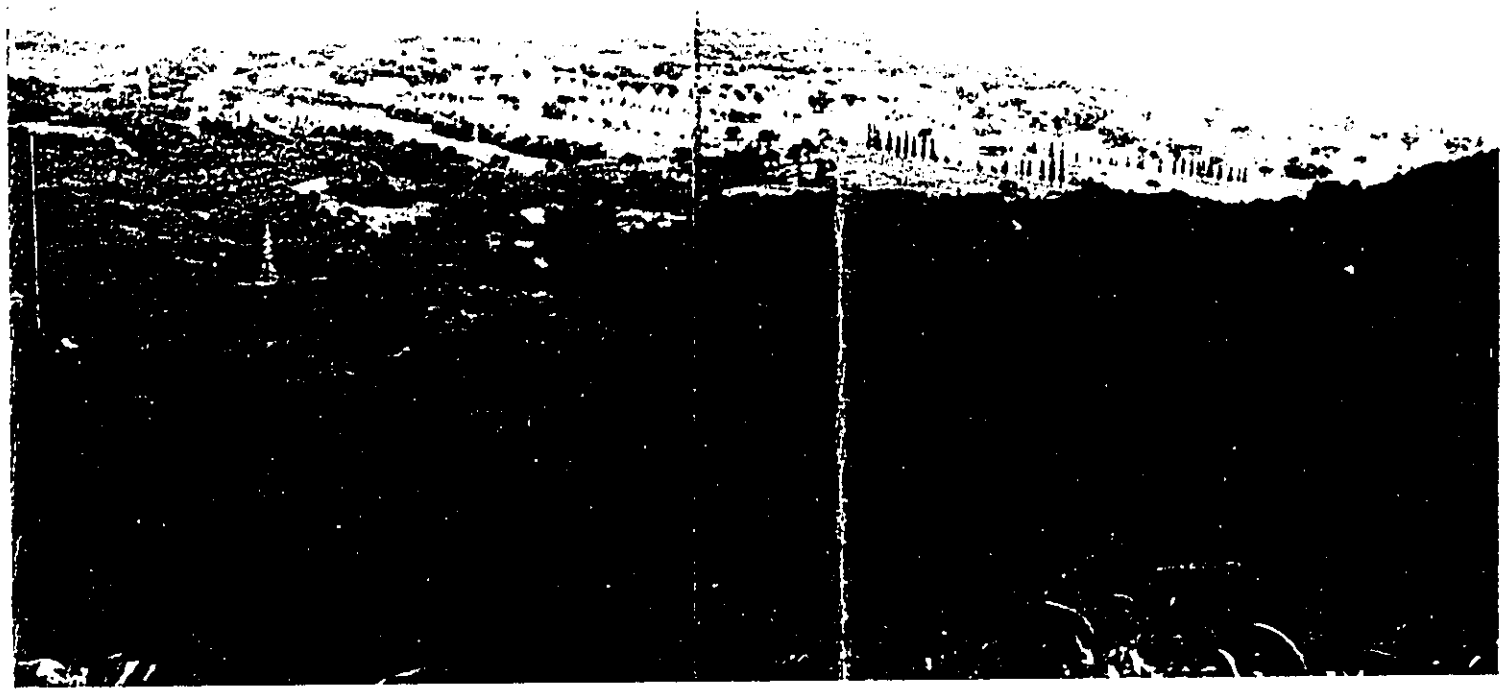


15 View of Clubhouse Sites 1, 2, and 3 from Pali Lookout



16 View of Clubhouse Sites 1 and 2 from near Kilonani Mauka in Hoomaluhia Park

EXHIBIT IV-20e Alternative Clubhouse Sites



CHAPTER V

V. ANTICIPATED IMPACTS AND MITIGATIVE MEASURES

A. GRADING AND SOIL EROSION

Grading of the golf course, while necessary to build the tees, fairways and greens, will be minimized to the extent possible to preserve the natural slope of the land and to maintain existing drainage patterns. **Prior to grading, however, the U. S. Army Corps of Engineers will be contacted to determine and designate wetland areas within the project site. The description of existing soils, particularly the Hanalei series (p. 32) and the botanical survey (Appendix B) indicate that wetland conditions exist within the project area. A Department of the Army permit may be required if the placement of fill adversely affects more than one acre of designated wetland areas. This step will be coordinated with the Army Corps of Engineers during the detail planning phase with topographic survey map.**

During construction, soil erosion control measures such as utilizing siltation basins and berms will be implemented. Exposed areas will be planted with landscaping or ground cover vegetation immediately after the grading of an area is completed to preclude baring large contiguous areas. All of the City and State regulations and ordinances dealing with grading work will be complied with.

Even with careful implementation of erosion control measures, during construction the project **will** cause some increase in the sediment transported, **if it rains heavily,** to the Loko Waimaluhia Reservoir and ultimately to Kaneohe Bay via Kamooalii Stream and Kaneohe Stream respectively. However, the majority of the potential sediment will be deposited in the reservoir and will not reach Kaneohe Bay.

Based on U. S. Geological Survey studies, the project area of approximately 225 acres is presently contributing 0.2 acre-feet or about 10 percent of the average annual sediment inflow to the Loko Waimaluhia Reservoir. The reservoir was designed to provide 200 acre-feet of sediment storage based on a design life of 100 years.

Upon completion of the proposed golf course there should be a decrease in the amount of sediment presently generated within the project site. The U. S. Department of Agriculture, Soil Conservation Service uses the Universal Soil Loss Equation (USLE) to estimate long-term average annual soil losses from sheet and rill erosion. It is used to estimate erosion on forest land, farm fields, construction/development sites and other areas. Soil losses can be estimated for present conditions or for a future condition. The soil loss equation is:

$$A = RKLSCP$$

where

A is the soil loss (tons per acre per year)
R is the rainfall factor
K is the soil erodibility factor
L is the slope length factor
S is the slope gradient factor
C is the cover and management factor
P is the erosion control practice factor

For the project site, all of the factors except C remain basically the same before and after the proposed golf course is constructed. Presently, the area is not managed and there are areas that are bare or poorly vegetated. When the golf course is completed, half of the project site will be grassed and landscaped, and will be well maintained. The remainder will remain in its current vegetated condition. Accordingly, the C factor is estimated to be 0.01 for the golf course landscaped areas and 0.04 for the unimproved or present condition areas. Based on the USLE, the result is a reduction of sediment transport to about one-half of the present average annual sediment losses for the 225-acre project site and an increase of the design life of the Loko Waimaluhia Reservoir by about five years if the project is realized.

B. DRAINAGE

There may be a slight increase in the storm runoff due to higher runoff coefficients for golf course fairways and greens, roads, parking areas and other impervious surfaces. However, other features of the golf course such as bunkers, ponds and retention basins will help offset the increase in runoff flows. In addition, the actual area being improved is less than 5% of the total drainage basin of the streams flowing into the reservoir. Consequently the proposed golf course improvements are not expected to create a significant increase in stream flows and would not adversely affect the function of the dam and reservoir in Hoomaluhia Park which were constructed to protect residential areas.

The golf course clubhouse complex will be built well above the estimated flood levels of streams during Standard Project Flood peak flows. On the other hand, the golf course will be allowed to flood thereby creating retention/flood basins that will help to lessen the storm flows.

All drainage improvements will be designed and constructed in conformance with the Storm Drainage Standards of the Department of Public Works, City and County of Honolulu.

C. WATER QUALITY

There are two general water categories, groundwater and surface water, that could be affected by the project. Environmental impact to groundwater would be primarily the result of using chemicals on the golf course, while the impact to surface water (streams and Loko Waimaluhia Reservoir) would be the result of chemical application and from sediment transport.

Adverse impact of the project in regard to soil erosion and sediment transport is basically a temporary and short-term concern during construction. Proper implementation of soil erosion control measures would help mitigate the sediment transport to the streams and reservoir during this period. As explained in a previous section, upon completion of the golf course, there will be a decrease in soil erosion and sediment transport, so that the long-term impact would be positive. In addition, mitigative measures such as retention/sedimentation basins could be incorporated as permanent features of the golf course.

Regarding the use of chemicals on golf courses, the two major uses are fertilizers and pesticides. Chemicals used as pesticides are further categorized according to their use to control plant diseases, insects and weeds. The description, uses and application amounts are summarized in Exhibit V-1 and covered in detail in Appendix F. The use of these fertilizers and pesticides must meet the requirements of the State Departments of Health (DOH) and Agriculture (DOA). Therefore, all chemicals to be used shall be bio-degradable and U. S. Environmental Protection Agency (EPA) approved in terms of content. Operators will be qualified by the DOA for spray dispersal use.

Since groundwater is the island's primary potable water source, its quality is a vital concern. Consequently, the contamination of groundwaters that are existing or potential sources of potable water is normally of greatest concern in the application of fertilizers and pesticides to soils. However, much of the proposed golf course will overlie artesian groundwater. There is likely no chance of downward percolation of fertilizers and pesticides to ground water. Rather, surface flow and subsurface interflow to streams and subsequently to Loko Waimaluhia reservoir would be of concern.

The primary fertilizer elements of concern for contamination of surface water are nitrogen and phosphorus. Phosphorus, however, moves very little in soils and will cause no problems. Ammonium nitrogen also moves little in soils. The form of nitrogen which will move readily in soils is the nitrate form. Because of high nitrogen use by turfgrasses,

EXHIBIT V-1

TYPICAL FERTILIZER AND PESTICIDE FREQUENCY AND REQUIREMENTS FOR 18 HOLE GOLF COURSE

	AREA	AMOUNT	X	FREQUENCY	ANNUAL REQUIREMENT
FERTILIZERS: 28 Nitrogen - 3 Phosphate - 9 Potassium					
A. Greens & Tees	10 A.	2.5 tons		12/yr.	30 tons
B. Fairways & Roughs	100 A.	25 tons		6/yr.	150 tons
PESTICIDES:					
A. Herbicides: Fairways and Roughs					
MSMA	100 A.	33 gal.		4/yr.	132 gal.
Glyphosate					25 gal.
Metribuzion	100 A.	25 lb.		2/yr.	50 lb.
Pendimethalin	100 A.	400 lb.		2/yr.	800 lb.
B. Insecticides: Greens and Tees					
Seven	10 A.	21 gal.		12/yr.	252 gal.
C. Fungicides: Greens and Tees					
Dithane M-45	10 A.	109 lb.		25/yr.	2,725 lb.
Kocide	10 A.	217 lb.		12/yr.	2,604 lb.
Subdue	10 A.	6.7 gal.		3/yr.	20 gal.

Source: Hawaiian Fertilizer Sales, Inc., July 1986.

nitrogen normally will be used rapidly as it is applied. Only under conditions where heavy rainfall occurs in one to two days following the application of a soluble nitrogen source would there be excessive loss of nitrate nitrogen from surface runoff.

However, the potential for environmental hazards to surface waters from application of fertilizers and pesticides to the golf course is small. The total area in tees, greens and fairways (the area to which fertilizers and pesticides would be applied) would be no more than 80 to 100 acres. This is a small area compared to the total area of the Loko Waimaluhia Reservoir drainage basin of 3.14 square miles or 2,010 acres. Consequently, dilution of any fertilizer element or pesticide in the water runoff from the golf course is expected to be great enough to render concentrations insignificant.

The largest potential for environmental hazard would be in instances where just sufficient rainfall is received to cause slight runoff. This would result in the greatest concentration of fertilizer and/or pesticide in runoff water. In such cases negative environmental impact would probably be limited to fish, invertebrates and wildlife in the streams flowing through or immediately below the golf course.

The materials which would appear to present the greatest hazards for fish and wildlife are the insecticides and fungicides. These materials are usually applied only to high maintenance areas, such as greens and tees. There might be outbreaks of turf caterpillars occasionally on one or two fairways at a time which would warrant application of insecticides. It is unlikely that large acreages would be treated with insecticides and/or fungicides. These materials are of little or very short residual in the soil. The greatest danger to fish and wildlife is when applied directly to water. In the event that slight runoff occurred immediately after application of insecticides and/or fungicides, the retention and settling basins would greatly reduce hazards to fish, invertebrates and wildlife in the streams and the reservoir.

To mitigate potential adverse environmental impact, the following measures will be implemented:

1. Retention and settling basins will be incorporated into the golf course and drainage system design. This would greatly reduce the risk of environmental hazards to stream and the reservoir in instances when slight runoff occurs soon after the application of fertilizers and/or pesticides. **The basins will be checked periodically and maintained as needed to remain effective.**

2. Slow release nitrogen fertilizers will be used which release nitrogen at approximately the same rate as nitrogen is used by turfgrasses.

3. Pesticides used will be limited to those which provide the most effective control of turf pests under Hawaii conditions with the least environmental hazard.

4. **The Kamooalii and Hooleinaiwa Streams will be monitored near U. S. Geological Survey Stream gaging stations 2657 and 2665 to evaluate the project's impact on stream quality.**

D. BIOLOGICAL RESOURCES

1. Vegetation

The vegetation in the project area consists largely of introduced species due to the varied history of past land uses. While native species may be scattered through the area, they are usually found on the steeply sloping areas and in the open scrub. These native species, which include uluhe fern, hala, hau, ohia, akia and others, are found in similar environmental habitats throughout the Hawaiian Islands and none are considered rare, threatened, or endangered. Development of the area will have only a minimal impact on the total island populations of the species involved.

Only about 100 acres of the total project area will be cleared and re-landscaped. The remainder will be left in its natural state. Significant trees and other plant material will be retained and incorporated into the golf course landscape plans.

2. Wildlife

There are no endemic Hawaiian waterbirds or forest birds, or suitable habitat for them, in the project area. Although two species of endemic waterbirds are found in small numbers on the reservoir in Hoomaluhia Park, the lake does not provide suitable habitat for reproduction of these species.

It is anticipated that the proposed golf course would not have any adverse effect on the owl, night heron, golden plover, or introduced species. The proposed project may actually increase and improve the wildlife habitat in the area through appropriate landscaping, the creation of ponds as water hazards, and the control of existing pests and predators.

3. Aquatic Fauna

As mentioned earlier in the existing aquatic fauna condition (p. 45), the major factor currently limiting the abundance of diadromous endemic species in the streams of the project area is the unsurmountable vertical dam of Loko Waimaluhia Reservoir.

Additionally, variations in the water level of streams and reservoirs can potentially impact aquatic life, however this is not expected to be a problem from the golf course project. There may be a slight increase in storm runoff from the project, but not likely enough to affect wildlife in either the streams in the project area or the reservoir in Hoomaluhia Park. If a well is used for water supply to the project, the developer will work closely with BWS and DLNR to monitor and control any effects on the base flows for all streams in the project area. **Well pumpage will be reduced and/or pumped water will be released into the stream, if it is determined that streamflow is being reduced due to well pumpage for golf course irrigation during dry periods.**

There may be, however, a slight increase in sediment transported in the streams to the Loko Waimaluhia Reservoir during construction of the golf course. It is unlikely that this sediment will affect the abundance of introduced species in the waters, in the same way that the construction activity of the flood control dam did not adversely affect the abundance of introduced fish residents.* The amount of sedimentation created by the golf course construction will be considerably lower than that resulting from dam construction, and erosion control measures will be implemented, as described in Section A of this chapter, to minimize the impacts. Once the golf course is completed, the amount of sediment presently generated within the project site will be reduced by about half, thereby improving the sediment-related water quality conditions.

A concern for impacts of the golf course project on aquatic fauna is related to the use of pesticides and fertilizers. These impacts are described in Section C, Water Quality, of this chapter.

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*Timbol, Amadeo S., Ph.D. Biological Reconnaissance of Kaneohe Stream and Two of its Tributaries; Luluku and Kamooalii, Oahu, 1979.

E. ARCHAEOLOGICAL SITES

The proposed development of a golf course will result in ground disturbance on about 100 acres of the project area. The purpose of the recent archaeological and historical study has been to assess the possible adverse impacts this may have on archaeological sites in the project area. In order to do this, the concern has been primarily one of identification of sites and an understanding of how the area was utilized in the past. Available information indicates that none of the sites identified would require either in situ preservation or an extensive program of data recovery. The value of the sites primarily rests with the data they contain for scientific research. All of the sites appear to have very little value for public education or display purposes, or cultural or religious significance.

It is, nevertheless, decided that the golf course would be designed around all of the sites, leaving then in a "no build" area. This would result in "no effect" to these sites.

In the event the "avoiding" is impossible and any of the sites must be utilized, further archaeological work will be completed to evaluate site significance and acceptable mitigation plans will be prepared and executed. These steps will be coordinated with the State Historic Preservation Office (SHPO).

During the detail design process with topographical survey map, the following measures will be taken in coordination with the State Historic Preservation Office.

1. Prior to any additional field work, conduct an instrument survey to determine whether sites -2940 and -2941 are actually within the project area. Because of their proximity to the southern boundary, it is possible that these sites could in reality lie outside the project area. If these sites are outside the project area, additional fieldwork and data recovery may not be necessary.

2. Determine whether or not the four possible site locations are in fact sites. This will involve clearing vegetation around the suspect features, mapping, and undertaking subsurface testing. If any of the locations are determined to be sites, they would then be accurately located on the project map with an instrument survey to make certain that they are in fact located within the project area. The possible need for additional data recovery at any locations that are determined to be sites would be coordinated with SHPO.

3. Prior to construction and land alteration activities, further archaeological documentation will be obtained from the four sites (or two sites, pending instrument survey) found during the survey to fully evaluate their significance. Recommendations will then be made concerning the possible need for additional data recovery.

4. During initial land clearing and bulldozing for golf course construction, a professional archaeological monitor will be present on an intermittent basis to observe the subsurface conditions in areas which have been recently cultivated and other areas that appear to be of potential archaeological interest based on prior archaeological observations and investigations. A **report documenting the findings shall be submitted to the SHPO.**

F. UTILITIES

1. Water Supply

Groundwater is the primary source of the base flows for all of the streams in the project site. However, most of the base flow (90 percent) of the streams originate as groundwater seepage between elevations of about 100 and 200 feet (see Appendix E). Higher elevations account for 10 percent or less of the total, according to measurements recorded by U. S. Geological Survey (USGS). Since the groundwater is confined in compartments created by relatively impervious vertical dikes, a well constructed above elevation 350 feet is not likely to measurably affect base flow. The free water table at this elevation stands about 300 feet above sea level. The maximum base flow reduction expectable from a well above elevation 350 feet would be on the order of 10 percent for an affected stream if at all. Only after long-term monitoring can the actual reduction in base stream flow be determined. The effect of recharge from golf course irrigation could be a factor.

The Board of Water Supply, with the aid of the USGS and the Hoomaluhia Park staff, has established a monitoring program to determine short-term and long-term impacts on stream base flows due to groundwater withdrawal (VTN Pacific, 1983). The Developer intends to work closely with BWS if the alternative to construct and operate one or more wells is selected.

In conclusion, the project will not have an adverse impact on Oahu's potable water supply. The Board of Water Supply is presently locating and constructing new well fields in the Kamooalii watershed. **The development of wells in this area is one of the sources intended to provide water for future growth on Oahu.** If, for some reason, new wells are not developed by Board of Water Supply and the project would adversely affect the current supply, the golf course development may utilize another water supply alternative, as described in Chapter III.

2. Wastewater System

The estimated average daily wastewater anticipated from the clubhouse is approximately 20,000 gallons per day. According to the City and County of Honolulu Department of Public Works, Wastewater Division, the existing municipal sewer system and treatment facilities will be able to accommodate the relatively small flows from the project.

Based on the recommendations of a study conducted to evaluate the Kaneohe and Kailua sewerage systems, the Kailua Sewage Treatment Plant will be expanded to service the entire Kaneohe-Kailua area. The flows currently directed to the Kaneohe STP will be conveyed to the expanded Kailua STP. Presently under design, construction of the expansion improvements is scheduled to commence in 1988.

G. TRAFFIC

It is estimated that the average daily traffic would be approximately 120 vehicles on weekdays and 150 vehicles on weekends for golfers, 60-80 vehicles for employees, and 150 additional vehicles when large functions are held at the banquet facilities. However, the proposed golf course is expected to have its peak traffic generation between 10 AM and 3 PM; employee traffic would be heaviest very early in the morning; and banquet facilities traffic would primarily occur after 6 PM.

Traffic data obtained from the State Department of Transportation indicate that Pali-bound traffic peaks before 8 AM and Kaneohe-bound traffic peaks after 4 in the afternoon on weekdays. On Saturdays traffic peaks at mid-day. Based on the foregoing it appears that under normal circumstances, project impact would be greatest between 3-4 PM on weekdays and 11 AM-12 noon on Saturdays.

For traffic analysis studies, the worst case hourly traffic volumes are used. For this project, the existing hourly traffic volumes for Kamehameha Highway were projected to 1989

conditions (when the golf course is expected to be fully operational) using a 1.5 percent annual traffic growth rate. An adjustment was then made to account for the impact of Interstate Route H-3. Because of the delay to the overall H-3 project, the completed portion between Kamehameha Highway and Mokapu Saddle Road, including modifications to provide an at-grade intersection with Kamehameha Highway, is scheduled to open in 1987. This action will increase the traffic on Kam Highway between Likelike Highway and Pali Highway until the total Interstate Route H-3 is completed, at which time the traffic on Kam Highway is expected to decrease. The resultant traffic forecast is summarized below: (See Appendix G for more detailed explanation).

Week day (3-4 PM)

- to Kaneohe (westbound)	1360 vph
- to Pali Highway (eastbound)	1040 vph

Saturday (11 AM-12 noon)

- to Kaneohe (westbound)	1340 vph
- to Pali Highway (eastbound)	1200 vph

Trip generation and distribution procedures were used to estimate the hourly volume (based on heavy traffic periods) and distribution of trips which would be generated by the proposed project. The results are summarized below:

TRIP GENERATION AND DISTRIBUTION SUMMARY

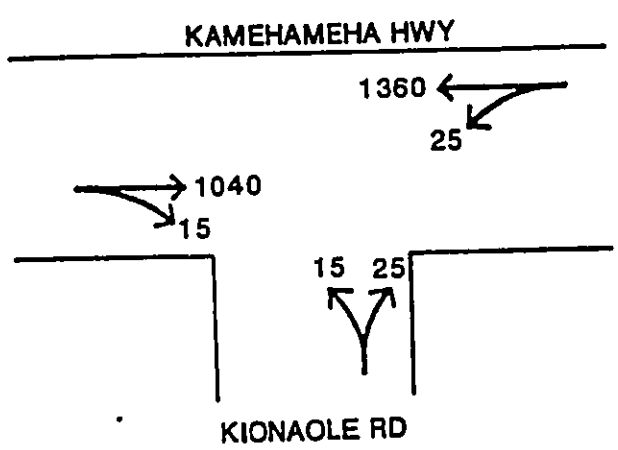
Direction	Hourly T.G. Rate/Acre	Hourly Volume of Trips	Directional Split to Pali (eastbound)	Directional Split to Kaneohe (westbound)
WEEKDAY:				
Inbound	0.2	40	25	15
Outbound	0.2	40	25	15
SATURDAY:				
Inbound	0.32	65	40	25
Outbound	0.32	65	40	25

NOTES:

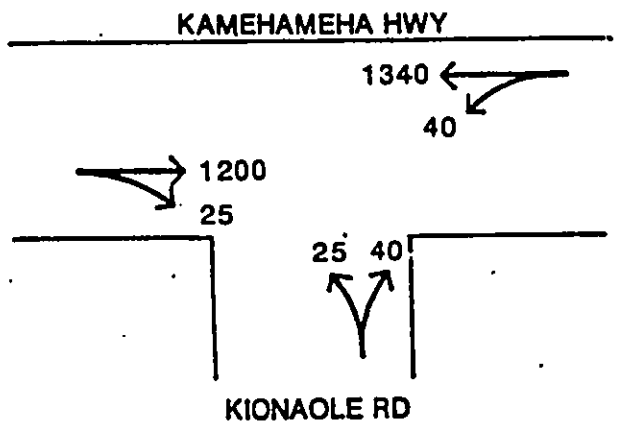
1. Standard trip generation rates were obtained from Institute of Traffic Engineer's (ITE)'s Trip Generation Report. Third Edition, 1982.

2. Directional split was based on manual counts taken at the Pali Golf Course.

Combining the generated trips with the forecasted traffic volumes yields the traffic volumes shown below.



(A) WEEKDAY, 3-4 PM



(B) SATURDAY, 11-12 NOON

These forecasted traffic volumes were evaluated to determine the traffic impact of the proposed project on the highway network. The level of service results for the Kionaole Road intersection with Kamehameha Highway are as follows:

Movement	Weekday PM Level of Service	Saturday AM/Noon Level of Service
Left turn into Kionaole	C	D
Both turns from same lane of Kionaole	D	E
Left turn from Kionaole	D	E
Right turn from Kionaole	C	D

The levels of service C and D obtained for the weekday conditions imply "average traffic delays" and "long traffic delays", respectively. The level of service E for the Saturday condition implies "very long traffic delays" for certain movements. The left turn movement from Kionaole Road has the worst level of service, and would also affect the right turn movements if a separate right turn lane were not provided. As a mitigating action, the Kionaole Road approach should be widened to provide two turning lanes.

The forecast levels of service for the Kionaole Road intersection should be very similar to corresponding movements at the Pali Golf Course access road intersection. Both access roads are expected to have similar volumes, and traffic volumes on Kamehameha Highway should be similar at the two locations. For this reason, the relative impact of the proposed development should not be considered as adverse.

The traffic impacts for Saturday conditions are worse than the weekday conditions for several reasons. First, more trips are generated by the golf course complex on the average Saturday than on the average weekday. Also, the Saturday peak hour volumes are equal to or exceed the weekday off peak hour traffic volumes. However, this condition should occur for only a few hours on weekends, and other hours should have better traffic performance. Similarly, most weekday hours should have better traffic performance than the high off-peak hour conditions which were assumed.

The use of traffic signals as a mitigating action should not be considered at this time. The projected volume of trips which would be generated by the proposed country club are not sufficient to meet the warrants for traffic signals.

The greatest traffic related impact would occur if a major professional golf tournament, such as the Hawaiian Open, is held at the project golf course. Similar to situations at any major sports event at any facility in the State, it would be difficult to mitigate the adverse traffic impact of a major golf event. Traffic may be congested on Kionaole Road, Kamehameha Highway, and perhaps the Pali and Likelike Highways, for the time periods of the event. However, the occurrence of professional golf tournaments at the project golf course would be very infrequent. Parking for such a major event will be accommodated within the project area and should not impact the surrounding land uses.

H. HIKING TRAILS

The proposed project will not physically impact Likeke Trail, however it will be visible from the trail. Visual impact is discussed in Section N of this chapter.

Access to Likeke Trail from Hoomaluhia Park is through two sub-trails. (See Exhibit IV-15). These two sub-trails which cross the project area may be retained during the design of the golf course. However, safety and security concerns such as hikers getting hit by flying golf balls or hikers wandering around the golf course, may dictate relocating the trails just outside the project area.

I. AIR QUALITY

The principal source of short-term air quality impact will be construction activity. Site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles will also generate particulate emissions.

EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons per acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30 percent), and a precipitation/evaporation (P/E) index of 50. Although the onsite soil, a silty clay, probably has a silt content greater than 30 percent, fugitive dust is not likely to be a serious concern due to the high rainfall in the area and a P/E index of 121.

Since there is only a slight potential for fugitive dust, adequate dust control measures should not be difficult to employ during the construction period. Should dry periods occur, dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. Dust barriers could be considered if problems arise from wind-driven dust. Finally, grassing and landscaping will be planted as soon as possible after grading is completed to minimize the extent of exposed soil.

Two sources of long-term air quality impact will be motor vehicles and use of pesticides. While air pollution from automobile emissions will be daily, air pollution from the use of pesticides will be intermittent.

However, air quality impacts due to automobile emissions are expected to be negligible since the total increase in the number of visits to the site will not be large for the proposed type of use. As indicated earlier in the traffic impact section, the fully developed golf course will generate an average daily traffic of 120 vehicles on weekdays and 150 vehicles on weekends for golfers, 60-80

vehicles for employees, and 150 additional vehicles during banquet functions. This traffic will be spread throughout the day with no peaks resulting in emissions build up and will be in compliance with the Ambient Air Quality Standards of Chapter 59, Public Health Regulations.

The use of pesticides and herbicides in the area should not present a significant problem if applied according to prescribed methods. Golf course maintenance will use EPA approved herbicides and pesticides. However, in order to assess the possible impact of pesticide use on property and people downwind, a worst case dispersion modeling analysis was performed for each of the chemicals. The results are summarized in Exhibit V-2.

Even under the worst case conditions of user error, wind speed, and proximity to the source, the downwind pesticide concentrations are low and of short duration. This clearly indicates that under proper use conditions, there will be no significant pesticide impact on air quality.

As a practical matter, these chemical agents will be used judiciously. It is also anticipated that the use of windbreaks and a buffer strip around the project area will be a means of mitigating any fugitive chemicals. For further detailed discussion, refer to Appendix H.

EXHIBIT V-2

ESTIMATES OF WORST CASE DOWNWIND PESTICIDE CONCENTRATIONS

PRODUCT	ACTIVE AGENT EMISSION RATE (g/sec)	ACTIVE AGENT CONCENTRATION (mg/m3)
MSMA	.076	.2348
Glyphosate	.069	.2132
Metribuzin	.007	.0216
Pendimethalin	.083	.2564
Sevin	.292	.9020
Dithane M-45	.303	.9360
Kocide 101	.377	1.1646
Subdue	.047	.1452

Conditions:	Windspeed:	7 m/sec
	Stability category:	D (neutral)
	Downwind distance:	100 m
	Exposure duration:	5 minutes
	Treated area:	1,000 ft2
	Application height:	1 m
	Active agent drift:	25 %

J. NOISE QUALITY

During the golf course construction, there will be temporary and localized adverse noise impacts. All pertinent State noise control regulations and ordinances will be complied with.

Traffic noise predictions for the project indicate that Year 1989 traffic noise levels along the Kionaole Road should not exceed 51 Ldn at 50 feet setback distance from the roadway centerline. This level of project-related traffic noise is very low when compared to current traffic noise levels of 65 to 70 Ldn at the intersection of Kionaole Road and Kamehameha Highway. The location of the golf course entrance road approximately 300+ feet west of the existing farm lot residence is more than adequate to minimize traffic noise impacts on the existing farm lot at the northeast corner of the proposed golf course.

Due to the relatively low volume of anticipated project traffic, risks of adverse noise impacts from traffic noise are considered to be low, and special noise mitigation measures are not required.

Adverse noise impacts from the clubhouse activities are not anticipated due to the total enclosure and air conditioning of the facility's dining and social function areas. This, plus the large buffer (over a quarter mile) between the clubhouse site and the Hoomaluhia Park road, should be adequate to minimize risks of adverse noise impacts from the clubhouse activities.

A more detailed analysis and discussion of noise quality is included in Appendix I.

K. AGRICULTURE

Although the ALISH system classifies some lands in the project area as "Prime Agriculture Lands", the Land Study Bureau rates them fair to poor for productivity. In the past, only the lands east of Kamooalii Stream have been in agriculture production, with pineapple cultivation and small truck farms. Some land near the middle of the project area was at one time used for animal pasture. Historical land use data* attributes the failure of pineapple cultivation in the area to poor soil, and most of the truck farms were retained only until the early 1950's. Since the project area is not in agriculture use, the proposed project has a minimal impact to agriculture lands on an island-wide or statewide basis.

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*Refer to pp. 24-25 of Appendix D.

Furthermore, the project will not impact agriculture in the area in terms of water supply. As indicated by BWS efforts to develop new wells in the area, there is adequate groundwater supply to support urban development and agricultural needs. The existing banana farm adjacent to the project area utilizes City water to supplement rainfall for irrigation.

L. SOCIAL IMPACTS

The proposed project will not directly impact the existing housing stock and population level in the area because users will not be lodged in the area. In addition, there are no plans for displacement or relocation contemplated by the project. The Sakamotos of the leased banana farm parcel adjacent to the project area should not be directly affected as their parcel is excluded from the project area.

Although it is very unlikely, secondary (or indirect) impacts may occur if the net gain of jobs for the project creates a demand for housing within the vicinity or if the enhancement of the area by the development had a subtle effect. However, the number of new jobs by the project is not expected to be large enough to create a demand for new housing, and although the project will enhance the area, the vacant land around the project site is not currently designated for residential use by either the State or County.

The proposed golf course will not considerably change the character or culture of the area as there is already an existing golf course, large park and college campus in the immediate vicinity. Rather, it will eliminate a threat of the potential urban development of the project site and maintain this large acreage in open space character. This will also help meet a part of recreational needs on Oahu.

M. ECONOMIC IMPACTS

Economic impact of the proposed project will occur during both its construction and operation. Each dollar that is spent for the construction, operation and maintenance of the proposed golf course will not only stimulate growth in those businesses from which the course purchases goods and services directly, but will also stimulate growth as the dollar is recycled through numerous other sectors of the island's economy. A technique for measuring the inter-industry relationships in a given region is the Input-Output Model. This model is used to develop multipliers which enable one to measure the overall impact of an industry, or the change in an industry's input and output, on the employment, income, and sales within the particular region.

In 1983, the Department of Planning and Economic Development (DPED) Research and Economic Analysis Division staff updated the input-output model of Hawaii's economy. This model is used here to analyze the direct, indirect and induced effects* of the proposed golf course project on the State's economy. The total impact of the golf course can be broken down into two phases: short-term or temporary impacts created during construction, and long-term impacts from the operation and maintenance of the project. Within each of these phases, the total impact is further broken down into impacts on 1) total sales (output), 2) household income and 3) employment.

1. Project impacts based on total construction expenditure (short-term impacts)

Since there is no industry category in the Hawaii Input-Output Model specifically for golf courses, the multipliers and coefficients for the industry category "other construction" have been used. This category is appropriate for a golf course as it typically includes such activities as construction of roads, parks, airports and other primarily *non*-structure type construction.

The sales, income and employment impacts resulting from construction of the proposed project are estimated based on the total construction expenditure of the project, excluding land costs. This expenditure is estimated to be 30 million dollars ($30,000,000), in 1986 dollars. The appropriate multipliers/coefficients from the Hawaii Input-Output Model are then multiplied by the construction cost to determine the economic impacts in dollars. The multipliers and coefficients used include direct, indirect and induced effects. These impacts are described below:

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*The following definitions are adopted from DPED, The Economic Impact of Tourism in Hawaii: 1970 to 1980. Research Report 1983-2. April 1983.

Direct effect - the change in sales, income and employment in Hawaii's economy as a direct result of the purchase of goods and services by the golf course development. Indirect effect - the change in sales, income and employment generated indirectly in the economy as the businesses that directly receive golf course development dollars spend them in order to buy material and service inputs to meet the demand created by direct sales to the golf course development. Induced effect - the further change in sales, income and employment as employees and proprietors spend their income earned from companies as a result of a direct or indirect effect of the golf course development's spending.

a. Direct Labor Output

The model identifies the direct labor output for the "other construction" industry category as 33%. In other words, 33% of the total construction cost is spent directly for labor.

$30 million x .33 = $9.9 million labor output

b. Output (sales) Impact

The output impact of the golf course construction is the change in output of Hawaii's industries (measured by sales) resulting from the total golf course construction expenditures. From the model, the output multiplier, which includes direct, indirect and induced sales, is 2.04.

$30 million x 2.04 = $61.2 million total sales

This indicates that the estimated $30 million construction expenditure for the project can be expected to generate an additional $31.2 million of sales.

c. Impact on Household Income

The total household income (direct, indirect and induced) generated by construction of the proposed project can be estimated by multiplying the total construction expenditure times the "income coefficient" for the "other construction" category, which is .73.

$30 million x .73 = $21.9 million

Thus, of the $30 million spent for construction of the golf course facility, $21.9 million goes to household income.

d. Employment Impact

In 1984, on the average, there was one direct job in the construction industry for every $77,000 worth of construction put in place.* Using the same ratio for the proposed golf course project, it can be estimated that about 390 jobs will be directly generated by the construction of the project ($30 million ÷ $77,000 = 390 jobs).

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*Department of Planning and Economic Development, The State of Hawaii Data Book, 1985, November 1985, pp. 321 and 528.

The total number of jobs generated in the economy by the project can be estimated by multiplying the number of direct jobs generated by the construction of the project times the State multiplier. The employment multiplier from the Hawaii Input-Output Model for "other construction" is 2.5.

390 direct jobs x 2.5 = 975 jobs

Therefore, the project can be expected to generate a total of 975 new jobs in the economy.

In summary, the short-term impacts from construction of the golf course on the sales, household income, and employment on Oahu were projected above using an estimated total construction expenditure of 30 million dollars and the multipliers/coefficients from the Hawaii Input-Output Model for the "other construction" industry category. These impacts would occur over the total construction time of the project, which is expected to be 18 months.

2. Project impacts based on annual revenue (long-term impacts)

Long-term impacts are those resulting from the operation and maintenance of the golf course project once completed. Multipliers and coefficients from the Hawaii Input-Output Model are multiplied by the projected annual revenue of the golf course to estimate the project's annual impacts on sales, income and employment in Hawaii. The impacts for this project can be analyzed using two different industry categories: "Amusement services" and "eating and drinking places", and their respective multipliers/coefficients. "Amusement services" multipliers are used with the projected annual revenue of the golf-related activities at the complex. This is expected to be $3.7 million. "Eating and drinking places" multipliers are used with projected revenues from the restaurant/banquet facilities at the complex. These are estimated at $1.3 million.

The project annual impacts (in 1986 dollars) during the operation and maintenance of the golf course complex are shown below.

		Average Annual Revenue	Multiplier/ Coefficient	Annual Impact
a.	**Direct Labor Output**			
	Golf Course	$3.7 mil x	.42	= $1.554 mil
	Restaurant/ Banquet	$1.3 mil x	.23	= .299 mil
			Total	$1.853 mil
b.	**Output (Sales) Impact**			
	Golf Course	$3.7 mil x	2.27	= $8.399 mil
	Restaurant/ Banquet	$1.3 mil x	1.95	= 2.535 mil
			Total	$10.934 mil
c.	**Impact on Household Income**			
	Golf Course	$3.7 mil x	.93	= $3.441 mil
	Restaurant/ Banquet	$1.3 mil x	.59	= .767 mil
			Total	$4.208 mil
d.	**Employment Impact (full-time equivalent)**			
	Golf Course	40 jobs x	1.69	= 67.6 jobs
	Restaurant/ Banquet	20 jobs x	1.72	= 34.2 jobs
			Total	101.8 jobs

Approximately 40% of the project's membership is expected to be foreign, or out-of-state, and 60% local. Thus, 40% of the above calculated impacts are a true economic addition to the State economy in that the project will draw new money to Hawaii. A portion of the remaining 60% impact is also new money to the economy in that the project will serve more people than are currently being served by existing private country clubs.

The new employment opportunities generated by the proposed project are significant for the community. As is typical with existing golf courses on Oahu, the majority of the new jobs will be filled by existing community residents; others will be filled by the regional workforce.

Overall, the economic impact of the proposed project on availability of jobs, diversity of employment, and wage rates will be substantially positive.

3. Project Impacts on Tax Revenues

The proposed project will also affect State and local tax revenues during both the construction phase and operation/maintenance phase. The impact on total tax collections from the project is difficult to estimate precisely, but can be estimated by assuming the share of total State and local tax revenue generated by the golf course complex is equal to the share of total State household income generated by the golf course.

In 1980, State and local government revenues collected from all sources (such as property, income, fuel, excise, etc.) amounted to 1,336.8 million, compared with total State household income of $7,553 million.*

The projected household income to be generated by the project during construction (21.9 million) is .29% of the total 1980 State household income. Assuming the same percentage (.29%) of State and local government revenues is generated by the project, $3.9 million would be the project's annual tax revenues during construction.

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*Department of Planning and Economic Development, The Economic Impact of Tourism in Hawaii: 1970 to 1980. Research Report 1983-2, April 1983.

The household income generated during the operation and maintenance of the project (4.2 mil) is .056% of the total 1980 State household income. In this case, the tax revenues of the project would be $.75 mil (1986 dollars) per year for the life of the project.

4. Summary of Project Impacts

As described above, economic impacts of the proposed project during both its construction and operation is substantially positive.

N. VISUAL QUALITY

The view of the project site from above and from ground level will be a primary consideration in designing and building the golf course. "Aerial" views from Nuuanu Pali State Wayside Park, Likelike and Pali Highways and Likeke Trail encompass the entire project area at once. From this perspective, it is important that the project blend in with the surrounding area, particularly the natural appearance of Hoomaluhia Park and the tree-covered palis. This will be attained by retaining the existing vegetation in the undisturbed areas, and incorporating tree masses of natural and interesting patterns into the actual golf course area. Natural features of the site such as streams and stream valleys, varied terrain and significant vegetation will also be retained and enhanced. Physical features of the golf course (clubhouse, roadway and parking) will be carefully sited to conform with the existing landform and require minimal grading.

Views of the site from ground level at Hoomaluhia Park, Pali Golf Course and Kam Highway would be intermittent because of topography and vegetation screens and would be from a distance of 800' to over 1 mile away. The proposed H-3 Freeway would also be a significant visual barrier to the project from down-slope.

The proposed clubhouse area is the most likely to be visible from down-slope because it is a highpoint on the site and is fairly steep in places. Although the exact location of the clubhouse and related facilities has not been determined, the structure will be designed to blend harmoniously with its surroundings. This includes minimizing building height, integrating the structure into the landform, and utilizing natural color schemes. The visibility of the clubhouse from Hoomaluhia Park will be carefully analyzed in the design phase and mitigation measures will be coordinated with the City and County Department of Parks and Recreation.

The night-lighting of the access road, parking and driving range may be visible from some locations in Hoomaluhia Park. The visual impact of the lights will be minimized by using shields that direct the light toward the activity area and away from the Park.

During construction, the initial clearing and grading activities will expose portions of the site making them visually contrast the surroundings. However, these areas will be landscaped immediately after grading is complete.

CHAPTER VI

VI. RELATIONSHIP OF PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

A. FEDERAL

1. Federal Flood Insurance Program

The proposed project is located within the Federal Insurance Administration's Zone D, "areas of undetermined, but possible, flood hazards". The project design reflects this designation by locating the golf course clubhouse complex well above the estimated flood levels of streams. The golf course area, however, will be allowed to flood, acting as a retention basin to lesson storm flows.

B. STATE OF HAWAII

1. State Planning Documents

The proposed project complies with the following objectives of the adopted Hawaii State Plan:

- Encourage businesses that have favorable financial multiplier effects within Hawaii's economy. (The proposed project will favorably affect sales, income and employment in Hawaii, as described in Chapter V. Section K. Economic Impacts.)

- Promote Hawaii's vacation attractions overseas. (Membership to the proposed golf course development will be promoted overseas as well as locally.)

- Ensure that visitor industry activities are in keeping with the social, economic and physical needs and aspirations of Hawaii's people.

- Take into account the physical attributes of areas when planning and designing activities and facilities; design developments and activities that complement the natural beauty of the islands; Promote the visual and aesthetic enjoyment of mountains, ocean vistas, scenic landscapes and other natural features. (The project will be designed to achieve a harmonious relationship with the natural environmental resources of the upland Kaneohe site. Natural features of the site, such as streams and stream valleys, varied terrain, significant vegetation, and dramatic views and vistas, will be retained and enhanced.)

- Protect rare and endangered plant and animal species and habitats native to Hawaii. (Studies indicate that the project area contains no rare and endangered species. Potential adverse impacts on these resources will be avoided or minimized.

- Preserve and restore significant natural and historic resources. (Significant evaluation and mitigation measures for archaeological sites in the project area will be coordinated with the State Historic Sites Office).

- Provide a wide range of activities and facilities to fulfill the recreation needs of all diverse and special groups. (The proposed golf course will help meet the current demand for golf facilities.)

With reference to the Priority Guidelines of the Hawaii State Plan, the proposed golf course meets several of the guidelines in various sections:

Section 226-103(b) HRS: Priority guidelines to promote the economic health and quality of the visitor industry

"(1) Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawaii's residents and visitors."

The development of the proposed world class championship golf course complex will greatly enhance the sport of golf in Hawaii and attract avid golfers from around the world. While the golf course will be used by members and their guests, the world class status of the course may attract championship tournaments and enhance Hawaii as a visitor destination without forsaking the well being of Hawaii's residents and visitors.

"(4) Encourage visitor industry practices and activities which respect, preserve, and enhance Hawaii's significant natural, scenic, historic, and cultural resources."

The golf course will be designed to enhance the natural resources and beauty of the proposed site. Natural features of the site, such as streams and stream valleys, varied terrain, significant vegetation and dramatic views and vistas will be retained and enhanced.

Section 226-104(b) HRS: Priority guidelines for regional growth distribution and land resource utilization

"(9) Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized."

The anticipated impacts of the proposed golf course on the environment were thoroughly evaluated and appropriate mitigative measures have been recommended to preserve the natural beauty and integrity of the area.

"(12) Utilize Hawaii's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations."

The proposed golf course will contribute to meeting Hawaii's recreational needs for its growing population. Furthermore, the golf course is consistent with the objectives of the Conservation District Resource and General Subzones in that it will maintain use of the natural resources of the area by an environmentally sensitive design and development which minimizes grading and maintains existing drainage channels. The integrity of the conservation district will be retained by the golf course design.

"(13) Protect and enhance Hawaii's shoreline, open spaces, and scenic resources."

The golf course will maintain landscaped open spaces and the proposed design minimizes possible adverse impacts on scenic views.

Functional plans have been prepared as part of the State planning process and were passed by the Legislature in 1984 and 1985. The following functional plans are pertinent to the proposed project.

- State Conservation Lands Plan: The siting, design and development of the proposed golf course respects the policies to protect and preserve valuable natural resources of the State.

- State Historic Preservation Plan: The proposed project supports the plan's goal to preserve and enhance significant historic and cultural sites.

- State Recreation Plan: The proposed golf course development assists the State in its goal to provide adequate recreation facilities to meet the demands for outdoor recreation resources.

- State Agriculture Plan: The proposed project does not remove any productive agriculture lands from use.

2. State Land Use Controls

The 225-acre project area (portion of TMK 4-5-42:1 & 6) is in the State Conservation District as designated by the State Land Use Commission. The Conservation District, which is under the jurisdiction of the Hawaii State Board of Land and Natural Resources, is divided into subzones, as authorized by Chapter 183, HRS. The Board's regulation No. 4 establishes four subzones and sets forth objectives and permitted uses for each, in varying degrees of restrictiveness. As shown on Exhibit VI-1, most of the project area (approximately 70% or 155 acres) is in the General (G) subzone and the remainder (30% or 70 acres) is in the Resource (R) subzone. The General and Resource subzones are the two least restrictive, respectively, of the four subzones, as to permitted uses. The boundary between these two subzones coincides with the State forest reserve boundary, but it does not necessarily demarcate a distinct transition between different natural environments. The project area has been purposefully located primarily within the General subzone as these are the most level lands within the property. Although the Resource subzone lands tend to have steeper slopes, the vegetation and wildlife characteristics of those lands do not differ significantly from those of the General subzone lands in the project area. (Refer to Chapter IV, Existing Environmental Setting.)

Although golf course projects are not expressly permitted in either subzone, an approved Conservation District Use Application (CDUA) will allow such use if it can be shown that the public benefits outweigh any impact on the Conservation District and complies with the general objectives of the subzone. The objective of the General subzone is to designate open space when specific conservation uses may not be defined, but where urban use would be premature. Land uses within the General subzone adjacent to the project area include Hoomaluhia Park and the Pali Golf Course. The objective of the Resource subzone is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas. The boundaries of the Resource subzone encompass several specified lands, including lands suitable for outdoor recreational uses

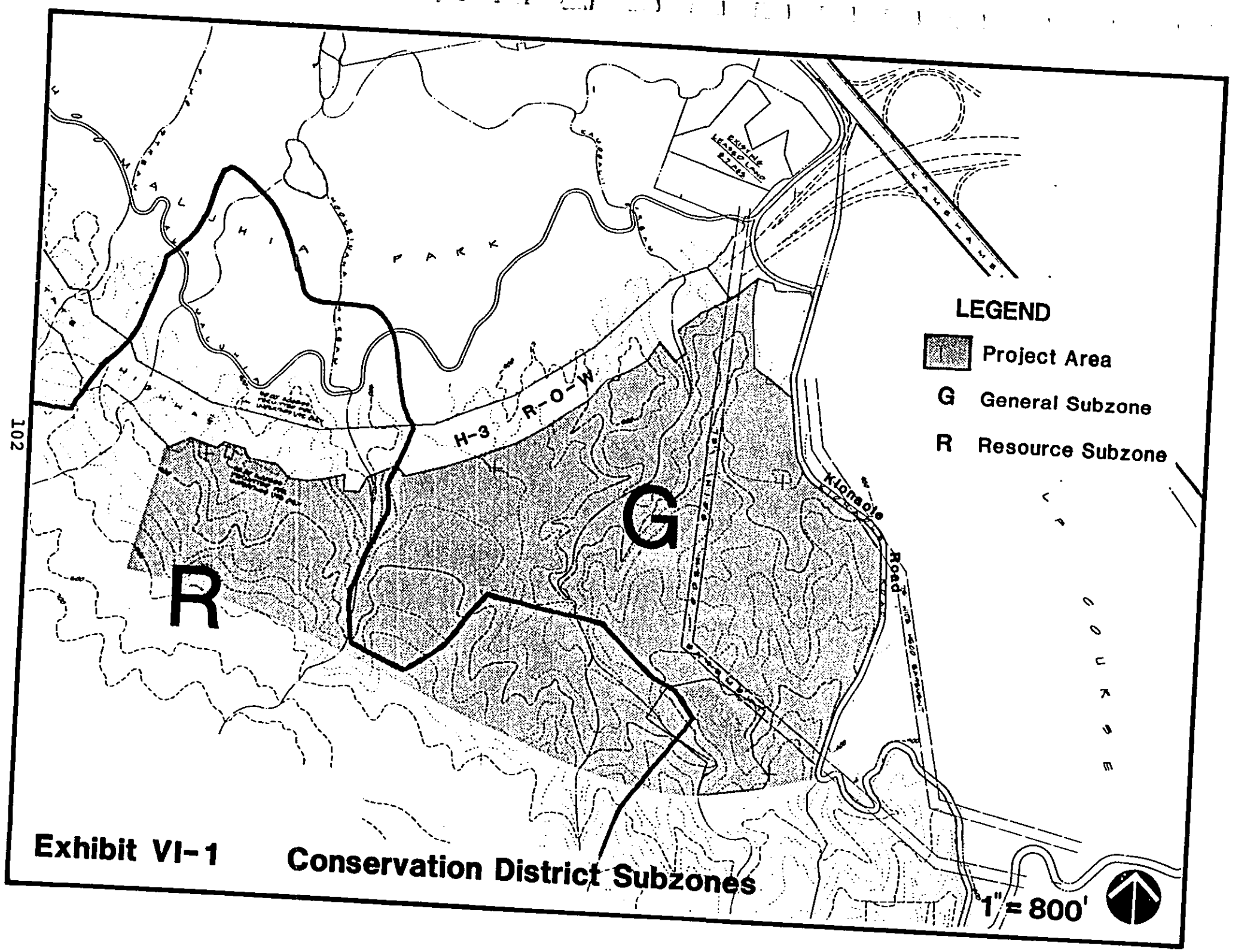

Exhibit VI-1 Conservation District Subzones

such as hunting, fishing, hiking, camping and picnicking. Therefore, the proposed golf course is consistent with the use of lands classified as Resource Subzone for outdoor recreational uses.

3. Environmental Impact Statements

Under the provisions of Chapter 343, HRS, all proposed actions within the State Conservation District require a determination by the Department of Land and Natural Resources (DLNR), at the time a CDUA is accepted for processing, whether or not an Environmental Impact Statement (EIS) is required. DLNR has determined that an EIS is required for the proposed project and this document has been prepared to fulfill that requirement. The BLNR, as "approving agency" for the CDUA, must accept the EIS as having met Chapter 343 requirements before the CDUA can be approved by the BLNR.

C. CITY AND COUNTY OF HONOLULU

1. General Plan

The General Plan, adopted in 1977 and revised in 1982, serves as a guide to the development of Oahu through long range objectives and policies for attaining the objectives.

The proposed project is consistent with the following objectives and policies of the General Plan:

a. Promote employment opportunities that will enable all the people of Oahu to attain a decent standard of living through:

   - o growth and diversification of Oahu's economic base
   - o industries of a nonpolluting nature

b. Protect and preserve the natural environment through:

   - o consideration to natural features such as slope, flood and erosion hazards, water-recharge areas, distinctive land forms, and existing vegetation
   - o protection of natural environment from damaging levels of air, water, and noise pollution
   - o protection of unique plants, birds and other animals

- o retain the Island's streams as scenic, aquatic, and recreation resources

c. Preserve and enhance the natural monuments and scenic views of Oahu through:

- o protection of well-known resources: mountains, craters, forests, watershed areas, marshes, rivers, streams
- o protection of scenic views

d. Protect Oahu's cultural, historic, architectural and archaeological resources through:

- o identification and, to the extent possible, preservation of areas with cultural, historic and archaeological significance

e. Provide a wide range of recreational facilities and services through:

- o encouraging the private provision of recreation and leisure-time facilities and services

2. Koolaupoko Development Plan/County Zoning (Exhibit VI-2)

The proposed project conforms to the urban design principals set forth for Koolaupoko in that it provides the visibility, preservation, enhancement and accessiblity of open space and protects panoramic views of Kailua and Kaneohe from public places. The project area is designated "Preservation" on the Development Plan Land Use Map and currently has no designation on the Development Plan Public Facilities Map. The zoning for the area is P-1 (Preservation).

Despite the above land use designations, the City and County of Honolulu has no direct jurisdiction over the project area since it is entirely within the State Conservation District, which is under the authority of the Board of Land and Natural Resources.

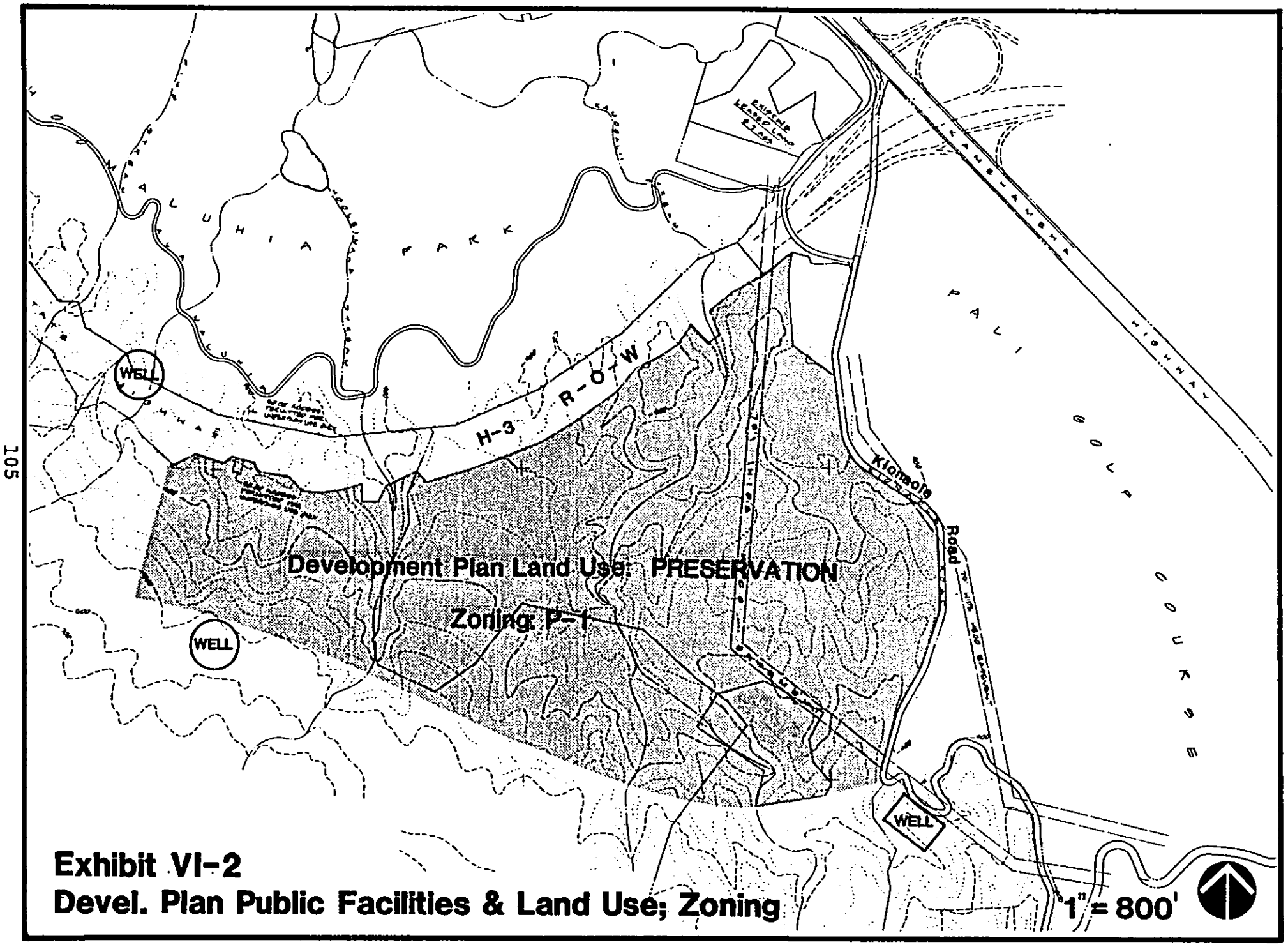

Exhibit VI-2
Devel. Plan Public Facilities & Land Use; Zoning

D. LIST OF NECESSARY CONSTRUCTION-RELATED APPROVALS

1. Federal

U. S. Army Corps of Engineers

2. State of Hawaii

Department of Land and Natural Resources

CDUA
EIS
Stream Channel Alteration Permit
Well Drilling (CDUA)
Historic Site Section's Approval, if any archaeological site is used

Department of Agriculture

Pesticides Permit

Department of Health

Noise Permit
Construction Plan Approval
Drinking Water Approval
Solid Waste Disposal Permit
Pesticides and Fertilizers

Department of Transportation

Street Improvements
Easement for Sewer Line Across H-3

3. City and County of Honolulu

Board of Water Supply

Potable Water
Use of Their Well

Building Department

Building Permit

Department of Public Works

Grading, Grubbing, Excavating and Stockpiling Permits
Sewer Permit
Street Improvements
Drainage Improvements

City and County of Honolulu (cont'd)

Department of Transportation Services

Street Improvements

Department of Parks and Recreation

Easement for Sewer Line in Park

Department of General Planning

Development Plan Public Facilities

Fire Department

Fire Protection System

CHAPTER VII

VII. RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Currently, the project area lands are vacant open space in the State Conservation District. While a previous proposal for the area included residential development, this was not deemed appropriate since it did not conform with the intent of the land use district and required a district boundary change. The proposed golf course, however, is a low intensity land use, with minimal facilities on minimal acreage, and will retain much of the site in the current "natural" state.

Although the development of the project does preclude other options for the project area, other uses conforming with the existing "Conservation" land use regulations would not generate the economic, recreation and aesthetic benefits of the proposed golf course project.

CHAPTER VIII

VIII. ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE AVOIDED

Based on the impact analysis, there are some adverse environmental impacts which are not likely to be avoided during the construction and operation of the golf course complex. The construction process will create localized and temporary adverse impacts on noise levels, and air and water quality. Construction equipment will increase the amount of air-borne dust and particulate emissions and will increase noise levels. Water quality will be affected by some increased sediment in the streams. The partially-exposed site may be somewhat unsightly during construction when viewed from the Pali Lookout. However, none of these construction impacts are expected to be significant or long term in nature.

Unavoidable adverse impacts during the operation of the golf course will include increased traffic volume on Kionaole Road and Kam Highway, as well as noise and auto emissions associated with the increased traffic. Significant traffic impacts may occur if major tournament events are held at the project, however these would be very infrequent. Relocation of existing trails may be unavoidable, particularly if H-3 is constructed. There may also be occasional impact to the stream water quality and aquatic fauna if rains cause slight runoff shortly after the application of insecticide or fungicide.

CHAPTER IX

IX. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The construction of the proposed golf course complex will require the irreversible commitment of capital, labor expended in design, development and construction, construction materials, and energy for construction equipment. Modifications to the site may be possible but the commitment of the land is irreversible.

CHAPTER X

X. SUMMARY OF UNRESOLVED ISSUES

The potential impacts of proposed actions are generally known, and appropriate mitigation measures have been developed to address these impacts. If additional issues are raised during the EIS public review phase, these issues will be investigated and appropriate mitigation measures will be developed.

CHAPTER XI

XI. ALTERNATIVES TO PROPOSED ACTION

A. NO ACTION ALTERNATIVE

There are several conditions which would constitute the "No Action" alternative. If a Conservation District Use permit is not granted, the land cannot be developed as a golf course complex. Also, if the land sale between Iolani School and Nitto Kogyo Company, Ltd. is not finalized, the project may not be continued. Further, Nitto Kogyo could chose not to pursue the project.

The "No Action" alternative would have impacts, just as action alternatives do. The potential positive economic benefits to the State and community, by the golf course complex, will not materialize. By not developing the site for the proposed project, the land will remain vacant or will be used for some other use in the future. Also, the current shortage of, and demand on, golf courses on Oahu will not be reduced if the project is not built.

B. ALTERNATIVE SITE USES

In addition to the potential golf course development, the project area has been considered for other uses. In 1981, Iolani School proposed a mixed residential development on their lands, but this was not pursued. If the existing H-3 right-of-way (R-O-W) is not utilized for a freeway, expansion of Hoomaluhia Park onto the R-O-W land has been suggested by the City and County of Honolulu.

C. ALTERNATIVE CLUBHOUSE SITES

In response to the public comments and responses during the draft EIS public review period (November 8-December 8, 1986) and at the Conservation District Use Application (CDUA) hearing (November 20, 1986), three (3) additional sites for the clubhouse were examined (Exhibit XI-1).

Site No. 1

Site No. 1 is the original site and is evaluated in detail in the previous chapters.

Site No. 2 (Exhibit XI-2)

Site No. 2 is located just across Hooleinaiwa Stream east of Site No. 1. Infrastructure requirements for this site would be similar to Site No. 1.

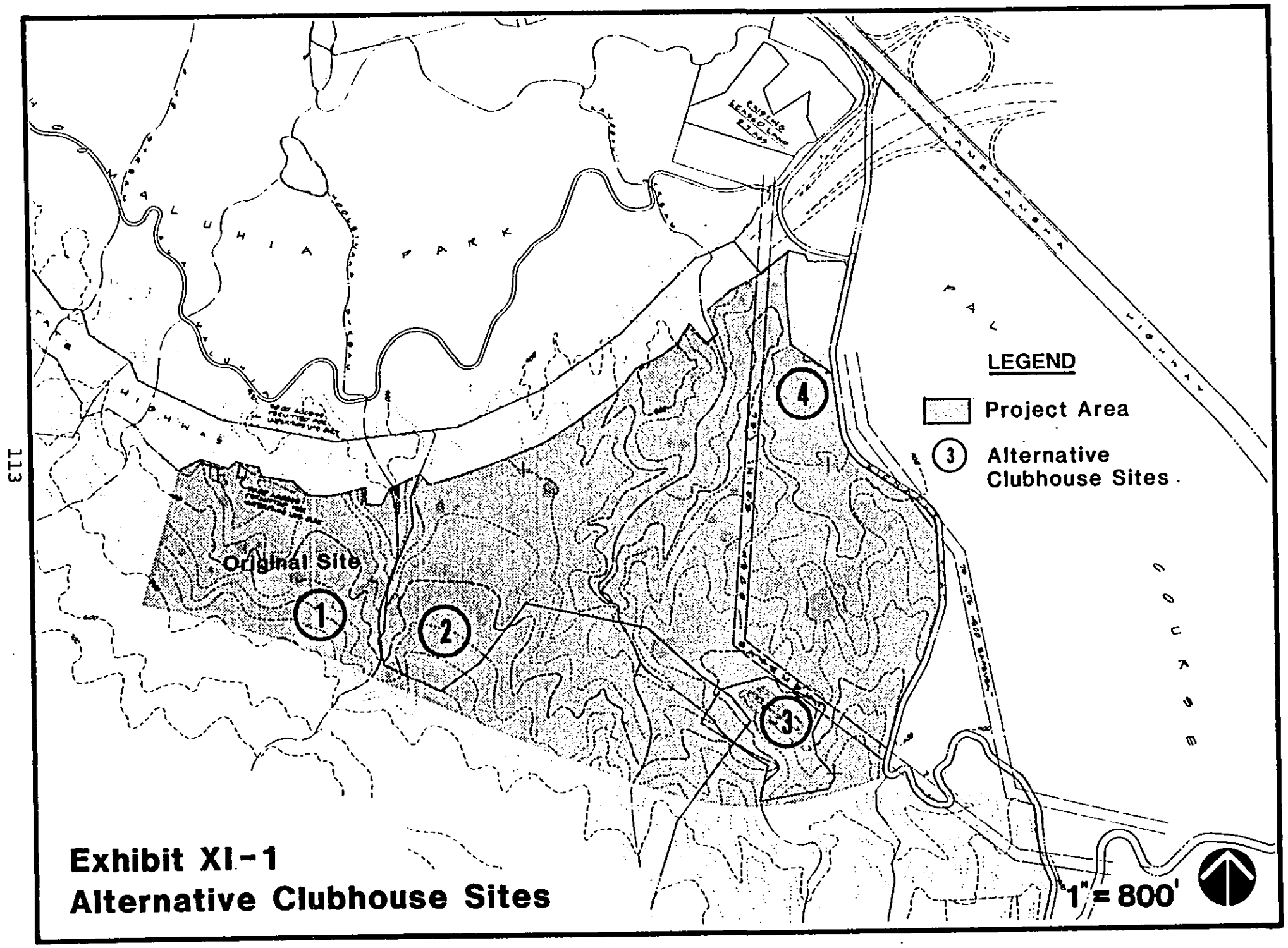

Exhibit XI-1
Alternative Clubhouse Sites

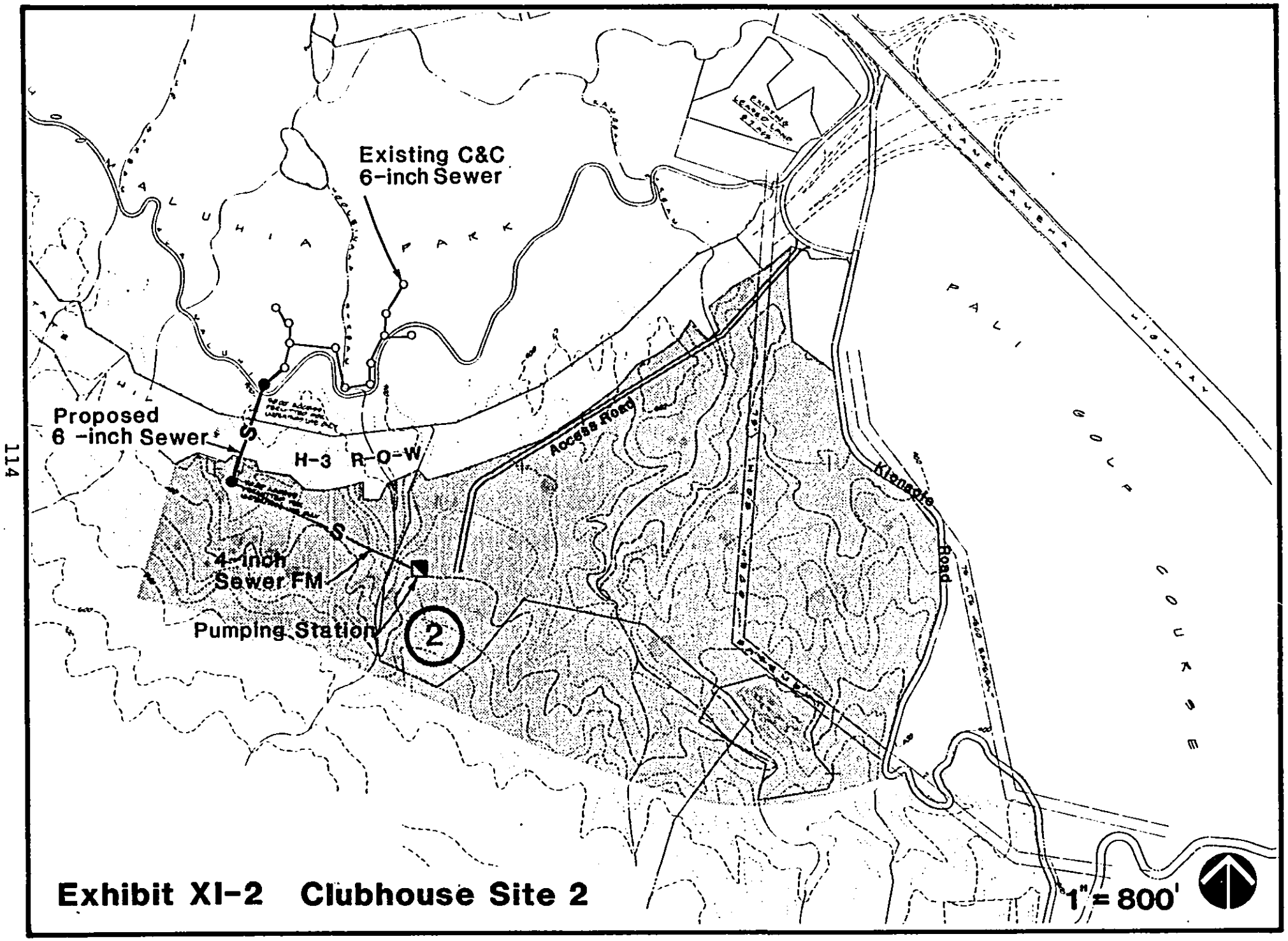

Exhibit XI-2 Clubhouse Site 2

- Access Road

  An access road approximately 3,000 feet in length would extend from Kionaole Road to the clubhouse. The road will cross Kamooalii Stream, but will not have to cross Hooleinaiwa Stream.

- Water System

  All of the water system alternatives for Site No. 1 would also apply to Site No. 2.

- Wastewater System

  The wastewater system would connect to the municipal system located in Hoomaluhia Park, similar to Site No. 1. However, a pumping station will be required to convey the wastewater from Site No. 2 across Hooleinaiwa Stream to the proposed H-3 Interstate Highway underpass located approximately 1,500 feet from the clubhouse.

- Electric and Telephone Service

  Similar to Site No. 1.

- Onsite Improvements

  Onsite work for the parking and recreational facilities would require the least amount of work among all 4 sites due to the site's gentle, even slope of about 10 percent, and large open area.

- Visual/Noise Impacts

  Potential visual impacts on the Hoomaluhia Park users may be less than those caused by Site No. 1, due to its lower elevation and farther distance (approximately 400 feet) from the Park. (See Exhibit IV-20e)

  Noise impacts, if any, may be the same as those of Site No. 1.

Site No. 3 (Exhibit XI-3)

Site No. 3 is located on a knoll near Kionaole Road where a house currently sits (former Knowles residence).

- Access Road

  The access road from Kionaole Road would be about 500 feet long.

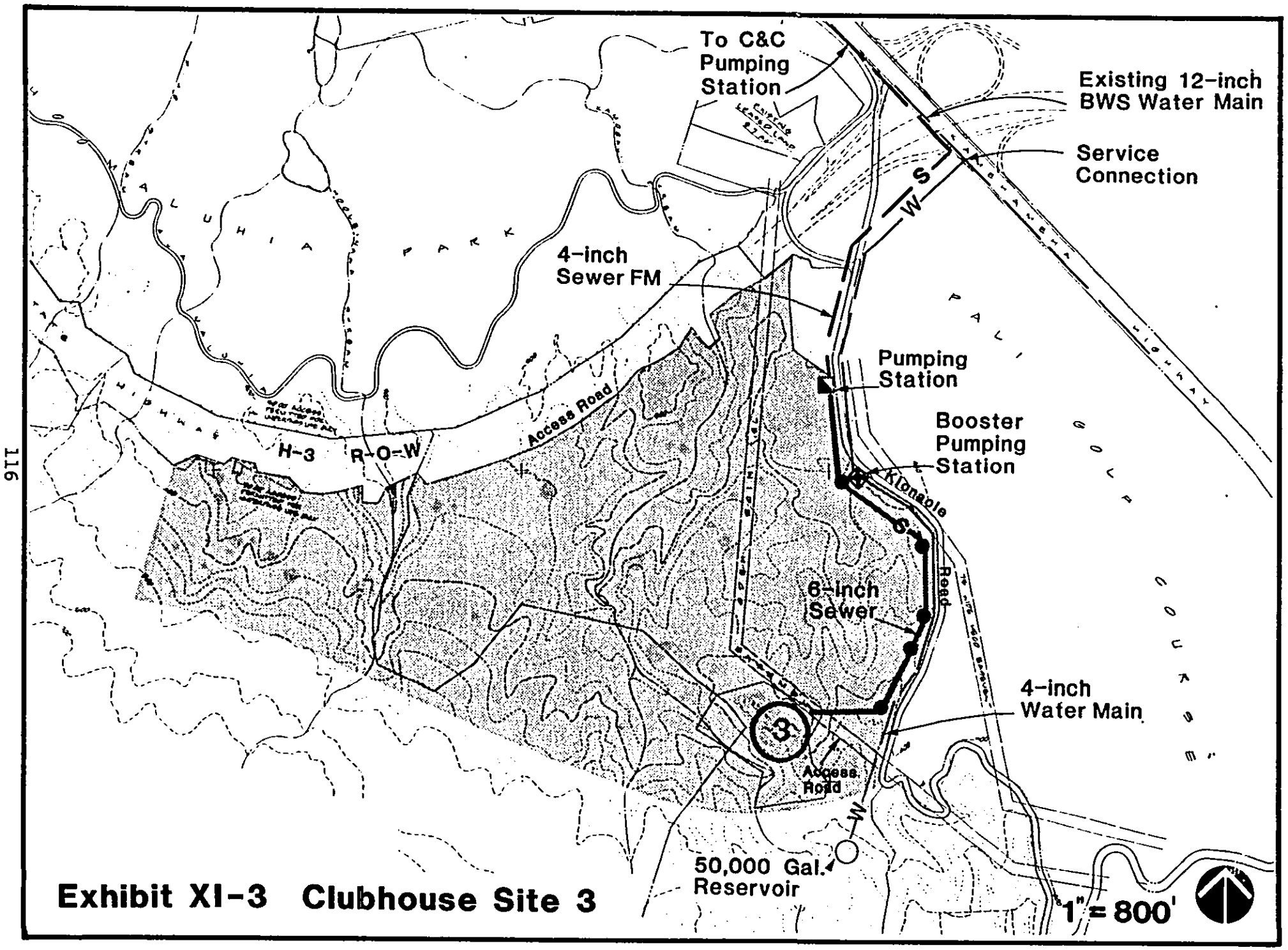

Exhibit XI-3 Clubhouse Site 3

- Water System

  A potable water system will be connected to the BWS water main on Kamehameha Highway. If the clubhouse is located at/or below elevation 400 feet, a booster pumping station and reservoir may not be required for potable water service. The clubhouse location would not, however, significantly affect the irrigation system options.

- Wastewater System

  The wastewater system will be connected to the City's wastewater pumping station located near the Kionaole Road/Kamehameha Highway intersection.

- Electric and Telephone Service

  Service will be provided from systems on Kionaole Road.

- Onsite Improvements

  Although this site is not as steep as Site No. 1, part of the site has to be filled to provide enough area for the parking and recreational facilities.

- Visual/Noise Impacts

  Visual and night time lighting impacts on Hoomaluhia Park would be minimal. However, the views from Pali Lookout may be affected. Creative siting, appropriate architectural design and landscaping could mitigate potential adverse impacts. (See Exhibit IV-20e)

  Noise impacts on Hoomaluhia Park would be minimal.

Site No. 4 (Exhibit XI-4)

Site No. 4 is located at the northeast corner of the proposed golf course, adjacent to Kionaole Road and the Sakamoto residence. Of the 4 sites, this site is closest to Kamehameha Highway and residential areas.

- Access Road

  The access road would be very short since the clubhouse would be located close to Kionaole Road.

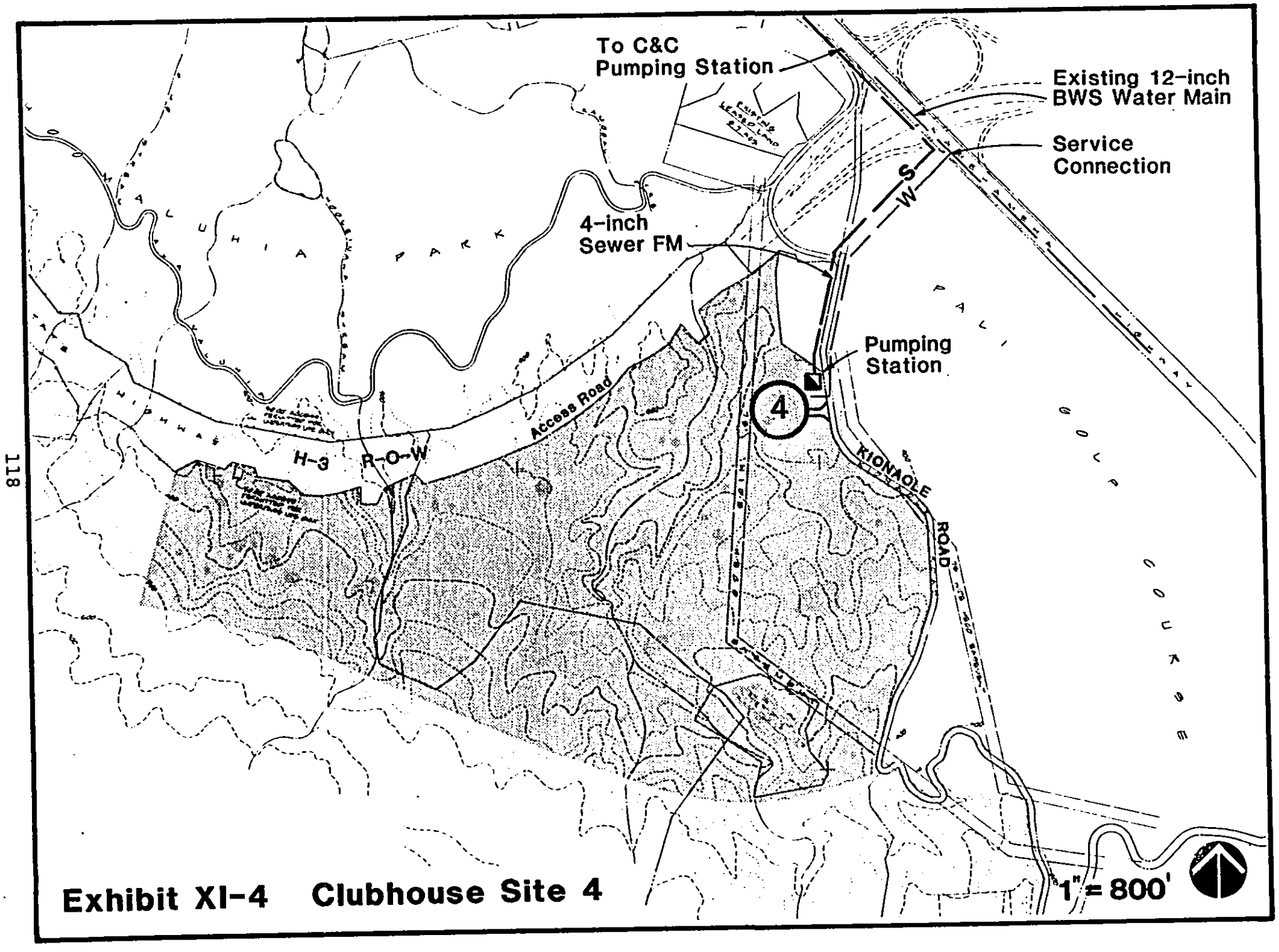

Exhibit XI-4 Clubhouse Site 4

- Water System

  The potable water system would connect to the BWS "500" system in Kamehameha Highway. Since the clubhouse site is below elevation 300 feet, there would be no need for a booster pumping station and reservoir. Irrigation and fire protection water system alternatives would be similar to Site No. 1.

- Wastewater System

  Like Site No. 3, the wastewater from clubhouse Site No. 4 would be pumped to the City's wastewater pumping station near the Kionaole Road/Kamehameha Highway intersection.

- Electric and Telephone Service

  Electric and telephone service will be provided by existing systems on Kionaole Road.

- Onsite Improvements

  Clubhouse Site No. 4 is located in a depressed area where the primary soil type is the Hanalei Series. According to the U. S. Army Corps of Engineers, the Hanalei Series soil type is generally found in areas that are designated as wetlands. This area is poorly drained and, if not built up, would be subject to flooding. The site improvements for this location are expected to be most extensive among the alternatives. In addition, a Corps permit may be required if the placement of fill adversely affects more than one acre of designated wetland areas.

- Visual/Noise Impacts

  Visual and noise impacts on Hoomaluhia Park would be minimal or non-existent. The impact on the view from Pali Lookout may be also minimal.

  However, traffic noise impacts on the neighboring Sakamoto residence may not be mitigable.

Recommended Clubhouse Site

Based on comments and concerns expressed by Kaneohe residents, Hoomaluhia Park staff members and users, and other public agency representatives, it has been decided that clubhouse site will be relocated to the Alternative Site No. 3.

D. ALTERNATIVE DESIGN DECISIONS

The layout of the proposed golf course and support facilities is the result from consideration of environmental implications by the development team, including golf course architect, engineers, planners, developer, and others. The major guiding principles for the project design are:

- avoid major areas of steep slopes
- avoid realignment and diversion of the streams
- avoid areas with high potential for archaeological sites
- protect the banana farmer tenant
- enhance the visual quality of the area

The current layout is preliminary, and there is flexibility in the design of certain project elements. In other words, there are further alternative choices that can be made. These choices include:

- the exact location of tees, greens, and fairways in relation to drainage channels, archaeological sites, slopes etc.
- the exact location of the clubhouse, parking, access road, maintenance facilities, etc.
- facility siting to minimize grading and ensure adequate site drainage
- Banquet facility design capacities
- Utility improvement alternatives
- Landscape design
- Hiking trail location

Flexibility for future detailed design, engineering, construction and operational aspects of project insures that changes necessary for functional, economic or environmental reasons could be accomplished without compromising the overall integrity of the plan.

CHAPTER XII

XII. AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED

EIS Preparation Notice was published in the OEQC Bulletin of September 23, 1986. In addition, copies of DLNR's "Notice of Acceptance and Environmental Determination" were distributed by the applicant to the following organizations or representatives:

U. S. GOVERNMENT
- Department of the Army-Army Corps of Engineers
- Department of Agriculture-Soil Conservation Service
- Department of the Interior-Fish & Wildlife Service

STATE OF HAWAII
- Department of Agriculture
- Department of Defense
- Department of Health
- **Department of Land & Natural Resources**
- Department of Planning & Economic Development
- State Historic Preservation Officer
- Department of Transportation
- Department of Social Services & Housing
- Office of Hawaiian Affairs
- University of Hawaii Environmental Center
- **University of Hawaii Water Resources Research Center**

CITY AND COUNTY OF HONOLULU
- Board of Water Supply
- Department of General Planning
- Department of Land Utilization
- Department of Parks & Recreation
- Department of Public Works
- Department of Housing & Community Development
- Department of Transportation Services
- Police Department
- Fire Department

ORGANIZATIONS AND INDIVIDUALS
- Kaneohe Neighborhood Board No. 30
- Councilman David Kahanu
- Representative Marshall K. Ige
- Representative Terrance W. H. Tom
- Senator Clayton H. W. Hee
- Senator Charles Toguchi
- Kaneohe Outdoor Circle
- Sierra Club, Hawaii Chapter
- Luluku Banana Growers
- Oahu Metropolitan Planning Organization
- Hui Malama Aina O'Koolau
- Hawaii Thousand Friends
- Life of the Land
- Hawaiian Electric Company, Inc.

The Draft EIS was officially submitted to the Office of Environmental Quality Control on November 5, 1986 and was published in the November 8, 1986 OEQC Bulletin. The deadline for comments and the end of the 30-day public review period was December 8, 1986. Copies of the statement were sent to the following organizations or representatives:

U. S. GOVERNMENT

Department of the Army-DAFE (Facilities Eng.-USASCH)
Department of the Navy
Department of Agriculture-Soil Conservation Service
Department of the Army-Army Corps of Engineer
Department of the Coast Guard
Department of the Interior-Fish & Wildlife Service
Department of the Interior-Geological Survey

STATE OF HAWAII

Department of Accounting & General Services
Department of Defense
Department of Planning & Economic Development-Library
Department of Social Services and Housing
Department of Transportation
State Archives
State Energy Office
University of Hawaii Marine Programs
University of Hawaii Water Resources Research Center

CITY AND COUNTY OF HONOLULU

Building Department
Department of Housing and Community Development
Department of General Planning
Department of Transportation Services
Police Department
Fire Department
Municipal Reference and Records Center

ORGANIZATIONS AND INDIVIDUALS

Honolulu Star-Bulletin
Honolulu Advertiser
Sun Press
American Lung Association
Hawaiian Electric Company
Office of Hawaiian Affairs
U. H. Hamilton Library, Hawaiian Collection
Legislative Reference Bureau
State Main Library
Kaimuki Regional Library
Kaneohe Regional Library

ORGANIZATIONS AND INDIVIDUALS (cont'd)

Pearl City Regional Library
Hilo Regional Library
Wailuku Regional Library
Lihue Regional Library
Ko'olau Polo Land and Resource Trust
Luluku Banana Growers' Association
Oahu Metropolitan Planning Organization
VTN Pacific, Inc.
Kaneohe Neighborhood Board #30

CHAPTER XIII

XIII.COMMENTS DURING THE CONSULTATION PROCESS

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HAWAII
96850

October 16, 1986

Mr. Robin Oura, Project Manager
Land Process Service Corporation
800 South Beretania Street, 3rd Floor
Honolulu, HI 96813

Dear Mr. Oura:

Subject: EIS Preparation Notice
Proposed Golf Course with Accessory Uses
TMK: 4-5-42 Parcels 1 & 6
Koolaupoko District, Oahu, Hawaii

25 We reviewed the "Notice of Acceptance and Environmental Determination" and have no comments to offer.

Thank you for the opportunity to review the document.

Sincerely,

RICHARD N. DUNCAN
State Conservationist

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

REPLY TO ATTENTION OF:

October 15, 1986

Mr. Robin Oura
Landpro
800 S. Beretania Street
Third Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

Thank you for the opportunity to review and comment on the EIS Preparation Notice for the Proposed Golf Course with Accessory Uses (TMK:4-5-42 Parcels 1 and 6), Koolaupoko District, Oahu. The following comments are offered.

126

a. The project area, for the most part, appears to be in the headwaters for Kamooalii Stream. Since the review document provides only generalized descriptions of the work to be done, it is recommended that any work in the streams onsite, or in the adjacent wetlands, be coordinated with Operations Branch (telephone 438-9258) to determine whether nationwide or individual permits may be applicable.

b. According to the Flood Insurance Study for the City and County of Honolulu, the subject parcels are within Zone D, areas of undetermined, but possible flood hazards. You should coordinate this study with the City and County of Honolulu for any specific use restrictions within the Zone D areas.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

DHM inc.
land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

October 29, 1986

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
Building 230
Ft. Shafter, Hawaii 96858

Dear Mr. Cheung:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

On behalf of Mr. Robin Oura of LANDPRO, we thank you for your letter of October 15, 1986 regarding the above.

The proposed project will involve no work in the adjacent wetlands, and minimal work in the streams on site. The applicant will most certainly coordinate all such work with Army's Operations Branch in regards to applicable permits.

Regarding the Flood Insurance Study, the City and County of Honolulu will be involved in the review of the draft EIS and coordinated with for all relative restrictions and permits for the proposed project.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

CEA

GEORGE R. ARIYOSHI
GOVERNOR

RECEIVED

86 OCT 2 P12:50

STATE OF HAWAII

JACK K. SUWA
CHAIRPERSON, BOARD OF AGRICULTURE

SUZANNE D. PETERSON
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

September 30, 1986

MEMORANDUM

To: Mr. Susumu Ono, Chairperson
Board of Land and Natural Resources

Subject: Conservation District Use Application
OA-8/13/86-1947 Nitto Kogyo Company, Ltd.
Conditional Use Permit for Proposed Golf Course in Resource and General Subzones
TMK: 4-5-42: Por. 1 and 6 Kaneohe, Oahu
Acres: 200

RECEIVED
86 OCT -2 PM 4:25
OFFICE OF CONSERVATION

127

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

According to the application, the proposed development will consist of "One 18-hole Championship Golf Course Plus Club House and Ancillary Service Facilities" (Application, page 1). The project, located in the State Conservation District, would utilize a parcel of approximately 200 acres. The applicant states the site is essentially "vacant" with no existing uses present, although the site "is documented to have been planted in sugar cane and pineapple and/or land as pasture land" (Application, page 47).

References to the Soil Conservation Service Soil Survey (SCS), Agricultural Lands of Importance to the State of Hawaii (ALISH) system, and the Land Study Bureau Detailed Land Classification for the Island of Oahu are correct (Application, pages 26 - 34). Approximately 35 percent of the site is classified by ALISH as "Prime" agricultural land, and an equal amount is rated as "C" by the Land Study Bureau Overall Productivity Rating system. The "Conservation" land use classification does not preclude the use of the property for agricultural purposes.

OTHER CONSIDERATIONS

Our primary concerns are essentially two-fold. Will the removal of lands suitable for agricultural purposes impact agriculture on a statewide basis, and what impact on agriculture

can be anticipated when groundwater supplies are reduced daily by .02 mgd of potable water and .25 to .50 mgd of water for golf course irrigation purposes?

The Hawaii State Constitution requires the State to provide standards and criteria to conserve and protect agricultural land, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands. We view important agricultural land as a valuable resource in its own right, from a statewide perspective. Conditions such as scarcity and high cost of arable land and irrigation water, income from agricultural activities that is insufficient to meet production costs, and competing demands on the land and water resources by higher-valued economic activities, may tend to reduce the economic viability of agriculture.

On page 64 of the application, it is stated that the "removal of groundwater from wells could reduce stream flow. Although the extent of reduction due to water withdrawal from a well cannot be predicted ahead of time, no significant reduction is expected". If there is a reduction, will there be an impact on agricultural activities (primarily banana production) in the vicinity of the subject parcel?

Both the loss of land with agricultural potential and the impact on groundwater resources should be addressed at time of hearing and in the Draft Environmental Impact Statement.

Thank you for the opportunity to comment.

Jack K. Suwa

JACK K. SUWA
Chairman, Board of Agriculture

GEORGE R. ARIYOSHI
GOVERNOR

JACK K. SUWA
CHAIRMAN, BOARD OF AGRICULTURE

SUZANNE D. PETERSON
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

October 9, 1986

Mr. Robin Oura, Project Manager
LANDPRO
800 South Beretania Street, 3rd Floor
Honolulu, Hawaii 96813

Subject: EIS Preparation Notice - Conservation District Use Application
OA-8/13/86-1947 Nitto Kogyo Company, Ltd.
Conditional Use Permit for Proposed Golf Course in Resource and General Subzones
TMK: 4-5-42: Por. 1 and 6 Kaneohe, Oahu
Acres: 200

Dear Mr. Oura:

Thank you for your letter of October 3, 1986, requesting comments on the above-referenced project. Our comments were previously sent to Mr. Susumu Ono, Chairperson, Board of Land and Natural Resources, in response to the "Conservation District Use Application and Environmental Assessment" prepared by DHM, Inc., July, 1986. I have attached a copy of our memorandum of September 30, 1986, for your review and consideration in preparation of the EIS.

We will provide further comment upon our receipt and review of the Draft EIS.

Sincerely,

Jack K. Suwa

JACK K. SUWA
Chairman, Board of Agriculture

Attachment

cc: DLNR

128

DHM inc.
land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph (808) 521-9855

October 29, 1986

Mr. Jack K. Suwa
Chairman, Board of Agriculture
Department of Agriculture
1428 S. King Street
Honolulu, Hawaii 96814

Dear Mr. Suwa:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

Thank you for your letter to Mr. Robin Oura of LANDPRO regarding the above. We are responding directly to your comments on behalf of LANDPRO.

Your concerns regarding the project's impact on agriculture on a statewide basis and groundwater in the region will be addressed in the draft EIS which will be distributed in early November.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

ALEXIS T. LUM
MAJOR GENERAL
ADJUTANT GENERAL

PAUL K. NAKAMURA
COLONEL, HAW
DEPUTY ADJUTANT GENERAL

OCT 10

HIENG

OCT 09 1985

Mr. Robin Oura, Project Manager
Land Process Service Corporation
800 South Beretania St., 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

Proposed Golf Course with Accessory Uses
Koolaupoko, District, Oahu, Hawaii

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.

Yours truly,

Jerry M. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

GEA

RECEIVED
'86 OCT 21 PM 3:31
OFC. OF ENVIRONMENTAL QUALITY CONTROL
OCEA

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86 OCT 21 A8:03
STATE OF HAWAII
EPHSD

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

October 15, 1986

MEMORANDUM

To: The Honorable Susumu Ono, Chairperson
Board of Land and Natural Resources

From: Director of Health

Subject: Conservation District Use Application
File No: OA-8/13/86-1947
Request: Golf Course and Accessory Uses, Koolaupoko, Oahu

Thank you for allowing us to review and comment on the subject CDUA project. We provide the following comments:

130

Wastewater Disposal

As long as the project ultimately connects to the public sewer system, we have no wastewater disposal concerns.

Noise

The environmental assessment must address the noise generated during the construction phase of the project.

1. Construction activities 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 regulations.

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

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

2. Traffic noise from heavy vehicular travelling to and from the construction site must be minimized near existing residential areas and must comply with the provisions of Title 11, Administrative Rules, Chapter 42, Vehicular Noise Control for Oahu.

Drinking Water

Thank you for the opportunity to review the subject project. The project consists of an 18-hole golf course and clubhouse facilities. Water will be required for potable use,

fire protection, and landscape irrigation. A separate system for irrigation and fire protection is being considered. Please be advised that if a new source of water is developed to support the golf course, it will be subject to all applicable terms and conditions of Chapter 20.

The Department of Health is vested with the responsibility to assure that public water systems in the State are providing water which is in compliance with the State's drinking water regulations known as Chapter 20, Title 11, Administrative Rules, and are in compliance with all other applicable terms and conditions of Chapter 20. A public water system is defined as a system serving 25 or more individuals at least 60 days per year or having a minimum of 15 service connections. In the event that the new well is intended to serve these minimum numbers of persons or service connections, please be advised that the well and distribution system will be subject to the terms of Section 11-20-29 and Section 11-20-30 of Chapter 20 respectively.

Section 11-20-29 of Chapter 20 requires all new sources of potable water serving public water systems to be approved by the Director of Health prior to their use to serve potable water. Such 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 11-20-30 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.

In the event that the proposed well is solely intended to serve irrigation or other nondomestic purposes, or if the proposed well will not serve the minimum number to qualify as a public water system as defined earlier, then the new well and distribution system are not subject to Chapter 20 requirements. However, if at some point in the future, the decision is made to use the water for potable purposes, or if the system expands to meet the minimum service population or number of service connections, the source and distribution system will be subject to Section 11-20-29 and Section 11-20-30 respectively prior to their use to serve the new public water system.

The existence of two water systems, one potable and one nonpotable, introduces the opportunity for backflow or back pressure. Cross connections between the two systems should be avoided. The owner or supplier of the potable water system must ensure that any cross connections which do exist are protected by an approved backflow prevention device.

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

LESLIE S. MATSUBARA

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph (808) 521-9855

October 29, 1986

Mr. Leslie S. Matsubara
Director
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Matsubara:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

Thank you for your comments on the COUA of the subject project.

The draft EIS, which will be circulated in early November, will address the issues to which you refer, including wastewater disposal, construction and traffic noise, and water supply.

We also appreciate your clarification of the requirements of Chapter 20, the State's drinking water regulations, as they pertain to this project.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

RECEIVED
'86 OCT 1 AM 9:51
PLANNING OFFICE

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

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

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

September 30, 1986

MEMORANDUM

TO: Roger Evans, OCEA

FROM: Ralston H. Nagata, State Parks Administrator

SUBJECT: CDUA OA-8/13/86-1947 16848 -- Golf Course & Accessory Uses (Nitto Kogyo Company, Ltd.)
Kaneohe, Koolaupoko, Oahu
TMK: 4-5-42: 1 and 6

132

HISTORIC SITES CONCERNS:

This project covers 200 acres. The EA (1986) reviews archaeology on pages 44-47, 64 and Appendix D. No archaeological surveys have been done in the project area. The EA reviews nearby surveys which indicated that significant sites are likely to be present, particularly agricultural site complexes along the streams. The applicant notes that little is known about upland land use on windward Oahu and that the information in such sites can potentially be very important (p. 64). The applicant proposes to have an intensive archaeological survey conducted throughout the entire project area after the CDUA is awarded and prior to detailed design of the golf course, so that significant archaeological sites worth preserving can be either avoided or incorporated into the course layout. The application further states that historic preservation measures will be coordinated with this department.

While we appreciate the concern of the applicant to preserve significant sites and while we agree with the site predictions, a critical point is that, at this time, we do not know how many historic sites are in this parcel and where, their nature or significance. This information is needed prior to approval of a CDUA. We need it in order to evaluate whether the proposed use of the conservation land is appropriate in regard to historic sites concerns. In order for our office to evaluate the CDUA, the following needs to be done:

1. An archaeological survey must identify all sites and their location and provide sufficient descriptive information so that each site's significance can be determined.
2. The significance of the sites must then be determined in consultation with our office.
3. The applicant must then provide a mitigation plan to handle the likely impacts to the significant sites in the parcel. This might include preservation of all significant sites or preservation of some sites and archaeological data recovery at others to recover significant information on upland land use.

We strongly recommend that no decision be made on this CDUA application until this information is supplied. We are also available to advise the applicant on these various points, to help them be efficiently carried out.

RECREATION CONCERNS:

There are no known State Park concerns except for the subject projects impact on Nuuanu Pali State Wayside. The applicant has identified this impact and has stated it will be a primary consideration in designing and building the golf course. However, we have no evidence to support this statement and there is no mention of the visual impact of the various facilities such as the clubhouse, driving range and road/parking lot.

The subject project should also be received by the City and County of Honolulu, Department of Parks and Recreation since it is near Hoomaluhia Park and will drain into the wildlife area and reservoir located in this park. The subject property includes a portion of the Likeke Trail, a hiking trail commonly used by the public with access from Kionole Road, Likelike Highway and Hoomaluhia Park. This trail does not appear to be in the project area but is existence has not been identified in the subaittal.

RALSTON H. NAGATA

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2105
Honolulu HI 96813
Ph (808) 521-0851

October 7, 1986

Mr. Ralston H. Nagata
State Parks Administrator
Department of Land and
Natural Resources
Division of State Parks
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Nagata:

SUBJECT: Your Memorandum of September 30, 1986
regarding CDUA OA-8/13/86-1947 16848--
Golf Course and Accessory Uses

133 The archaeological field survey of the subject lands has been completed for use in preparing a draft environmental impact statement for the proposed project.

A copy of this report, Archaeological Inventory Study of an Inland Parcel, Kaneohe-Kailua, Oahu, Hawaii, by Kanalei Shun, Patricia Price-Beggerly, and J. Stephen Athens, will be hand-delivered to your office by Dr. J. Stephen Athens on October 7, 1986. The report addresses your comments and concerns relative to historic sites. If you have any questions, please feel free to contact me.

In regards to your recreation concerns, the visual impact of the various facilities of the golf course complex from several vantage points, including Pali Lookout, Likeke Trail, Kam Highway and Hoomaluhia Park, will be addressed in the draft EIS. The draft EIS will also identify other potential impacts on Hoomaluhia Park.

Thank you for your comments.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

WM:lt

cc: Dr. J. Stephen Athens
Mr. Robin Oura

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES
EDGAR A. HAMABU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT
P. O. BOX 373
HONOLULU, HAWAII 96809

RECEIVED
'86 OCT 2 P1

October 1, 1986

MEMORANDUM

TO: Mr. Roger Evans, OCEA

FROM: Manabu Tagomori

SUBJECT: Review of CDUA and Environmental Assessment for a Golf Course and Accessory Uses at Koolaupoko, Oahu, TMK: 4-5-42:1 & 6 (CDUA File No. OA-1947)

134

The applicant, Nitto Kogyo Company, proposes to construct a 180-acre golf course; club house, driving range, access road, and drainage improvements, and install utility systems. Other recreational uses will include tennis and swimming. Dining/banquet facilities will also be provided.

Potable water requirements for the project are estimated at 20,000 gpd. Water for irrigation and fire protection is estimated at 250,000 - 500,000 gpd and 2000 gpm, respectively. The applicant is considering three alternatives - connecting to the existing BWS system, utilizing existing wells nearby, or drilling new well(s) near the golf course.

Permits from DLNR will be required if the applicant proposes to drill a new well or modify an existing well. The Board of Water Supply should have the opportunity to review the proposed alternatives.

Slopes within the project site range from 3% to 40%. Although natural features such as streams will be retained, the 180-acre golf course, club house site, access roads, and driving range will be graded. As such, appropriate erosion and sediment control measures should be fully utilized. Major grading operations should be scheduled for the drier months of the year.

The project site is crossed by two perennial streams - Kamooalii and Hooleinaiwa Streams. Although existing drainage channels are to be retained as much as possible in their natural state, culverts and bridges will be installed to cross existing waterways.

Should the project require placing materials or structures within the stream channel, a stream channel alteration permit from DLNR will be required in accordance with Departmental Administrative Rule, Title 13, Chapter 167 for the protection of instream uses in Windward Oahu streams.

DOWALD would be pleased to assist the applicant in reviewing plans to determine stream channel alteration permit requirements.

MANABU TAGOMORI

SS:ko

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

October 29, 1986

Mr. Manabu Tagomori
Department of Land and
Natural Resources
Division of Water and
Land Development
State of Hawaii
P. O. Box 373
Honolulu, Hawaii 96809

Dear Mr. Tagomori:

13 SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

Thank you for your comments on the CDUA and Environmental Assessment for the subject project.

We acknowledge the potential need for Department of Land and Natural Resources permits related to well-drilling or well-modification, and stream channel alterations, and appreciate your offer of assistance in this matter.

The Board of Water Supply has been consulted during the preparation of the EIS in respect to the proposed water supply alternatives, and will be reviewing the draft EIS as well.

Grading and drainage related issues to which you refer, will be addressed in the draft EIS.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

GEORGE R. ARIYOSHI
KENT M. KEITH
MURRAY E. TOWNS
Roger A. Ulveling

DIVISIONS
BUSINESS AND INDUSTRY DEVELOPMENT DIVISION
ENERGY DIVISION
FOREIGN TRADE ZONE DIVISION
LAND USE DIVISION
PLANNING DIVISION
RESEARCH AND ECONOMIC ANALYSIS DIVISION
OFFICES
ADMINISTRATIVE SERVICES OFFICE
INFORMATION OFFICE

Ref. No. P-5170

September 25, 1986

MEMORANDUM

TO: The Honorable Susumu Ono, Chairperson
Department of Land and Natural Resources

FROM: Kent M. Keith

SUBJECT: Conservation District Use Application, Golf Course and Accessory Uses, Koolaupoko, Oahu (OA 8/13/86-1947)

We have reviewed the subject application and associated Environmental Assessment (EA) with respect to the Hawaii Coastal Zone Management (CZM) Program and offer the following comments.

Historic Resources

In view of prior archaeological investigations and recorded sites around the proposed project area, we recommend an intensive archaeological survey prior to any site work and the subsequent mapping and preservation of significant sites. Similar mitigating measures are suggested in the project EA.

Coastal Ecosystems

The project EA indicates that the natural terrain and existing major drainage pattern will be retained as much as possible. However, it appears that some grading, filling, and extensive stripping of natural vegetation will be required in the development of the fairways, greens, culverts, paths and accessory structures. Mitigation of impacts on coastal ecosystems, both during construction and the operational stage of the project, should be discussed. Potential impacts may result from siltation and chemicals associated with the maintenance of a golf course. This is of particular concern in consideration of the moderate to heavy rainfall in the area.

Thank you for the opportunity to provide these comments.

136

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

Roger A. Ulveling

OFFICES
ADMINISTRATIVE SERVICES OFFICE
INFORMATION OFFICE

OCT 28 1986

Ref. No. P-5331

October 23, 1986

MEMORANDUM

TO: The Honorable Susumu Ono, Chairperson
Department of Land and Natural Resources

FROM: Kent M. Keith

SUBJECT: EIS Preparation Notice, Golf Course, Conservation District Use Application, Koolaupoko District, Oahu

We have reviewed the subject preparation notice and offer the following comments.

The EIS should discuss the consistency of the proposed project to the Hawaii State Plan (Chapter 226, HRS). This review should at a minimum discuss the relationship of the proposed project to the following: Economy (Section 226-8, HRS), Physical Environment (Sections 226-12 and 226-13, HRS) and Socio-Cultural Advancement (Section 226-23, HRS). Among the relevant Priority Guidelines, the following should be examined: Economic (Section 226-103(b), HRS) and Regional Growth and Land Resource Utilization (Section 226-104(b), HRS). All Functional Plans should be reviewed and those relevant to the proposed project should be discussed in the EIS in terms of their relationship to the proposed project.

The following comments on historic resources and coastal ecosystems were provided in our memorandum dated September 25, 1986, to you on the golf course's Conservation District Use Application Permit and should be addressed.

In view of prior archaeological investigations and recorded sites around the proposed project area, we recommend an intensive archaeological survey prior to any site work and the subsequent mapping and preservation of significant sites. Similar mitigating measures are suggested in the project EA.

The project EA indicates that the natural terrain and existing major drainage pattern will be retained as much as possible. However, it appears that some grading, filling, and extensive stripping of natural vegetation will

be required in the development of the fairways, greens, culverts, paths and accessory structures. Mitigation of impacts on coastal ecosystems, both during construction and the operational stage of the project, should be discussed. Potential impacts may result from siltation and chemicals associated with the maintenance of a golf course. This is of particular concern in consideration of the moderate to heavy rainfall in the area.

Thank you for the opportunity to provide these comments.

cc: Mr. Robin Oura
Landpro

137

DHM inc.
land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

October 29, 1986

Mr. Kent M. Keith, Director
Department of Planning and
Economic Development
State of Hawaii
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Keith:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

Thank you for your comment letters of September 25 and October 23, 1986 on the Golf Course EIS Preparation Notice and CDUA.

The Environmental Impact Statement (EIS) will address the provisions of the Hawaii State Plan, as you recommend, as well as applicable functional plans. An intensive archaeological survey of the project area has been completed and the results will be included in the EIS. The EIS will also address your concerns about the coastal ecosystems.

Sincerely,

DHM Inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING
HAWAII HOUSING AUTHORITY
P. O. BOX 17907
HONOLULU, HAWAII 96817

IN REPLY REFER TO:
86:PLNG/6433

October 23, 1986

Ms. Robin Oura
Project Manager
Land Process Service Corporation
800 South Beretania Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Ms. Oura:

Thank you for the opportunity to review and comment on the Environmental Impact Statement Preparation Notice for the Nitto Kogyo's Golf Course in Koolaupoko District on Oahu.

The Hawaii Housing Authority (HHA) does not have any specific comments to offer at this time, however, we request to be kept apprised of the development and the upcoming EIS.

For any further questions, please contact Colette Sakoda of my staff at 848-3226.

Sincerely,

RUSSELL N. FUKUMOTO
Executive Director

38

University of Hawaii at Manoa

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

OCT • 6 1986

October 14, 1986
PN: 0050

Mr. Robin Oura, Project Manager
LANDPRO
800 South Beretania Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

Preparation Notice
Environmental Impact Statement
Nitto Kogyo's Golf Course
Kaneohe, Oahu

139

Although the Environmental Center does not usually comment at the preparation stage of the EIS process, we wish to call attention to the special need to address archaeological concerns in this area. The potential for early subsurface sites in the low lying areas of this project, such as were found in nearby Kawainui Marsh and most recently under alluvial deposits at the West Beach Resort site suggests that special attention and assessment is warranted. We will address other issues as needed at the Draft EIS state.

Yours truly,

Jacquelin N. Miller
Acting Associate Director

cc: OEQC
Patrick Takahashi
Walington Yee

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

October 29, 1986

Ms. Jacquelin N. Miller
Acting Associate Director
Environmental Center
University of Hawaii
2550 Campus Road
Honolulu, Hawaii 96822

Dear Ms. Miller:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

Thank you for your letter to Robin Oura of LANDPRO regarding archaeological concerns in the project area.

On behalf of LANDPRO, we would like to inform you that an intensive archaeological field survey and land use study has been completed for the project area. The findings and recommendations of the study will be included in the environmental impact statement.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

WM:lt

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

October 3, 1986

Mr. Susumu Ono, Chairperson
Board of Land and Natural
Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Your Letter of September 11, 1986 on the Conservation District Use Application and Environmental Assessment for the Nitto Kogyo Company, Ltd. Golf Course, TMK: 4-5-42: 1 and 6

Thank you for the opportunity to review the Conservation District Use Application and Environmental Assessment for the Nitto Kogyo Company, Ltd. Golf Course.

We offer the following comments:

1. The existing 12-inch water main in Kamehameha Highway is part of the Kaneohe 500' High Service System, not the 272' water service zone as stated on page 16.

2. Requirements for the off-site fire protection fall under the jurisdiction of the Board of Water Supply. However, the on-site fire protection for the proposed Club House should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

3. On page 47, it should be noted that the Luluku Tunnel is interconnected with the Haiku and Kahaluu Tunnels to form the Kaneohe High Service System. However, water from Luluku Tunnel basically serves the areas of Kaneohe Bay Drive and upper Luluku Road. The Haiku and Kahaluu Tunnels are the predominant sources of water for the 12-inch water main along Kamehameha Highway.

4. If water is made available for the domestic requirement of the proposed golf course, the developer will be assessed our Water System Facilities Charges for source-transmission and daily storage.

5. On page 18, the first sentence should be changed to read, "Approval must be obtained from the Board of Water Supply to utilize the existing wells located at the Halekou Interchange."

6. On page 39, line 5, the word, "faults" should be changed to "fractures".

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

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Fire Prevention Bureau

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU HAWAII 96843

October 15, 1986

Mr. Robin Oura
Land Process Service Corporation
800 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Oura:

Subject: Your Letter of October 3, 1986 on the Proposed Golf Course with Accessory Uses in Koolaupoko, TMK: 4-5-42:1, 6

141

We have reviewed the environmental assessment for the proposed golf course and have sent our comments on the assessment to the Department of Land and Natural Resources, State of Hawaii. A copy of our comments is attached for your information.

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

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

Attachment

DHM inc.
land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph (808) 521-9855

October 29, 1986

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

Dear Mr. Hayashida:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

Thank you for your comments on the CDUA and Environmental Assessment for the subject project.

The draft EIS, which will be circulated in early November, will reflect the revisions and corrections you have recommended.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

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

KK/DGP 10/86-9742

October 10, 1986

Mr. Robin Oura, Project Manager
LANDPRO
800 South Beretania Street
Third Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

14 This is in response to your request for comments on an Environmental Impact Statement (EIS) for a proposed golf course with accessory uses on Conservation land between the Pali Golf Course and Hoomaluhia Park in Koolaupoko, Oahu.

We have reviewed your preparation notice and offer the following comments:

1. The EIS should consider the impact that the golf course and accessory uses will have on the surrounding residences and agricultural activities including traffic, noise, and drainage. Mitigative measures should also be discussed.

2. Much of the project will occur mauka of the Board of Water Supply underground injection control line. The impact that chemicals used in the care of the golf course could have on our water supply should be discussed along with measures to mitigate these impacts.

3. The impact of grading activity on the existing views should be considered.

4. A drainage plan should be prepared for review by the Department of Public Works. Included should be the impact of chemicals in the drainage water.

5. An archaeological reconnaissance survey should be done with findings included in the EIS.

Thank you for the opportunity to offer our comments.

Should there be any questions, please call Keith Kurahashi at 527-6051.

Sincerely,

Donald A. Clegg

DONALD A. CLEGG
Chief Planning Officer

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

October 29, 1986

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:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

143

On behalf of Mr. Robin Oura of LANDPRO, we thank you for your letter of June 10, 1986 in reference to the above.

Potential impacts and mitigative measures for all the concerns you mention, including traffic, noise, drainage, water supply, grading, visual, water quality, and archaeology will be addressed in the draft EIS. An intensive archaeological study has been completed and will be included in the draft EIS as well.

We expect that you will receive a copy of the draft EIS in early November.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

MM:lt

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

MICHAEL M H MOON
DIRECTOR

ROBERT MIYABATO
DEPUTY DIRECTOR

October 15, 1986

Mr. Robin Oura, Project Manager
Land Process Service Corporation
800 South Beretania Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

Subject: Conservation District Permit with Department of Land and Natural Resources
Project: Golf Course with Accessory Use
TMK: 4-5-42: 1 and 6
Area: 211.4 Acres
Location: Mauka of Kamehameha Highway, between the Pali Golf Course and Likelike Highway, Kaneohe, Oahu
Proposal: Kitto Kogyo proposes a golf course development on 211 acres.

Thank you for the opportunity to review and comment on the proposed golf course development on Kaneohe, Oahu.

We have no objections to the proposed use for the subject site. However, as you are aware, there is a great demand for golf courses for the residents of Oahu. Presently, there are three regulation and one nine-hole public courses for the 750,000 residents of Oahu. This is a ratio of approximately 214,285 residents for public course. The desirable standard is 100,000 people per public course. There is a need for four additional public golf courses. To ease the tension on the public courses, we suggest that tee times for the general public be made available.

Sincerely,

MIKE MOON

144

DHM inc.
land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph (808) 521-9855

October 29, 1986

Mr. Mike Moon
Department of Housing and
Community Development
City & County of Honolulu
650 South King Street
Honolulu, Hawaii

Dear Mr. Moon:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

On behalf of Mr. Robin Oura of LANDPRO, we thank you for your letter of October 15, 1986 in reference to the above.

We recognize the great demand for golf courses on Oahu and the proposed project will help alleviate this problem. Your suggestion regarding public tee times will be taken into consideration.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

WM:lt

C29

K67

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

TOM T. NEKOTA
DIRECTOR

RECEIVED
'86 OCT 6 P2:50
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
86 OCT 6 P1:
LAND MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE OF HAWAII

October 2, 1986

Mr. Susumu Ono, Chairperson
Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii 96809

Dear Mr. Ono:

145 Subject: Conservation District Use Application (CDUA) No. OA-8/13/86-1947

We have reviewed the CDUA for Nitto Kogyo's proposed golf course and have no objections to the project's location and general concept. The golf course will offer a visually beneficial extension of open space and greenery which are now provided by the Pali Golf Course and Ho'omaluhia Park.

Our major concern, one which we are strongly opposed to, is the location of the proposed clubhouse with its large parking lot and long access road. This facility will be situated on the highest point of the project site and within proximity to the center of camping areas at Ho'omaluhia Park. Consequently, noise, lights and the visual impact of the clubhouse will have a grievously negative effect on park use.

Other concerns will be addressed during the EIS review/consultation period.

Thank you for the opportunity to comment on the CDUA.

Sincerely,

Tom Nekota

TOM T. NEKOTA, Director

TTN:ei

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

TOM T. NEKOTA
DIRECTOR

October 20, 1986

Mr. Robin Oura
Project Manager
Landpro
800 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Oura:

Subject: EIS Preparation Notice
Proposed Golf Course with Accessory Uses
Tax Map Key 4-5-42:1 and 6
Koolaupoko, Hawaii

We have reviewed the EIS Preparation Notice and recommend the following concerns, relative to possible impacts on Ho'omaluhia Park and users of the park, be addressed:

Water Quality/Drainage

Kamooalii Stream and Hooleinaiwa Stream passes through the proposed golf course site and ultimately feeds into the 32-acre lake and wildlife pond at Ho'omaluhia Park. Construction as well as post construction activities will produce nutrients and sediment which will enter and affect the water areas of the park. Impacts on ground water and surface water should be discussed.

Visual/Noise Impacts

The environmental assessment prepared in July 1986 revealed that the proposed clubhouse and a 150-200 stall parking lot will be located on the peak of the project site. Access to the clubhouse would be available via a long roadway extending from Kionaole Road and running parallel to the proposed H-3 right-of-way. Inasmuch as these improvements will be in proximity to the center of camping areas at Ho'omaluhia Park, noise, lights and the highly visible clubhouse will have a negative effect on park use. Alternate sites for the clubhouse should be considered.

Water Supply

The EIS should include discussion on the adequacy of existing water supply and, if required, the impacts of developing new sources other than those already planned by the Board of Water Supply.

Adequate stream flow to the water areas of Ho'omaluhia Park is required to ensure the proper interchange of fresh water and to support fishing and boating activities and the proposed aquaculture projects. Withdrawal of ground water to serve the golf course project needs may affect water levels at the lake and wildlife pond.

Thank you for the opportunity to review the EIS Preparation Notice.

Sincerely,

Tom Nekota

TOM T. NEKOTA, Director

TTN:el

cc: Department of Land and Natural Resources

146

DHM inc.
land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

October 29, 1986

Mr. Tom Nekota
Director
Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Nekota:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

Thank you for your comments to the CDUA and EIS Preparation Notice of the subject project.

All of your stated concerns, which include water quality, drainage, visual, noise, and water supply, will be addressed in the draft EIS which will be circulated in early November. Your major concerns regarding potential noise, light and visual impacts of the Clubhouse facilities will also be addressed. The draft EIS will contain site plans, sections and elevations of the facilities, and cross-sections showing the visibility of the golf course from several vantage points on Kionaole Road, Kamehameha Highway, and Ala Maluhia Road in Hoomaluhia Park.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

FRANK F. FASI
MAYOR

DOUGLAS G. GIBB
CHIEF

MARWAN FERREIRA
DEPUTY CHIEF

OUR REFERENCE DI-LK

October 14, 1986

Mr. Robin Oura
Project Manager
LANDPRO
Land Process Service Corporation
800 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Oura:

Subject: EIS Preparation Notice
Proposed Golf Course with Accessory Uses
TMK: 4-5-42 Parcels 1 & 6
Koolaupoko District, Oahu, Hawaii

We have reviewed the material on the proposed golf course with accessory uses at the Koolaupoko District, Oahu. We do not have any objections to the proposed project at this time.

Sincerely,

DOUGLAS G. GIBB
Chief of Police

147

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

RUSSELL L. SMITH, JR.

ENV 86-215

October 14, 1986

Mr. Robin Oura
Project Manager
Landpro
800 South Beretania Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

148

Re: EISPN for Proposed Golf Course with Accessory Uses, Koolaupoko, Oahu, Hawaii, (TMK: 4-5-42: 1 and 6)

We are responding to your letter dated October 3, 1986, concerning the subject matter.

a. The disposal of wastewater from the proposed clubhouse should be discussed. There are no sewerage facilities in the proposed project area.

b. The project may increase storm runoff, erosion, sediment disposition and maintenance of waterways under our control. These matters should be addressed in the EIS. A drainage report should be submitted to the Division of Engineering for review and approval, together with the construction plans.

Very truly yours,

RUSSELL L. SMITH, JR.
Director and Chief Engineer

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph (808) 521-9855

October 29, 1986

Mr. Russell L. Smith, Jr.
Director & Chief Engineer
Department of Public Works
City & County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Smith:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

On behalf of Mr. Robin Oura of LANDPRO, thank you for your letter of October 14, 1986 in reference to the above.

Your concerns regarding the disposal of wastewater, storm runoff, erosion, sediment disposition and maintenance of waterways will be addressed in the draft EIS. We expect you will be receiving a copy of the report in early November.

A drainage report and construction plans will be submitted to your department for review and approval prior to construction.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

October 1, 1986

TO: Mr. Robin Oura, Project Manager

LANDPRO
800 S. Beretania St., #3rd. floor
Honolulu, HI 96813

FROM: Robert Carter, Director
Ko'olau Poko Land & Resource Trust
1570 Ulupuni St.
Kailua, HI 96734

RE: Nitto Kyogo Co. Kaneohe golf course development.

Dear Sir,

Please include me and my organization in the preperation of the E.I.S. contact list, as a consulted party.

The Ko'olau Poko Land & Resource Trust supports buisnesses ventures such as you propose, Which inturn support the community.

The mega trend for Windward Oahu strongly favors golf course recreational use as a major industry, Our organizations intent is to insure local residents within this industry.

Thank you for this chance to participate, and to become informed of your development plans.

Sincerly,

Robert Carter, Director

149

OCT - 6 1986

LANDPRO
LAND PROCESS SERVICE CORPORATION

October 07, 1986

Mr. Robert Carter, Director
Ko'olau Poko Land &
Resource Trust
1570 Ulupuni Street
Kailua, Hawaii 96734

SUBJECT: EIS Preparation Notice
Proposed Golf Course with Accessory Uses
TMK: 4-5-42 Parcels 1 & 6
Koolaupoko District, Oahu, Hawaii

Dear Mr. Carter:

Thank you for your letter dated October 01, 1986 and for your interest in this project. As you may be aware, we are currently processing a Conservation District Use Application Permit with the Department of Land and Natural Resources to develop an 18 hole Championship Golf Course and Clubhouse facility located on the above-captioned conservation designated land.

DLNR has determined that an Environmental Impact Statement will be required for the proposed development before a CDUA permit can be granted. We believe that you may have an interest in this project and in our preparation of the EIS. We have, therefore, enclosed a copy of the DLNR's "Notice of Acceptance and Environmental Determination" for your review.

We welcome your early input and expertise to assure the preparation of a comprehensive environmental impact statement.

Please submit any comments or specific concerns that you feel should be addressed in the EIS to this office by October 23, 1986. Should you have specific questions, please feel free to contact me directly at 523-7071.

Very truly yours,

Robin Oura
Project Manager

RO:sn
Enclosure

LULUKU BANANA GROWERS' ASSOCIATION
c/o P.O. Box 475
Kaneohe, Hawaii 96744

October 22, 1986

Mr. Robin Oura, Project Manager
LANDPRO
800 South Beretania Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

Thank you for the opportunity to comment on the proposed golf course project on lands located in Kaneohe, Oahu and lies southwest of Kamehameha Highway between the Pali and Likelike Highways. The subject project is bordered on the north by Hoomaluhia Park, east by Kionaole Road, south by the summit of the Koolau Range, and west by the Likelike Highway.

The farmers in the Luluku Banana Growers' Association are very concerned that the proposed golf course project will adversely affect our livelihood and our intent to continue farming. The land in the Luluku area where we farm and is adjacent to the proposed project has very unique characteristics that enable the Brazilian (apple) variety of banana to grow very well. In fact, this area produces 70% - 80% of Hawaii's Brazilian (apple) bananas. To take advantage of the area's uniqueness and production capabilities, we are currently finalizing the formation of a cooperative with definite long range objectives being planned. Consequently, we are very concerned about the proposed golf course project and its affect on us.

150

Our concerns are as follows:

1. Under what kinds of conditions and terms will the farmers be allowed to continue farming?
2. Since we depend primarily on natural rainfall for irrigation, what will be the affect on rainfall in the area?
3. If the proposed project is developing its own water resource, what will be the affects to the area? (Board of Water Supply's wells in the area have reduced surface water flows which are used by some farmers for limited irrigation purposes.)
4. If an access through the farming area to the proposed golf course is being planned, what kinds of security measures are being planned to prevent vandalism and theft?
5. During the construction phase are any measures being planned to prevent banana theft and vandalism?
6. Will there be a buffer zone between the proposed golf course and the farming area to prevent any kind of pesticide drift and personal injury by golf balls?
7. Are there any future plans for a housing or any other types of development adjacent to the proposed golf course that will affect the productive farm lands?
8. What will be the affects on the flood control dam and lake in Hoomaluhia Park during excavation?

Again, we are very concerned about the affects of the proposed golf course on our livelihood and our intent to continue farming, and we appreciate the opportunity to express them. We will be anxiously awaiting your response to our concerns.

Yours truly,

Fred Shiroma, President

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph (808) 521-9855

October 29, 1986

Mr. Fred Shiroma, President
Luluku Banana Growers' Association
c/o P. O. Box 475
Kaneohe, Hawaii 96744

Dear Mr. Shiroma:

SUBJECT: Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

151 On behalf of Mr. Robin Oura of LANDPRO, thank you for your letter of October 22, 1986 in reference to the above.

The proposed project area is limited to a portion of the land area identified as TMK 4-5-42:1 and 6 and does not include the Luluku banana farm lands. Moreover, the project area is located one-half mile east of the farm lands providing a considerable buffer zone between the farming area and the golf course project.

Regardless, we understand your concerns about the effects of the proposed golf course on the Luluku banana lands. The EIS will address these concerns, which include impact on surrounding agricultural lands, rainfall, water resources, access, air quality, and Hoomaluhia Park. We expect you will be receiving a copy of the draft EIS in eary November.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM/WM:lt

OMPO

Oahu Metropolitan Planning Organization

Suite 1509
1164 Bishop Street
Honolulu, Hawaii 96813
(808) 523-4178
(808) 548-2638

October 15, 1986

Mr. Robin Oura, Project Manager
LANDPRO
800 South Beretania Street
Third Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

EIS Preparation Notice
Proposed Golf Course with Accessory Uses
TMK: 4-5-42 Parcels 1 & 6
Koolaupoko District, Oahu, Hawaii

Thank you for your letter of October 3, 1986, relative to the above subject matter.

We have no comments on the subject project at this time but would appreciate receiving a copy of the EIS for review when it is completed.

Sincerely,

Gordon G.W. Lum
Executive Director

GGWL:pc

152

VTN PACIFIC, INC.

1164 Bishop Street, Suite 906
Honolulu, Hawaii 96813

Telephone (808) 521-5631

October 6, 1986

Robin Oura
Project Manager
LANDPRO
800 South Beretania Street
3rd Floor
Honolulu, Hawaii 96813

Subject: Conservation District Use Application
for a Golf Course with Accessory Uses

Dear Mr. Oura:

153 This is letter is in reponse to the EIS Preparation Notice in the OEQC Bulletin dated September 23, 1986 concerning the Conservation District Use Application for a Golf Course. VTN Pacific would like to be a consulted party to the EIS. Please send a copy of the EIS Preparation Notice and the Draft EIS to:

VTN Pacific, Inc.
1164 Bishop Street, Suite 906
Honolulu, Hawaii 96813

Attn: John L. Sakaguchi

Thank you for your help in this request.

Sincerely,

VTN Pacific, Inc.

John L. Sakaguchi
Planner

LANDPRO
LAND PROCESS SERVICE CORPORATION

October 09, 1986

Mr. John L. Sakaguchi
VTN Pacific, Inc.
1164 Bishop Street
Suite 906
Honolulu, Hawaii 96813

SUBJECT: EIS Preparation Notice
Proposed Golf Course with Accessory Uses
TMK: 4-5-42 Parcels 1 & 6
Koolaupoko District, Oahu, Hawaii

Dear Mr. Sakaguchi:

Thank you for your letter dated October 06, 1986 and for your interest in this project. As you may be aware, we are currently processing a Conservation District Use Application Permit with the Department of Land and Natural Resources to develop an 18 hole Championship Golf Course and Clubhouse facility located on the above-captioned conservation designated land.

DLNR has determined that an Environmental Impact Statement will be required for the proposed development before a CDUA permit can be granted. Pursuant to your request to become a consulted party in our preparation of the EIS for this project, please find enclosed a copy of the DLNR's "Notice of Acceptance and Environmental Determination" for your review.

We welcome your early input and expertise to assure the preparation of a comprehensive environmental impact statement.

Please submit any comments or specific concerns that you feel should be addressed in the EIS to this office by October 23, 1986. Should you have specific questions, please feel free to contact me directly at 523-7071.

Very truly yours,

Robin Oura
Project Manager

RO:sn
Enclosure

CHAPTER XIV

XIV. COMMENTS DURING THE PUBLIC REVIEW PERIOD

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Ms. Everette A. Flanders
Chief, Construction-Operations Division
Department of the Army
U. S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Ms. Flanders:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 5, 1986.

a. During the detail planning phase, the grading and drainage improvement plans will be coordinated with your Operations Branch.

b. During the detail planning phase with topo survey map, your office will be contacted to determine and designate the wetland areas. If the placement of fill will affect more than one acre of the designated wetland areas, a Department of the Army permit will be obtained.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

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

REPLY TO
ATTENTION OF

December 5, 1986

Operations Branch

Mr. Dean Uchida
Department of Land and
Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

We have reviewed the Draft Environmental Impact Statement (DEIS) for Golf Course with Accessory Uses on Iolani School Property, Kaneohe, Oahu and offer the following comments:

a. The project area includes non-tidal streams that are located above the headwaters, as defined by Corps' regulations. Provided that the discharge or placement of fill material into these waters, including adjacent wetlands, results in the loss of less than one acre of such waters, an individual Department of the Army permit is not required, and the action is considered authorized under nationwide permit, 33 CFR 330.5(a)(26). If more than one acre of such waters, including their adjacent wetlands are involved, the grading and drainage plans for the project should be coordinated with the Corps' Operations Branch to determine applicable permit requirements.

b. A review of the description of soils (p. 31) and the botanical survey (Appendix B) shows that positive indicators of wetland conditions exist within the project area. The Hanalei soil series is considered a wetland or hydric soil, and the plant species list includes at least 15 facultative wetland species and one obligate species. The species in question have been provided to the proposing party, DHM, Inc. These indicators should be evaluated in conjunction with past and proposed modifications to the site and the predominance of wetland species in areas where fill material may be placed. As discussed in the previous comment, a DA permit may be required if the placement of fill adversely affects more than one acre of designated wetland areas.

We appreciate the opportunity to comment on the DEIS. If there are any questions on our comments, the applicant should contact the Operations Branch at 438-9258.

Sincerely,

Everette A. Flanders
Chief, Construction-Operations Division

Copy Furnished:

DHM, Inc.
1188 Bishop Street, Suite 2405
Honolulu, Hawaii 96813

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 19, 1986

Mr. Dan A. Davis
Acting District Chief
United States Department of the Interior
Geological Survey
Water Resources Division
P. O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Davis:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your letter of December 5, 1986. The following comments are in response to your concern:

Page	Item	
14	Exhibit III-7	The exhibit shows the location and alignment of the streams only; it was not intended to infer that the streams were intermittent.
68	Paragraph 2	We have revised the EIS as follows: Even with careful implementation of erosion control measures, during construction, the project will cause some increase in sediment transport if it rains heavily during that period.
68	Paragraph 3	The statement was based on a report prepared by the U. S. Corps of Engineers entitled, Flood Control & Allied Purposes, Kaneohe - Kailua Area, Design Memorandum No. 1, dated September 1972. This report refers to U. S. Geological Survey cooperative studies which, based on measurements of the suspended sediment concentration for Kamooalii Stream at a station just downstream from the damsite and the corresponding streamflow record for the period of sediment observation, estimated an average annual rate of 0.64 acre-feet of sediment per square mile of contributing drainage area behind the dam.

Page	Item	
68	All	Hydrological survey of the reservoir's bottom before and after golf course construction would be expensive. With careful implementation of soil erosion control measures, the sediment transport to the reservoir should not be excessive. The golf course area amounts to about 10 percent of the total drainage tributary area for the reservoir, and the area of the golf course to be graded represents only about half of that or 5 percent. Surveying the reservoir bottom would not accurately determine the siltation due strictly to the golf course construction. Further, upon completion of the landscaping for the golf course, the sediment transport from the project site will be less than the current condition. For these reasons, surveying the reservoir bottom by the developer does not appear to be justified.
72	Item 1	The basins will be checked periodically and maintained as needed to remain effective.
72	All	Kamooalii and Hooleinaiwa Streams will be monitored, as suggested.

Again, thank you for taking the time to bring your concerns to our attention. We appreciate the benefit of your views.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

December 5, 1986

Mr. Dean Uchida
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Subject: Draft EIS Conservation Use Application for Golf Course with Accessory Uses on Iolani School Property, Kaneohe, Oahu

Dear Mr. Uchida:

The subject draft EIS has been reviewed by personnel in the Hawaii District of the U.S. Geological Survey, Water Resources Division, principally by Harold Sexton and Johnson Yee.

The following are comments to the draft EIS:

Page	Item	Comments
14	Exhibit III-7	Kamooalii Stream is perennial in Hoomaluhia Park and not intermittent as shown in exhibit.
68	Paragraph 2	"the project may" should be changed to read "the project will".
68	Paragraph 3	The U.S. Geological Survey has not made any study on sediment yield of the project area before, during, or after the construction period.
68	All	The reservoir's bottom configuration could and should be monitored to evaluate sediment load into it before and after golf course construction.
72	Item 1	Owing to heavy rainfall intensity in the project area, some mention of planned maintenance of the retention and settling basins should be made.

72	All	Mitigating measures should contain monitoring efforts to ensure negative effects to the Reservoir. U.S. Geological Survey stream gaging stations 2657 and 2665 are excellent candidates to monitor stream quality. See attached diagram.

If you have questions, please call our office at 541-2653.

Sincerely,

Dan A. Davis
Acting District Chief

Copy to: DHM Inc.

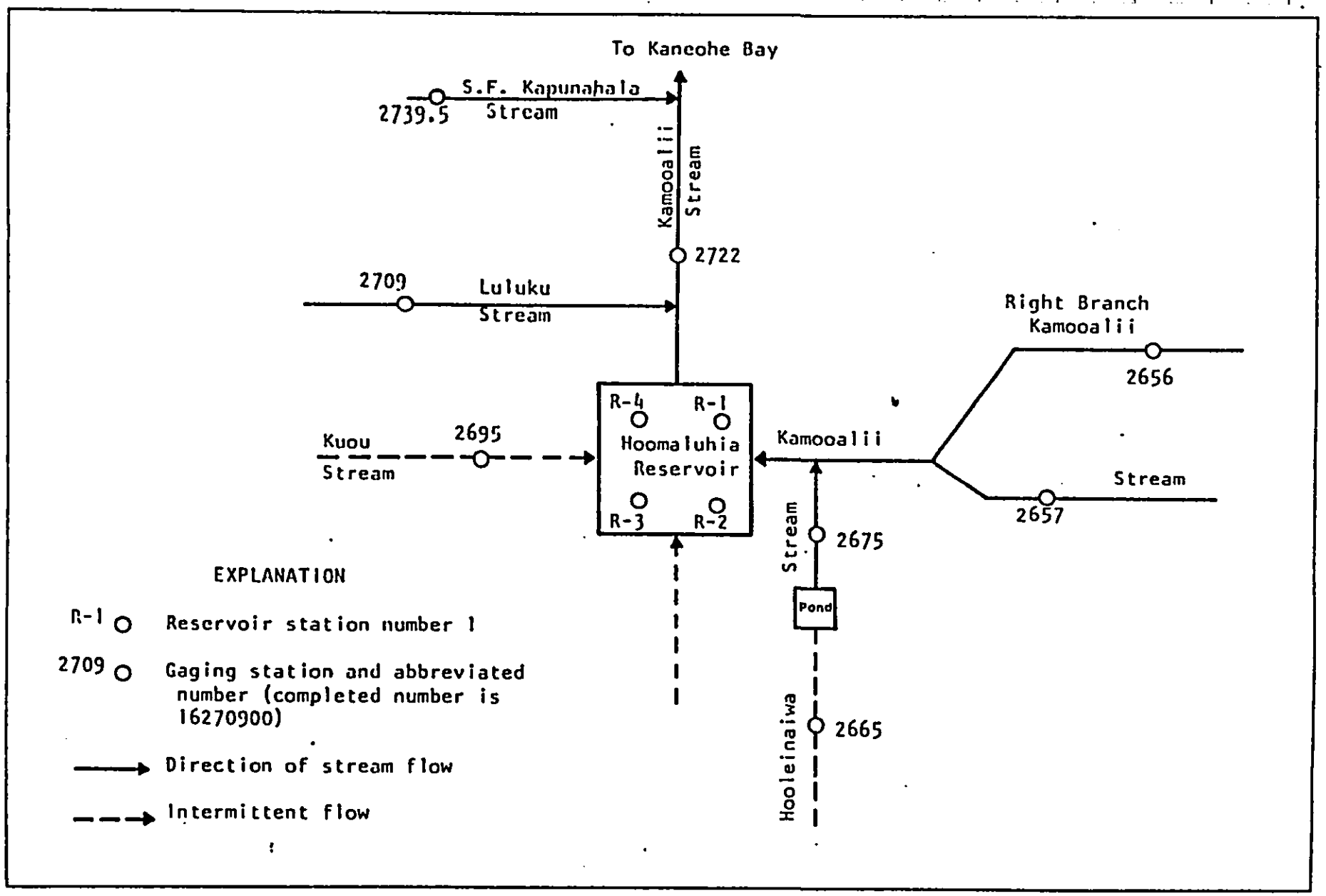

Figure 15.--Schematic diagram showing water-quality stations in Kamooalii Stream basin, Kaneohe, Oahu.

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Ms. Letitia N. Uyehara
Director
State of Hawaii
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Ms. Uyehara:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comment of November 19, 1986.

Regarding your concern on the housing development, no residential development is contemplated within the project site.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

GEORGE R. ARIYOSHI
GOVERNOR

LETITIA N. UYEHARA
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

November 19, 1986

Mr. Dean Uchida
Department of Land and
Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Subject: Draft Environmental Impact Statement for Golf Course with Accessory Uses on Iolani School Property

Golf courses and residential housing are usually developed in tandum. If residential development is being contemplated, it should be disclosed at this early date as impacts of residences near golf courses may be significant.

Sincerely,

Letitia N. Uyehara
Director

cc: DHM Inc.

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 22, 1986

Mr. Kamaki A. Kanahele III
Administrator
Office of Hawaiian Affairs
State of Hawaii
567 S. King Street, Suite 100
Honolulu, Hawaii 96813

Dear Mr. Kanahele:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 10, 1986.

In addition to the archaeological study already conducted, an appropriate significance evaluation study will be conducted during the detail planning phase with topographic survey map. The study will be conducted in coordination with the State Historic Preservation office.

A copy of the archaeological survey report is enclosed for your use and review. Copies of future studies will be forwarded to you as soon as they are completed.

Thank you again for your concern. We are in full agreement with your appreciation of the valuable archaeological resources in the area.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

Enclosure

SC

633

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STATE OF HAWAII

DIVISION OF
STATE PARKS
DEC 16 11 01 AM '86

TO:
____ ADMIN.
____ [illegible] ADMIN.
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FI
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____ INFO
____ SEE ME
____ SIGNATURE

STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
567 SOUTH KING STREET, SUITE 100
HONOLULU, HAWAII 96813
(808) 548-6960

December 10, 1986

Mr. Susumu Ono, Chairperson
Board of Land and Natural Resources
P.O. Box 621
Honolulu, HI. 96809

Dear Mr. Ono:

Thank you for your letter of November 13, 1986, and for the opportunity to comment on the Draft EIS of the proposed Golf Course on Iolani School Property, Kane'ohe, O'ahu (November 1986).

Please request the applicant to send two copies of the archaeological survey report to our office for our use and review (in original format without reduction).

The archaeological resources known to be present in the project area have research potential in the following areas: 1) comparative studies of site types and settlement patterns in traditional Hawai'i; 2) the chronology of human settlement and cultural evolution on O'ahu; 3) comparative studies of soil deposits and Hawaiian land use patterns; 4) environmental change and cultural adaptation in Hawai'i. We recommend that archaeological research be conducted in the project area that addresses these research questions and others that may develop during the course of fieldwork at the site.

We recommend that the State Historic Preservation Office be contacted whenever previously unknown archaeological sites, including human skeletal remains, are discovered during construction, and that this provision be included in all project work plans and job specifications.

We also recommend that ten copies of the final archaeological report for the project be sent to our office for our use and review.

Thank you again for the opportunity to comment on this project.

Sincerely,

Kamaki A. Kanahele III
Administrator

EN:

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 22, 1986

Mr. Leslie S. Matsubara
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Matsubara:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 11, 1986.
The final EIS states that pertinent State regulations and ordinances pertaining to noise will be complied with.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

CEA

699

John Waihee
GOVERNOR OF HAWAII

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STATE OF HAWAII
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OEQC

LESLIE S. MATSUBARA
DIRECTOR OF HEALTH

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

STATE OF HAWAII
DEPT. OF LAND & NATURAL RESOURCES
OCEA

In reply, please refer to:
EPHSD

December 11, 1986

MEMORANDUM

To: The Honorable Susumu Ono, Chairperson
Board of Land and Natural Resources

From: Director of Health

Subject: Review of Draft Environmental Impact Statement for Conservation District Use Application No. OA-1947 for Golf Course with Accessory Uses, Koolaupoko, Oahu, Hawaii

Thank you for the opportunity to review the subject document.

While the Draft EIS had indicated an increase in noise levels during the construction phase of the project, mitigative measures or provisions for compliance with regulations were not included. These concerns must be addressed in the final EIS.

LESLIE S. MATSUBARA

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Mr. Susumu Ono, Chairperson
Board of Land and Natural Resources
State of Hawaii
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 8, 1986.

First of all, we would like to inform you that in response to comments received during the public review period and concerns expressed at the CDUA hearing, we have reexamined the former Knowles residence. Although the precise clubhouse site has to be determined during the re-design of the golf course after the CDUA is approved, it has been decided that the general area of the former Knowles residence will be the clubhouse location. All discussions related to the original clubhouse location, however, have been retained in the final EIS.

Water Resources

The groundwater use permit will be deleted from the list.

Protection of Stream Uses

The final report will include the reduction of well pumpage and/or the release of pumped water into the stream as mitigation measures during dry periods, if it is determined that streamflow is being reduced due to well pumpage for golf course irrigation.

Drainage facilities will be designed so that the alteration of stream channels and banks will be kept to a minimum.

Grading restrictions, erosion control measures and the use of fertilizers and pesticides will be included in the construction contract documents.

Erosion and Sediment Control

The size of the retention/settling basins would depend on the size of the individual contributing drainage areas, the extent of grading, and the terrain. When the golf course design is developed and more accurate topographic maps become available, these variables will be evaluated to determine the correct size of the basins.

Historic Section Concerns

We have revised the Archaeological Sites Section of Ch. V. Anticipated Impacts and Mitigative Measures to reflect your recommendations.

At the same time, we have added Historic Site Section's Approval to the List of Necessary Construction-Related Approvals. This is to assure you that the approval will be obtained in the event any of the archaeological sites are included in the golf course design.

Clubhouse Site Selection

Discussions of alternative sites for the clubhouse and ancillary facilities, such as golf driving range and access parking are added in Ch. XI Alternatives to Proposed Action.

The primary reason for examining alternative sites was visual and noise concerns of Hoomaluhia Park users, particularly campers. Due to the time constraint, alternative golf course designs were not developed based on the additional three (3) alternative sites which were selected to minimize the potential visual and noise impacts. However, it has been decided that the general area of the former Knowles' residence (Alternative Clubhouse Site 3) will be the clubhouse location.

Noise and Wind

Predicted maximum noise level at approximately 900 ft distance from the clubhouse (at the Hoomaluhia Park) was 38 dBA. This was based on relatively high outdoor noise levels of 64 dBA outside the proposed clubhouse from outdoor air conditioning equipment and/or band music. By proper siting and treatment of noisy outdoor mechanical equipment, plus the enclosure and air conditioning of the proposed facility, noise levels less than 38 dBA at the park seem to be achievable. For these reasons, risks of adverse noise impacts from the clubhouse activities at the Hoomaluhia Park are believed to be minimal.

The greatest noise impact to Hoomaluhia Park would be when the air is still. Wind in any direction would tend to disperse the sounds originating at the clubhouse.

Visual

Discussions on the visual impacts of other alternative sites are added in the final EIS.

Discussion on the potential impact on night time activities in the park caused by night light at the golf facility is also included in the final EIS.

Recreation

As indicated in Exhibit IV-15 of the EIS, Likeke Trail is located approximately 1,500-2,000 feet directly mauka from the mauka boundary of the proposed golf course. Therefore, Likeke Trail will not be impacted by the project.

According to Mr. Richard Davis who is a member of the Hawaii Mountain and Trail Club, he cleared and built the trail during 1959-1961. The trail is open to the public and is cleared periodically by Mr. Davis. At this time, the applicant does not have any plan to alter the present practice. However, the applicant will assess the overall land management practice once the landownership is transferred.

In regard to any type of "general public" use of the golf course facilities, the applicant has not altered the original plan to limit the use of the golf course to members and their guests.

Economic Impact

The applicant is confident that the type of golf course proposed is in high demand on Oahu and will be economically and financially successful. The construction cost of $30 million plus land purchase cost will not be lightly invested unless the applicant is assured of a means for successful management of the project.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

JOHN WAIHEE
GOVERNOR OF HAWAII

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

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES
EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

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

DEC 08 1986

FILE NO.: OA-8/13/86-1947
DOC. NO.: 2090B

Mr. Robin Oura, Project Manager
LANDPRO
800 South Beretania St., 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Oura:

SUBJECT: Draft Environmental Impact Statement on Conservation District Use Application No. OA-1947 for a Golf Course and Accessory Uses at Koolaupoko, Oahu, Hawaii

We have completed our review of the subject document and offer the following general comments:

Water Resources

On page 97, we note a list of approvals which includes stream channel alteration, well drilling and ground water use permits. Ground water use permits are required only for withdrawal of water from designated Ground Water Control Areas (GWCA). The project site is not located in a designated GWCA. However, should the applicant choose to drill a new well or utilize an existing BWS well, a well drilling or well modification permit will still be required.

Protection of Stream Uses

Potential reduction of stream flow resulting from development of new wells or utilization of existing wells is a primary concern. We note the applicant's intention to work closely with the Board of Water Supply and Department of Land and Natural Resources to monitor and control any effects on the base flow of streams in the project area. We fully support the intention to monitor stream flow as noted on page 74; however, we would like to suggest that mitigiation of streamflow reduction also be addressed. Mitigation considered in other cases has included a reduction in well pumpage or replenishment of flow by a release of pumped water into the stream.

In our earlier comments, we noted that a stream channel alteration permit will be required for all work within Kamooalii and Hoolenaiwa Streams and their tributaries. We recommend that all culverts, bridges, and other channel alterations be designed such that stream banks and, in particular, the stream bed are retained in their natural state.

From aquatic resource standpoint, we have no objection to the Draft EIS. Planned limited grading, mitigating measures to prevent excessive erosion and runoff, and use of approved fertilizers and pesticides, including scheduling of grading activities during the dryer months of the year should be complied with in implementing the proposal.

Erosion and Sediment Control

The draft EIS acknowledges that soil erosion (during the development period) and run-off of pesticides into the wildlife refuge of Hoomaluhia Park could occur and also mentions mitigating measures such as settling basins to reduce the risk. However, it does not state the retention capabilities of these settling basins. Therefore, because of the potential hazard to the environment, the retention capabilities of these settling basins should be made a part of the EIS.

Historic Sites Section Concerns

The Draft EIS briefly summarizes the findings of the archaeological report (Shun, Price-Beggerly & Athens 1986) which is Appendix D. Much of the land has clearly undergone extensive alteration, making the presence of significant historic sites unlikely in such areas. The archaeological survey in less disturbed areas found only 4 sites and 4 possible sites. The Draft EIS suggests that the 4 sites seem to be significant solely for their information content, but it also states, as does the archaeological report, that more information needs to be gathered to accurately evaluate the significance of the sites and to check the 4 possible site areas. We agreed with these conclusions in a November 12, 1986 review of the report, sent to DHM, Inc. We recommended that this additional information be gathered before the Final EIS, so the presence/absence of significant historic sites could be clearly established and so any needed mitigation plan could be finalized.

DHM, Inc. then consulted with our office. Their schedule would not allow this further work before the Final EIS. As an alternative, it was decided that they would design around these sites and possible sites, leaving them in a "no build" area. This would result in "no effect" to these sites and makes final significance assessments unnecessary at this point. A letter is on the way from DHM to our office documenting this decision.

Thus, their mitigation plan is altered to avoidance of these sites and monitoring of some areas that might contain remnants of subsurface deposits (Item 4, p. 75). This is acceptable.

Conditions to the CDUA, if approved, should be attached as follows:

1. Avoid the 4 sites and 4 possible sites. If the applicant should wish to consider using these areas in the future, further archaeological work must take place to evaluate site significance and acceptable mitigation plans must be prepared and executed, with these steps to be reviewed and approved by the Historic Sites Section.

2. During initial land clearing and bulldozing for golf course construction, a professional archaeological monitor will be present on an intermittent basis to observe the subsurface conditions in areas, specified in the report (App. D, p. 40, Item 4), which might contain some subsurface archaeological remains. A report documenting the findings shall be submitted to the Historic Sites Section.

In addition, we would also like to provide you with the following specific comments:

Clubhouse Site Selection

On pages 104 and 105 of the document you discuss alternative design decisions. One of the alternatives discussed the location of the clubhouse facility. However, the document fails to disclose any of the alternative sites considered for the proposed clubhouse facility. These alternative sites should be discussed in the EIS.

Noise and Wind

The document indicates that existing noise levels within Hoomaluhia Park range from 40-45 leq (pg. 58). The document also states that the clubhouse will be enclosed and air conditioned to minimize risk of adverse noise impacts from the clubhouse activities.

The document does not discuss the expected noise level generated from the clubhouse facility (both day and night noise levels) and its effects on existing noise levels in Hoomaluhia Park.

Furthermore, would a change in the wind patterns (i.e. change in direction either during day or night) affect the existing noise level at Hoomaluhia Park?

Visual

The document discusses the visual impact of the proposed clubhouse from various sites; however, there is no discussion of the visual impacts for other alternative sites. A comparison of other alternative clubhouse sites should be included in the EIS. This comparison should also include a visual comparison of each alternative site from various points around the project area (i.e. Pali Lookout, Hoomaluhia Park, Likelike Highway, etc.).

Furthermore, the document should discuss the potential impact on nighttime activities in the park (i.e. stargazing) caused by night lights at the facility (i.e. access roads, clubhouse, parking lot, and driving range).

Recreation

The document mentions that Likelike trail will not be impacted by the project. Does the applicant/landowner have any future plan to maintain, upgrade and/or reconstruct the trail? Are there any plans to impede or prohibit public use of the trail?

We realize that the prposed golf course occurs entirely on privately-owned land, and that the use of the golf course will be for members of the facility; however, given the increasing popularity of the sport of golf on Oahu, as was alluded to in the document, has the applicant/landowner considered any type of "general public" (non-members) use of the facilities?

Economic Impact

The section of the document which discusses the economic impact of the proposed project only predicts the future short-term, long-term economic impacts resulting from the construction of the project. There is no economic analysis of the potential success of this type of facility. Is there a demand for this type of golf course on Oahu? What type of membership is the club attempting to attract? Essentially, is there a market for this project?

We appreciate this opportunity to comment. Should you have any further questions regarding this matter, please feel free to contact Dean Uchida of our Office of Conservation and Environmental Affairs at 548-7837.

Very truly yours,

SUSUMU ONO, Chairperson
Board of Land and Natural Resources

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 1, 1986

Mr. Ralston H. Nagata
State Parks Administrator
Division of State Parks
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Nagata:

Subject: CDUA and EIS
Golf Course on Iolani School Property

Thank you for meeting with us on November 24, 1986 to discuss the archaeological concerns expressed in your letter dated November 12, 1986.

As we discussed, the four historic sites and four possible site areas will be avoided by the design and construction of the proposed project. If there should be any desire or need in the future to utilize these areas, each site and/or potential site would be evaluated to determine its significance, and significant assessments would be submitted to your office for review. Further, we would consult with your office on possible mitigation plans appropriate for any of the sites - avoidance, preservation, archaeological data recovery, etc.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

WM:lt

Attachment

cc: J. Stephen Athens

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

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

December 5, 1986

Mrs. Duk Hee Murabayashi, President
DHM, Inc.
1188 Bishop Street, Suite 2405
Honolulu, Hawaii 96813

Dear Mrs. Murabayashi:

SUBJECT: CDUA OA-1947 and EIS -- Golf Course on Iolani School Property (Nitto Kogyo)
Kaneohe, Koolaupoko, Oahu
TMK: 4-5-42: 1, 6

Thank you for your letter of December 1, 1986. Your recommendations for treatment of the 4 historic sites and 4 possible sites are fine. As we discussed in our meeting, the project will now have "no effect" on these sites.

We just completed our review of the Draft EIS for this project, and we included this agreed upon treatment (see attachment).

If you have any further questions, please feel free to call our Historic Sites Section at 548-7460. Thank you for consulting with our office on this matter.

Sincerely yours,

RALSTON H. NAGATA
State Parks Administrator

Attachment

December 5, 1986

MEMORANDUM

TO: Roger Evans, OCEA

FROM: Ralston H. Nagata, State Parks Administrator

SUBJECT: CDUA OA-1947 -- Nitto Kogyo Golf Course
Kaneohe, Koolaupoko, Oahu
TMK: 4-5-42: 1, 6

HISTORIC SITES SECTION CONCERNS:

The Draft EIS briefly summarizes the findings of the archaeological report (Shun, Price-Beggerly & Athens 1986) which is Appendix D. Much of the land has clearly undergone extensive alteration, making the presence of significant historic sites unlikely in such areas. The archaeological survey in less disturbed areas found only 4 sites and 4 possible sites. The Draft EIS suggests that the 4 sites seem to be significant solely for their information content, but it also states, as does the archaeological report, that more information needs to be gathered to accurately evaluate the significance of the sites and to check the 4 possible site areas. We agreed with these conclusions in a November 12, 1986 review of the report, sent to DHM, Inc. We recommended that this additional information be gathered before the Final EIS, so the presence/absence of significant historic sites could be clearly established and so any needed mitigation plan could be finalized.

DHM, Inc. then consulted with our office. Their schedule would not allow this further work before the Final EIS. As an alternative, it was decided that they would design around these sites and possible sites, leaving them in a "no build" area. This would result in "no effect" to these sites and makes final significance assessments unnecessary at this point. A letter is on the way from DHM to our office documenting this decision.

Thus, their mitigation plan is altered to avoidance of these sites and monitoring of some areas that might contain remnants of subsurface deposits (Item 4, p. 75). This is acceptable. Conditions to the CDUA, if approved, should be attached as follows:

1. Avoid the 4 sites and 4 possible sites. If the applicant should wish to consider using these areas in the future, further archaeological work must take place to evaluate site significance and acceptable mitigation plans must be prepared and executed, with these steps to be reviewed and approved by the Historic Sites Section.

2. During initial land clearing and bulldozing for golf course construction, a professional archaeological monitor will be present on an intermittent basis to observe the subsurface conditions in areas, specified in the report (App. D, p. 40, Item 4), which might contain some subsurface archaeological remains. A report documenting the findings shall be submitted to the Historic Sites Section.

RECREATION CONCERNS:

The recreation concerns identified in the EIS Preparation Notice were addressed in this Draft EIS.

We share the concerned regarding the visual impact on Hoomaluhia Park as expressed by the City and County of Honolulu.

/s/ RICHARD KANAYAMA

for RALSTON H. NAGATA

cc: DHM, Inc.

RC/BG:gn 12/3/86

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Mr. Murray E. Towill
Deputy Director
Department of Planning and
Economic Development
State of Hawaii
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Towill:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 8, 1986.

We have revised the draft to indicate the passage of the State Functional Plans by the State Legislature in 1984 and 1985.

With reference to the Priority Guidelines of the Hawaii State Plan, we have included in Chapter VI (Relationship of Proposed Action to Land Use Plans, Policies and Controls for the Affected Area) of the final EIS discussions on the following guidelines:

1. Section 226-103(b) HRS: Priority guidelines to promote the economic health and quality of the visitor industry.

2. Section 226-104(b) HRS: Priority guidelines for regional growth distribution and land resource utilization.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT
KAMAMALU BUILDING, 250 SOUTH KING ST, HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359, HONOLULU, HAWAII 96804 • TELEX: 7430250 HIDPED

John Waihee
GOVERNOR

DIRECTOR
MURRAY E. TOWILL
Acting DIRECTOR

DEPUTY DIRECTOR

DIVISIONS
BUSINESS AND INDUSTRY DEVELOPMENT DIVISION
ENERGY DIVISION
335 Merchant St., Room 110 Honolulu Hawaii 96813
FOREIGN-TRADE ZONE DIVISION
Pier 2 Honolulu, Hawaii 96813
LAND USE DIVISION
PLANNING DIVISION
RESEARCH AND ECONOMIC ANALYSIS DIVISION

OFFICES
ADMINISTRATIVE SERVICES OFFICE
INFORMATION OFFICE

Ref. No. P-5550

December 8, 1986

MEMORANDUM

TO: The Honorable Susumu Ono, Chairperson
Department of Land and Natural Resources

ATTN: Mr. Dean Uchida
Office of Conservation and Environmental Affairs

FROM: Murray E. Towill *Murray E. Towill*

SUBJECT: DEIS for CDUA for Golf Course on Iolani School Property, Kaneohe, Oahu

We have reviewed the subject draft environmental impact statement (DEIS) and have the following comments to offer.

A statement on Page 93 of the DEIS that the State Functional Plans were not adopted by the State Legislature should be corrected. The State Legislature adopted ten State Functional Plans on April 19, 1984, by House Concurrent Resolution No. 26, as amended, and the Education and Agriculture Functional Plans on April 19, 1985, by House Concurrent Resolution No. 38, as amended. Also, amendments to the Overall Theme, Goals, Objectives, Policies and Priority Guidelines of the Hawaii State Plan, Chapter 226, HRS, were signed into law as Act 276 on May 29, 1986.

The EIS should examine the following Priority Guidelines: Economic (Section 226-103(b), HRS) and Regional Growth Distribution and Land Resource Utilization (Section 226-104(b), HRS). These sections were identified in our comments dated October 23, 1986, on the EIS preparation notice.

Thank you for the opportunity to comment on the subject document.

cc: ✓Mrs. Duk Hee Murabayashi
President, DHM Inc.

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Ms. Jacquelin N. Miller
Acting Associate Director
University of Hawaii at Manoa
Environmental Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Ms. Miller:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 8, 1986.

Irrigation

The annual average irrigation rate of 250,000 gallons per day (gpd) was based on information provided by the Pali Golf Course maintenance staff. Since the proposed golf course is adjacent to the Pali Golf Course, the 250,000 gpd is considered to be a dependable projection for the annual average irrigation demand. Information on Pali Golf Course's maximum demand during dry periods was not available, therefore, an irrigation parameter of 1-1/2 inches per week was assumed. The weekly demand for 60 acres would amount to about 2,450,000 gpd. If the golf course is irrigated 7 days per week, the application rate would be 350,000 gpd; for 5 days per week, the daily rate would be about 500,000 gpd. Consequently, the maximum demand range during dry periods would be between 350,000 - 500,000 gpd, depending on the irrigation cycle.

The irrigation requirements around the clubhouse and the maintenance needs of the swimming pool would not significantly affect the maximum daily irrigation demand which, at this time, is an approximate design criteria based on preliminary conceptual design.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

DHM:lt

University of Hawaii at Manoa

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

December 8, 1986
RE: 0451

Mr. Dean Uchida
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Draft Environmental Impact Statement
(Conservation District Use Application)
Golf Course With Accessory Uses on Iolani School Property
Kaneohe, Oahu

The above cited document addresses the environmental impacts relative to the constuction of a new golf course in Kaneohe, Hawaii. This review was prepared with the assistance of Paul Ekern, Soils and Agronomy; Peter Flaschbart, Urban and Regional Planning; Sheila Conant, General Science; Matthew Spriggs, Anthropology; and Michael Tokushige, Environmental Center.

Irrigation

Slight discrepancies between pages 17 and E-1 are noted for the estimates of irrigation water needs. On page 17 it is stated that, "the landscape irrigation demand is expected to average about 250,000 gpd during the year with increased demand of around 500,000 gpd during dry periods." Does this mean that the total demand during dry periods would be 750,000 gpd (ie. 250,000 + 500,000), or that the demand would increase to 500,000 gpd during dry periods? In either case the estimate for dry periods is not consistent with John Minks estimate of 350,000 gpd (Appendix E-1). Since the discussion of the irrigation needs does not include the methods used to estimate the water demands, it is not possible for us to evaluate the accuracy of the figures provided. For example, does the landscape irrigation include the total golf course area of 90 acres, including the rough? If the rough is omitted then 60 acres would be involved. According to the HSPA records for Maunawili, the evaporation rate is .15"/day in August and .11"/day in January. The Maunawili ranch records are similar with .14"/day in August and .11"/day in February. If

we assume the previous parameters and the value of 27,000 gal/A" which is the amount of water required to wet an acre to the depth of 1 inch, we can make the following calculations:

Winter dry period:

90 acres x .11"/day x 27,000 gal/A" = 267,000 gpd
60 acres x .11"/day x 27,000 gal/A" = 178,000 gpd

Summer dry periods:

90 acres x .15"/day x 27,000 gal/A" = 365,000 gpd
60 acres x .15"/day x 27,000 gal/A" = 243,000 gpd

As you can see these estimates of irrigation water required are quite different from those given in the DEIS. In addition there is no mention of intervals between irrigation, the water requirements needed to irrigate the landscape around the clubhouse, or the maintance needs of the swimming pool. Clarification as to the correct water use estimates and the basis for these estimates should be included in the final environmental impact statement.

Other Comments

- Other than the discrepancies and inconsistencies on the issue of irrigation and water use, we find this document to be well prepared and we appreciate the opportunity to offer comments.

Yours truly,

Jacquelin N. Miller
Acting Associate Director

cc: DHM Inc.
Patrick Takahashi
Stephen Lau
Paul Ekern
Peter Flascbart
Sheila Conant
Matthew Spriggs
Michael Tokushige

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Mr. Edwin T. Murabayashi
EIS Coordinator
University of Hawaii at Manoa
Water Resources Research Center
Holmes Hall 283
2540 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Murabayashi:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 5, 1986.

The water requirements for the proposed golf course have been coordinated with the Board of Water Supply (BWS). The alternative water system schemes were developed based on our discussions with the BWS staff.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

University of Hawaii at Manoa

Water Resources Research Center
Holmes Hall 283 • 2540 Dole Street
Honolulu, Hawaii 96822

5 December 1986

Mr. Dean Uchida
Department of Land & Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, HI 96813

Dear Mr. Uchida:

Subject: Draft Environmental Impact Statement for Golf Course on Iolani School Property, Kaneohe, Oahu

We have reviewed the subject document and offer the following comment. Allocation of water from the existing wells and proposed new wells should be confirmed with BWS to be sure sufficient quantities are available for the project. Well capacity and allocation quantities are two different things.

Thank you for the opportunity to comment. This material was reviewed by WRRC personnel.

Sincerely,

Henry K. Lee for ETM

Edwin T. Murabayashi
EIS Coordinator

ETM:jm

cc: DHM, Inc.

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 19, 1986

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

Dear Mr. Hayashida:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your letter of December 5, 1986. The following comments are in response to your concerns.

1. The alternative schemes are all considered to be feasible, however, the final determination of the scheme to be implemented will be based on several factors including BWS' water service requirements. Any scheme that is selected by the developer will be closely coordinated with BWS during the preliminary design phase.

2. We acknowledge that any water facility to be dedicated to BWS must be designed according to your Water System Standards and must be approved by BWS.

   Fire flow will be provided by the irrigation system, which will have a reservoir to satisfy the storage requirements. If the system will be a combined potable/fire protection/ irrigation water system, a reservoir will be included to provide adequate storage to satisfy fire flow requirements.

3. Before irrigation system Scheme 1 is selected by the developer, the improvements necessary for this alternative will be coordinated with BWS. If irrigation system Scheme 2 is selected and dedicated to BWS, the facility will be designed according to your Water System Standards and the plans will be submitted to BWS for approval.

4. The report will be corrected as recommended.

5. We agree that discharge of ground water into the ocean may also occur by coastal springs. The report will be revised to include that statement.

6. The statement that new well fields in the Kamooalii Watershed will provide ample water for existing and future demands will be revised to state that the development of wells in this area is one of the sources intended to provide water for future growth on Oahu.

Thank you very much for bringing your views to our attention.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:vl

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

December 5, 1986

Mr. Susumu Ono, Chairperson
Board of Land and Natural
Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Your Letter of November 13, 1986 on the Draft Environmental Impact Statement for Conservation District Use Application OA-1947, Golf Course With Accessory Uses at Koolaupoko

We appreciate the opportunity to comment on the environmental document for the proposed golf course project and have the following comments:

1. Page 15: Any plans to tap our transmission main on Kamehameha Highway as described in Scheme A may not meet our water service requirements. Should this scheme be pursued, the developer must coordinate his plans with us.

2. Page 17: Any source dedicated to the Board of Water Supply (BWS) as described in Scheme C must be built according to our Water System Standards.

   The minimum fire flow requirement without a contributing reservoir is 2260 gpm.

3. Page 20: Scheme 1 will require the BWS to evaluate the adequacy of offsite facilities such as source, storage and transmission main. The developer may be required to install a source interconnected to our system.

   Scheme II requires that any facility dedicated to the BWS must be constructed according to our Water System Standards.

4. Page 36: The last sentence on the section on Streams should be revised. The word "volcanoes" in the last sentence should be changed to "the volcano", since only the Koolau condition is being addressed.

5. Page 38: Discharge of ground water into the ocean may also occur by coastal springs.

6. Page 76: The statement that new well fields in the Kamooalii Watershed will provide ample water for existing and future demands is not valid and should be corrected. To date, the exploratory wells have not provided sufficient yields for us to consider developing them into production wells.

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

Very truly yours,

FOR KAZU HAYASHIDA
Manager and Chief Engineer

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 19, 1986

Mr. Tom Nekota
Director
Department of Parks & Recreation
City and County of Honolulu
650 S. King Street
Honolulu, Hawaii 96813

Dear Mr. Nekota:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 8, 1986.

In response to your comments and concerns, we have reexamined the Alternative Clubhouse Site 3, the former Knowles residence. Although a precise clubhouse site has to be determined during the golf course re-design after the CDUA is approved, the general area of the former Knowles residence will be the clubhouse location.

Use of pesticides and herbicides will meet the requirements of all applicable regulations. Discussions on the topic are included in the Draft EIS.

Regarding any further plans for the land area, there are no other plans at this point.

Again, thank you for taking the time to review and comment on the Draft EIS, CDUA and EA.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:vl

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

TOM T. NEKOTA
DIRECTOR

December 8, 1986

Mr. Susumu Ono, Chairperson
Board of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Draft Environmental Impact Statement (EIS) for Conservation District Use Application (CDUA) No. OA-1947 for a Golf Course with Accessory Uses at Koolaupoko, Oahu

We have reviewed the Draft EIS and CDUA and Environmental Assessment (EA). Our major concern, one to which we are strongly opposed, is the location of the proposed clubhouse with its large parking lot and long access road. We are further concerned with Water Quality/Drainage, Visual/Noise Impact and Water Supply (see EIS, p. 128 & 129). We feel these concerns have not been adequately addressed in either document.

EIS Exhibit IV-19, Sheet 1, Viewer Location and View Lines indicate Site 3 would be a far better choice than Site 1 for location of the proposed clubhouse. We would very much like to see a cost and site analysis comparison of these two areas with regard to road access, electricity, water, sewage, surface runoff, noise and visibility included in the EIS.

Environmentally, both short term and long term, Site 3 would be a far better choice. The problems for Ho'omaluhia with Site 1 are as follows:

1. The two streams on either side of Site 1 feed directly into the 1-1/2-acre Wildlife Pond which is not designed to handle either increased siltation or increased runoff. This area, a special feature of the U.S. Army Corps of Engineers' Wildlife Enhancement Program, would be rendered useless or would require extensive and ongoing maintenance, causing disruption to any wildlife present as a result of increase in siltation. Sediment in the Reservoir is a responsibility with which the City must deal by contract with the U.S. Army Corps of Engineers and the sediment-causer's responsibility for removal of same should be clarified. The "...higher runoff coefficients for golf course fairways and greens, roads, parking areas and other impervious surfaces..." will be a continual problem for the Wildlife Pond which is not designed to handle these fluctuations in water volume .

2. Rainfall data kept by Ho'omaluhia staff over the past five years indicate the area of highest rainfall to be in the two camp grounds directly below Site 1, due in all probability to the geologic configuration of Puu Lanihuli directly mauka. It seems somewhat imprudent to locate the clubhouse in the area of highest rainfall.

3. The clubhouse and its auxiliary activities would be highly visible as well as audible from both camp grounds directly below as well as the two camp grounds on either side and the mountain overlook area, which looks directly onto the proposed site. (It should be noted that the CDUA and Draft EIS "say nothing" about Kilonani Mauka.)

4. Traffic resulting from employees, golfers and participants in late night activities (p. 77 of Draft EIS) will have a steady impact on Ho'omaluhia users. Lighting at the driving range (p. 24 of Draft EIS) indicates intended evening use (also visible and audible). Lights for the long access road are to be shielded from Ho'omaluhia, which means they would be more visible from the Pali (p. 91 of Draft EIS). "Approximately 40% of the project's membership is expected to be foreign or out-of-state, and 60% local..." (p. 89) and "...the fully developed golf course will generate an average daily traffic of 120 vehicles on weekdays and 150 vehicles on weekends for golfers, 60-80 vehicles for employees and 150 additional vehicles during banquet functions..."(p. 81) (tournaments are another problem!). While these quotations are from sections on Traffic and Air Quality, the effect would be more on visibility and audibility of these constant disturbances in that part of Ho'omaluhia which offer the best "wilderness" camping environment. The clubhouse at Site 1 would continually be very visible and very audible for Ho'omaluhia users.

5. Archaeological sites A-D are near sites in Ho'omaluhia of a similar nature. Recent findings in connection with the Luluku Terraces indicate use of this whole area by the Hawaiians may have been far greater than was previously suspected. Siting the clubhouse in this "probable" sensitive area should be avoided.

6. Indications are waste water disposal would be through the sewer system at Ho'omaluhia, a plan which would leave the responsibility of any created problems within Ho'omaluhia with the City and County of Honolulu.

Relative to possible impacts on Ho'omaluhia Park, Site 3 would be preferable for the following reasons:

1. Runoff from the clubhouse site would enter streams which flow directly into the Reservoir which is designed to handle runoff and siltation and not into the Wildlife Pond.

2. Traffic noise at Ho'omaluhia would be minimal to non-existent.

3. Lighting would have minimal effect at Ho'omaluhia.

4. Noise at Ho'omaluhia would be minimal and limited primarily to daylight hours. The passing foursome would be similar to noise generated by hikers.

5. Greens, tees, bunkers and fairways would offer far better water retention than paved parking lots and roads above the Wildlife Pond.

6. The possible archaeological sites could be subject to far less disturbance and might be investigated and enhanced for study.

7. Indications are the rainfall would be less at Site 3 so use of the clubhouse facilities would be more pleasant.

Tesitmony at the CDUA hearing revealed the "former Knowles site" was not seriously considered because of its proximity to the Pali Lookout and the HECO *owerline easements*. However, creative siting and landscaping could mitigate these objections far easier than establishing a constant nuisance for a sensitive, already-established downstream environment.

Pesticides and herbicides are both subject to State regulations. Use of these agents and impacts on adjacent properties should be discussed.

It is our understanding that Nitto Kogyo Company, Ltd. will acquire from Iolani School approximately 1,388 acres of which only 225+ acres will be required for the golf course and appurtenances. Are there any further plans to develop the remaining 1,100+ acres? If yes, this should be discussed in the EIS.

Thank you for the opportunity to comment on the Draft EIS, CDUA and EA.

Sincerely,

Tom Nekota

TOM T. NEKOTA, Director

TTN:ei

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Mr. John P. Whalen
Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Whalen:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 4, 1986.

As indicated in Exhibit IV-15 of the (Draft) EIS, Likeke Trail is located approximately 1,500-2,000 feet directly mauka of the mauka boundary of the proposed golf course. Therefore, Likeke Trail will not be directly impacted by the project. The trails shown crossing the project area are not part of Likeke Trail, but are sub-trails. This will be clarified in the final EIS.

According to Mr. Richard Davis, who is a member of the Hawaii Mountain and Trail Club, he cleared/built the trail during 1959-1961 and named it after himself (Likeke means "Richard" in Hawaiian). The trail is open to the public and is cleared periodically by Mr. Davis.

1. Access to the Likeke Trail from Kionaole Road will not be affected by the proposed golf course project, but will be impacted by the proposed temporary closure of Kionaole Road by the City Department of Public Works. (Resolution No. 86-280 introduced in the City Council of the City and County of Honolulu: see p. 54 of the draft EIS).

   Access to Likeke Trail from Likelike Highway is gained by crossing the highway and climbing over a stonewall. This access is dangerous, however, it will not be affected by the proposed project.

   Access from Hoomaluhia Park to Likeke Trail is through two sub-trails (see Exhibit IV-15) which cross the project area and which may be retained. (See below).

2. The subtrails, not Likeke Trail, cross the project area. This will be clarified in the final EIS. The proposed golf course may be designed around these sub-trails.

3. If necessary, the sub-trails may be relocated to the edge of the golf course and then connected to Likeke Trail.

4. Safety and security concerns may dictate the relocation of the two sub-trails which lead to Likeke Trail. These concerns include hikers getting hit by flying golf balls or hikers wandering around the golf course.

Regarding the availability of the proposed golf course for public play, the applicant wishes to limit the use to members and their guests. The proposed private course will help to relieve some of the demand for golf courses on Oahu, though admittedly, not as much as a public course.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

DHM:lt

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

LU11/86-6544(BWM)

December 4, 1986

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Review of Draft Environmental Impact
Statement (DEIS) for Conservation District
Use Application (CDUA) No. OA-8/13/86-1947
"Golf Course on Iolani School Property"
Koolaupoko, Oahu; Tax Map Key 4-5-42: 1 and 6

The Department of Land Utilization (DLU) has reviewed the DEIS and has the following comments and questions:

We understand that Likeke Trail, a hiking trail commonly used by the public with access from Kionole Road, Likelike Highway, and Hoomaluhia Park may be relocated outside of the project area or may be accommodated with the design of the golf course.

1. How will access to the Likeke Trail from Kionole Road, Likelike Highway, and Hoomaluhia Park be affected?

2. How will the existing Likeke Trail, where it crosses the golf course, be incorporated into the design of the golf course?

3. If it is necessary to relocate the trail, where will it be relocated?

4. What safety and security concerns would dictate the relocation of the trail?

We understand that there is a great demand for public golf courses for the residents of Oahu. Currently, there are three regulation courses and one nine-hole course open to the public. While a desirable standard is one public golf course per 100,000 residents, there currently exists a ratio of one public golf course per 200,000+ residents. In view of the demand for public golf courses and Oahu's limited land area, consideration should be given to requiring that the proposed golf course be made available for public play as a condition to CDUA approval.

Thank you for the opportunity to comment. If you have any questions regarding our reponses, please call Bennett Mark of my staff at 527-5038.

Very truly yours,

JOHN P. WHALEN
Director of Land Utilization

JPW:sl
0567B

DHM inc.
land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 19, 1986

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:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 2, 1986.

As indicated in the draft EIS (p. 83), the Land Study Bureau rates the project area soils " fair to poor" for productivity. An agricultural consultant has been retained to study the feasibility of the potential agricultural productivity within the project area. A preliminary study indicates that approximately one-half of the proposed golf course area (the makai portion, with lower elevation) is not as suitable for banana farming as the adjacent Luluku farm area, which is not within the project site. This is due to the area's poor soil condition.

This unsuitability for banana farming is indicated by the Sakamoto family farm, located at the makai end of the project site and Kionaole Road. The Sakamotos switched from growing bananas to ornamental flowers, which require less productive soil conditions. The Sakamoto farm will not be displaced by the proposed golf course.

In addition, the agricultural consultant is working with the Luluku Banana Growers' Cooperative to study the feasibility of increasing banana productivity on their farm lands adjacent to the proposed golf course.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

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

KK/DGP 11/86-10041

December 2, 1986

Mr. Dean Uchida
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42: 1 and 6

We have reviewed the subject Draft Environmental Impact Statement (EIS) and find that the section discussing the project's impact on statewide agriculture addresses only current agricultural needs and not projected needs for agricultural land. Although the proposed golf course will not affect existing productive agricultural land, it will impact on land that could be available for future agricultural use.

The Draft EIS indicated that the soils on the project site were not suitable for pineapple cultivation, but did not discuss other possible crops. Since an adjacent area contains a banana farm, the feasibility of banana or other crop production on the site should be discussed as an alternative use of the site.

Thank you for the opportunity to offer our comments.

Sincerely,

Donald Clegg

DONALD A. CLEGG
Chief Planning Officer

cc: DHM, Inc.

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Dr. Brenner Munger, P.E.
Manager
Environmental Department
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840

Dear Dr. Munger:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of December 2, 1986.

1. The easement for the Koolau-Nuuanu 46 kv circuit will be included in the final EIS. The existing Halawa-Koolau-Pukele 138 kv, Koolau-Wailupe No. 2 46 kv, and Koolau-Kailua 46 kv circuits are outside of the project limits.

2. The contractor will be required to coordinate and comply with HECO's requirements.

3. The contractor will be required to comply with the State of Hawaii Occupational Safety and Health Law.

4. It is understood that any relocation of HECO's facilities will be done by HECO and paid for by the developer.

5. The contractor shall be liable for damages to HECO's facilities caused by him.

6. The contractor will report damages of HECO's facilities to the HECO Trouble Dispatch, as required.

7. HECO's 30' overhead clearance requirement will be complied with.

8. HECO's service roads and/or access trails will not be altered and/or disturbed without approval from HECO.

9. All work near HECO's facilities will be coordinated with HECO.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

ENV 2-1
NV/G

HEI

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

December 2, 1986

Mr. Dean Uchida
Department of Land & Natural Resources
State of Hawaii
1151 Punchbowl St., Room 131
Honolulu, Hawaii 96813,

Dear Mr. Uchida:

Subject: Draft Environmental Impact Statement (EIS) for Golf Course on Iolani School Property Kaneohe, Oahu

We have reviewed the above EIS and have the following comments regarding HECO transmission circuits and contractor construction:

1. The proposed golf course on Iolani School property is located in an area where there are existing HECO transmission, sub-transmission, and distribution circuits. The attached project location map (see Enclosure 1) indentifies the general routes of these circuits as follows:

   * The blue line indicates the existing Koolau-Nuuanu 46 kv circuit.

   * The red line indicates the existing Waiau-Koolau-Pukele 138 kv circuit, the Koolau-Wailupe #2 46 kv, (a future 138 kv circuit) and the Koolau-Kailua 46 kv circuits. These circuits are all supported on the same structures.

   * The brown line shows the existing Halawa-Koolau-Pukele 138 kv, Koolau-Wailupe #2 46 kv, and Koolau-Kailua 48 kv circuits.

2. The contractor is to exercise extreme caution when the excavation and construction of the golf course crosses or is in close proximity of our lines. The contractor must also maintain 13'-0" clearance for his equipment while working close to and/or under the overhead facilities.

3. The contractor is to comply with the directions of the State of Hawaii Occupational Safety and Health Law (DOSH).

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 of the HECO facilities relocation.

5. The contractor shall be liable for any damages to HECO's facilities.

6. The contractor shall report any damages of HECO's facilities to the HECO Trouble Dispatch at phone no. 548-7961.

7. A minimum of 30'-0" shall be maintained between HECO's overhead conductors and the final grade of the golf course.

8. Service roads and/or access trails leading to and from HECO's facilities may not be altered and/or disturbed.

9. When excavation is adjacent to or under existing HECO 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.

Sincerely,

Brenner Manger

JIM:gy

Enclosure

cc: ✓DHM, Inc.

HEI

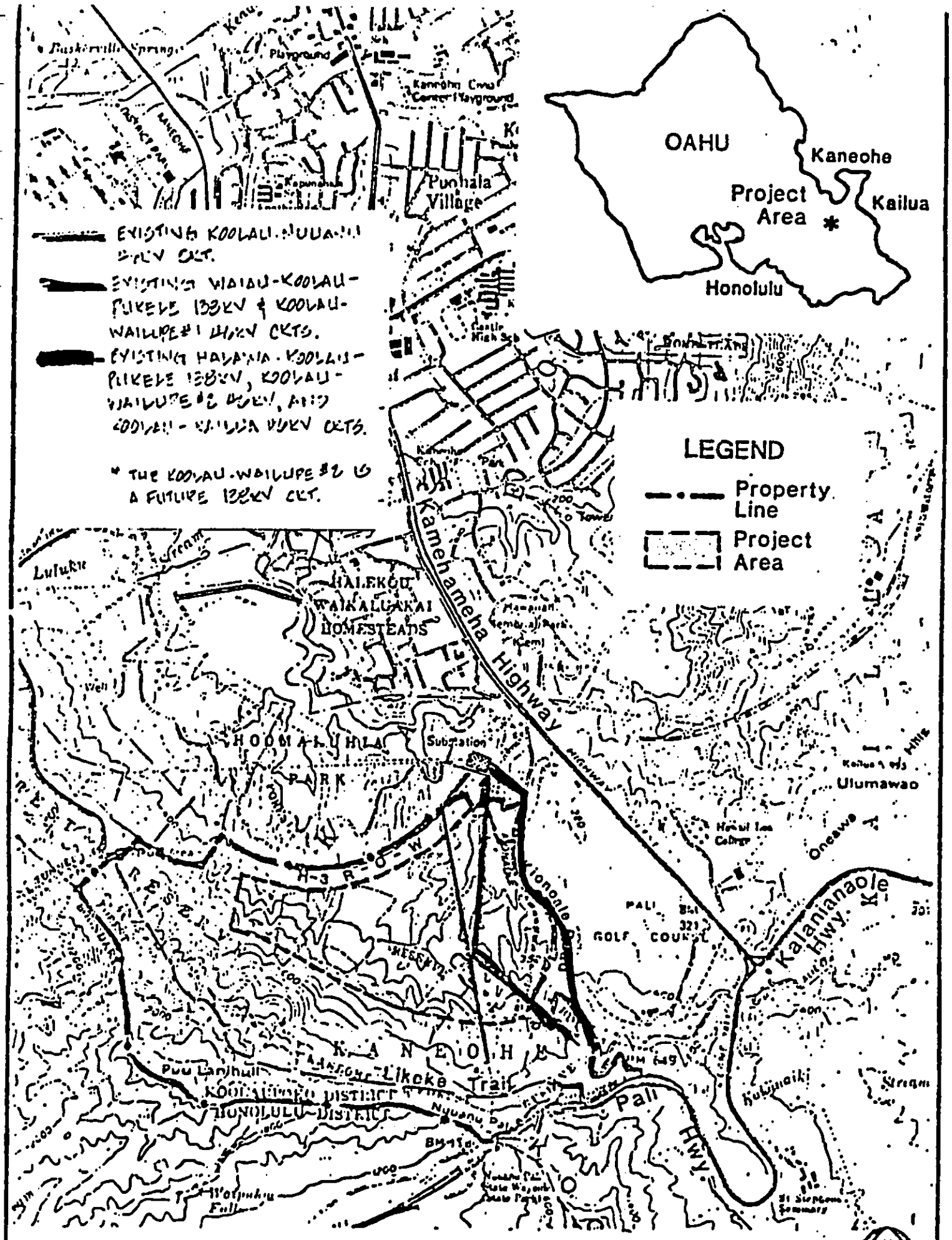

Exhibit III-1 Location Map

T-2000

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Ms. Susan Fristoe
President
Kaneohe Outdoor Circle
P. O. Box 32
Kaneohe, Oahu, HI 96744

Dear Ms. Fristoe:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of November 19, 1986.

There are currently 28 golf courses on Oahu and approximately 12 more are proposed or planned for the island. Of the 28 existing courses, 4 are owned and operated by the City and County of Honolulu and are open to the public. The remaining courses are either owned and operated by military or private entities. Some are restricted to members only, and guests are permitted with members.

Compatability of golf course accessory uses within the State Conservation District must be determined by the Board of Land and Natural Resources. This is the reason why the Conservation District Use Application (CDUA) is being processed.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

Kaneohe Outdoor Circle
"Forever Green"

P. O. BOX 32 • KANEOHE, OAHU 96744

NOV 19, 1986

Robin Ouza, Project Manager,

Subject: EIS Preparation Notice
PROPOSED Golf Course with Accessory Uses
T.M.K 4-5-42 Parcels 1 & 6
Koolaupoko District, Oahu, Hawaii

Enclosed please find statement to the Department of Land and Natural Resources from the Kaneohe Outdoor Circle.
This same statement applies to the EIS being prepared by your company. Thankyou for including Kaneohe Outdoor Circle input, & the chance to respond.

I am,
Yours Sincerely
Susan Tristao
President

Kaneohe Outdoor Circle
"Forever Green"

P. O. BOX 32 • KANEOHE, OAHU 96744

November 19, 1986

Susumu Ono, Chairman
and Members
Board of Land & Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

SUBJECT: Application for a golf course with accessory uses TMK 4-5-42:1/6 at Koolaupoko, Oahu, Hawaii - consisting of 233.075 and 471.465 acres, for a total of 704.54 acres of land designated "Conservation".

Dear Chairman and Members:

Kaneohe Outdoor Circle is greatly concerned about the proposed development of 704.54 acres of conservation land in Kaneohe being developed for a private golf course and accessory uses.

The designation of land in conservation status implies just that! Conservation.

Kaneohe Outdoor Circle feels that the development of a private sports facility, to be used only by members is alien to Hawaii's interests.

Conservation land belongs to the people of Hawaii. Golf courses per se; do retain our precious "open spaces", but to also include tennis, swimming and dining/banquet fecilities for private members only entails a lot of building and disturbing of natural resources presently retained in conservation status.

It is the strong recommendation of Kaneohe Outdoor Circle to deny LANDPRO, developer of the proposed Nitto Kogyo Golf Course project use of this conservation land.

Thank you for this opportunity to testify.

Sincerely,

Susan Fristoe

Susan Fristoe
President

SF:sp

RECEIVED AS FOLLOWS

Kaneohe Outdoor Circle
"Forever Green"

P. O. BOX 32 • KANEOHE, OAHU 96744

November 19, 1986

Susumu Ono, Chairman
and Members
Board of Land & Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

SUBJECT: Application for a golf course with accessory uses TMK 4-5-42:1/6 at Koolaupoko, Oahu, Hawaii - consisting of 233.075 and 471.465 acres, for a total of 704.54 acres of land designated "Conservation".

Dear Chairman and Members:

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It is the strong recommendation of Kaneohe Outdoor Circle to deny LANDPRO, developer of the proposed Nitto Kogyo Golf Course project use of this conservation land.

Thank you for this opportunity to testify.

Sincerely,

Susan Fristoe

Susan Fristoe
President

SF:sp

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 19, 1986

Mr. Fred Shiroma
President
Luluku Banana Growers' Cooperative
c/o P. O. Box 475
Kaneohe, Hawaii 96744

Dear Mr. Shiroma:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your letter of December 7, 1986. The following comments are in response to your concerns:

1. At this point, there is no plan to expand the golf course or housing or any other type of development adjacent to the proposed golf course.

2. We understand your concerns about the future of continued farming on lands adjacent to the proposed golf course. We are hopeful that the discussions between your cooperative and the agricultural consultant hired by Nitto Kogyo will result in a mutually agreeable resolution.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

LULUKU BANANA GROWERS' COOPERATIVE
c/o P.O. Box 475
Kaneohe, Hawaii 96744

December 7, 1986

Mr. Susumu Ono, Chair
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Ono:

This is in response to the Conservation District Use Application (CDUA) request from Nitto Kogyo Company, Limited for a golf course on Iolani School Property in the area near the existing Pali Golf Course.

The draft environmental impact statement did not address our two (2) major concerns as follows:

1. Are there any future plans for expanding of the golf course or housing or any other type of development adjacent to the proposed golf course that will affect the productive farm lands?

2. Will the Luluku farmers be allowed to remain on the land and under what kinds of conditions and terms will the farmers be allowed to continue farming?

The Nitto Kogyo Company, Limited has retained an agricultural consultant to work with the Luluku farmers to resolve our concerns of tenure on the land; but as of this date we have not received any firm assurances that there are no plans for additional development in the Luluku banana farm area nor any firm assurances that we can work out a long-term tenure agreement.

We will be continuing discussions with representatives of Nitto Kogyo Company, Limited, but until we can resolve our concerns to mutually agreeable terms, we will remain extremely insecure and concerned.

Thank you for the opportunity to comment.

Sincerely,

Fred Shiroma, President

✓cc: DHM inc.

DHM inc.

land use
and environmental
planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Mr. Gordon G. W. Lum
Executive Director
Oahu Metropolitan Planning Organization
1164 Bishop Street, Suite 1509
Honolulu, Hawaii 96813

Dear Mr. Lum:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your comments of November 26, 1986.

1. Improvements to Kionaole Road/Kamehameha Highway intersection, if implemented, would be the responsibility of the Developer.

2. The levels of service C and D for turning movements in and out of the Pali Golf Course, as stated in the report, represent current traffic conditions. Levels of service D and E for turning movements in and out of Kionaole Road are estimates of future conditions, which would probably also apply to the Pali Golf Course. These levels of service indicate future conditions for users of both golf courses during peak traffic periods, however, the relative impact of the proposed development on Kamehameha Highway through traffic is not expected to be significant.

Sincerely,

DHM inc.

Duk Hee Murabayashi (Mrs.)
President

DHM:lt

OMPO

Oahu
Metropolitan
Planning
Organization

Suite 1509
1164 Bishop Street
Honolulu, Hawaii 96813
(808) 523-4178
(808) 548-2638

November 26, 1986

Mr. Dean Uchida
Department of Land and Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Draft EIS - Golf Course on Iolani School Property

We have reviewed the above document and offer the following comments for your consideration:

1. Page 80, first paragraph, last sentence: "As a mitigating action, the Kionaole Road approach should be widened to provide two turning lanes."

   It is unclear whether the statement is proposing that the developer or the city will widen the roadway.

2. Page 80, second paragraph: "The forecast levels of service for the Kionaole Road intersection should be very similar to corresponding movements at the Pali Golf Course access road intersection. Both access roads are expected to have similar volumes, and traffic volumes on Kamehameha Highway should be similar at the two locations. For this reason, the relative impact of the proposed development should not be considered as adverse."

   The traffic impact analysis report indicated levels of service C and D for turning movements from the Pali Golf Course access road and levels of service D and E for turning movements from Kionaole Road. The above paragraph downplays the severity of left turns from Kionaole road and both turns from the same lane of Kionaole Road which will operate at level of service E which can be described as an adverse condition.

Thank you for the opportunity to comment on the draft EIS.

Sincerely,

Gordon G.W. Lum

Gordon G.W. Lum
Executive Director

Responses to letter from OMPO, dated November 26, 1986:

1. Improvements to Kionaole Road/Kamehameha Highway intersection, if implemented, would be the responsibility of the Developer.

2. The levels of service C and D for turning movements in and out of the Pali Golf Course, as stated in the report, represent current traffic conditions. Levels of service D and E for turning movements in and out of Kionaole Road are estimates of future conditions, which would probably also apply to the Pali Golf Course. These levels of service indicate future conditions for users of both golf courses during peak traffic periods, however, the relative impact of the proposed development on Kamehameha Highway through traffic is not expected to be significant.

DHM inc. land use and environmental planning

1188 Bishop Street
Suite 2405
Honolulu, HI 96813
Ph. (808) 521-9855

December 18, 1986

Ms. Lola Mench
Honolulu Group Conservation Committee
Sierra Club, Hawai'i Chapter
P.O. Box 11070
Honolulu, Hawaii 96828

Dear Ms. Mench:

RE: Draft Environmental Impact Statement
for a Golf Course with Accessory Uses
on Iolani School Property, Kaneohe, Oahu
Tax Map Key 4-5-42:1 & 6

Thank you for your December 6 letter. The majority of your concerns and questions regarding environmental impacts of the proposed golf course have already been covered in the draft EIS. The following information is provided to clarify some of your concerns.

- Regarding the possible "later requests for Inn or Hotel accommodations," there is no plan for such facilities.

Regarding the clubhouse site, three alternative sites have been studied (see attached map). This study is in response to the comments received during the public review period and concerns raised at the November 20, 1986 Conservation District Use Application (CDUA) public hearing.

Although a precise clubhouse location will be determined during the golf course re-design after the CDUA is approved, the former Knowles residence (Alternative Clubhouse Site #3) is considered favorable at this time. This is the site which the public expressed preference for at the CDUA hearing.

According to Mr. Richard Davis, who is a member of the Hawaii Mountain and Trail Club, he cleared/built the trail during 1959-1961 and named it after himself (Likeke means "Richard" in Hawaiian). The trail is open to the public and is cleared periodically by Mr. Davis.

As indicated in Exhibit IV-15 of the draft EIS, Likeke Trail is located approximately 1,500-2,000 feet directly mauka of the mauka boundary of the proposed golf course. Therefore, Likeke Trail will not be directly impacted by the project.

The trails shown crossing the project area in Exhibit IV-15 are not part of Likeke Trail, but are sub-trails. These two sub-trails may be retained by designing the golf course around them. However, if necessary, these trails may be relocated to the edge of the golf course and then connected to Likeke Trail. Safety and security concerns, such as hikers getting hit by flying golf balls or hikers wandering around the golf course, may require the relocation of these trails.

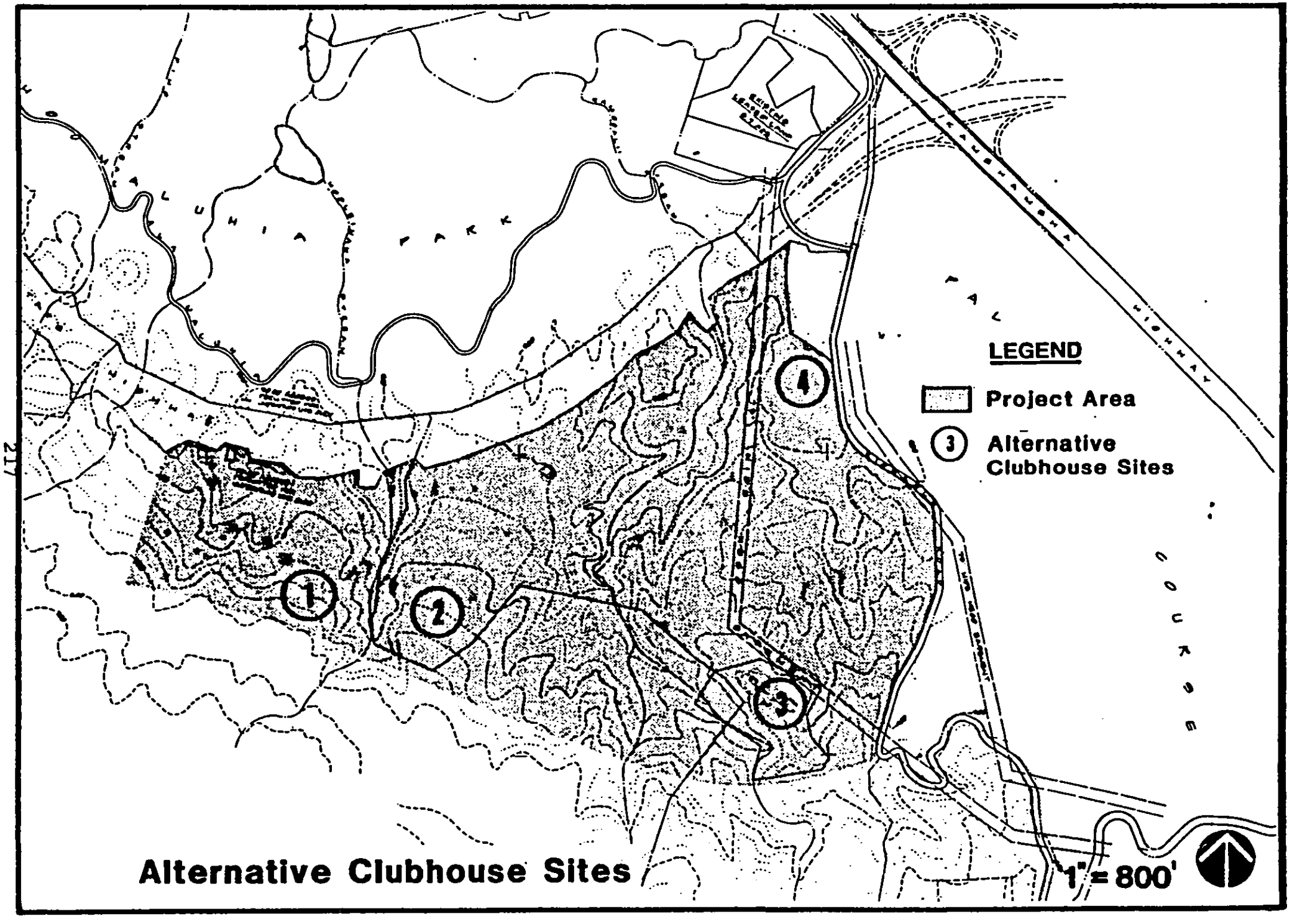
Again, thank you for taking the time to comment on this project.

Sincerely,

DHM inc.

Dyk Hee Murabayashi (Mrs.)
President

DHM:vl
Attachment



Alternative Clubhouse Sites

C E D

502

SIERRA CLUB, HAWAI'I CHAPTER
HONOLULU GROUP
P.O. BOX 11070, HONOLULU, HAWAI'I 96828
(808) 946-8494

December 6, 1986

Department of Land and Natural Resources
Board Chairman, Susumu Ono

Re: Request for Conservation District Use Permit by Nitto Kogyo Co.
Gentlemen:

This request is for the use of Conservation Land which constitutes a natural resource for Hawaii's people, regardless of the fact that the land is privately owned. Since the request is for exclusive use by people of a foreign country and their guests, we suggest that it is vital that certain conservation practices be used if the development is to be granted.

Therefore, we feel that pertinent questions must be asked and satisfactorily answered before the permit is considered. It seems that this request is being rushed, and we question the reason.

Does the applicant guarantee that stringent practices will be followed with soil studies being made to determine the suitability of construction and of moving land? Will every measure be taken to prevent land slides, erosion and silt production? What measures will be taken to prevent disturbance of natural water resources? Will extreme care be used in the application of fertilizers, insecticides and herbicides? Can the applicant guarantee that construction will be done in such a manner as to cause a minimum disturbance to the land and the vegetation? Can he guarantee that no residual silting will reach Kaneohe Bay and Hoomalahia Park?

Inasmuch as the proposed uses will require a large amount of water, would the applicant be willing to install a de-salination plant rather than applying for water use from Oahu's limited aquifer?

Will the applicant guarantee that no land presently in Agriculture be changed? If the development is kept low-scale, the rainfall that banana farmers now depend upon will be less likely to be affected. It is known that the building of Likelike Highway did affect the rainfall.

Would the applicant be willing to scale down the proposal? We question the addition of swimming pool and tennis courts and large banquet facilities. The description of the plan tends to suggest that there would be later requests for Inn or Hotel accommodations.

Is the applicant willing to place the clubhouse and accompanying facilities in a location that will have less affect upon the Hoomalahia Camp grounds?

Is the applicant willing to supply right-of-way access to the traditional trails of this area? Likeke is an old and valuable trail. Will this be another lost access?

Has the applicant considered the amount of rain that falls in this area which may make it less desirable for a world class championship golf course?

Thank you for permitting us to comment.

Aloha

Lola Mench

Lola Mench
Honolulu Group Conservation
Committee.

cc: DHM Inc.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. BOX 50004
HONOLULU, HAWAII 96850

December 2, 1986

Mr. Dean Uchida
Office of Conservation & Environmental Affairs
Department of Land & Natural Resources
1151 Punchbowl St., Room 131
Honolulu, HI 96813

Dear Mr. Uchida:

Subject: Conservation District Use Application for Golf Course with Accessory Uses on Iolani School Property Kaneohe, Oahu

We have reviewed the subject draft environmental impact statement and have no comments to make.

Thank you for the opportunity to review the document.

Sincerely,

Wm H Mann ACTING
RICHARD N. DUNCAN
State Conservationist

cc:
DHM Inc.
1188 Bishop St., Suite 2405
Honolulu, HI 96813

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P.O BOX 50167
HONOLULU, HAWAII 96850

ES
Room 6307
DEC 5 1986

Mr. Dean Uchida
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Re: Conservation District Use Application for Golf Course with Accessory Uses on Iolani School Property

Dear Mr. Uchida:

We have received the subject Draft Environmental Impact Statement and believe that it adequately addresses fish and wildlife resources within our jurisdiction.

We appreciate this opportunity to comment.

Sincerely yours,

Ernest Kosaka
Project Leader
Office of Environmental Services

✓cc: DHM Inc.

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

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

IN REPLY REFER TO
5090
Ser 002B/6435
19 NOV 1986

Mr. Dean Uchida
Department of Land & Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

DRAFT ENVIRONMENTAL IMPACT STATEMENT
GOLF COURSE ON IOLANI SCHOOL PROPERTY

The Draft EIS for the Golf Course on Iolani School Property has been reviewed and we have no comments. 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,

P. O'CONNOR
Captain, U.S. Navy
Chief of Staff

Enclosure

Copy to:
DHM Inc.
1188 Bishop Street, Suite 2405
Honolulu, Hawaii 96813

Office of Environmental Quality Control

221

(P)2057.6

NOV 17 '986

Mr. Dean Uchida
Department of Land and
Natural Resources
State of Hawaii
Honolulu, Hawaii

Dear Mr. Uchida:

Subject: Golf Course on Iolani School Property
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

/mkk
cc: DHM inc.

C GPS

JOHN D. WAIHEE III
GOVERNOR

RECEIVED
85 DEC 9 A8:3

JACK K. SUWA
CHAIRPERSON, BOARD OF AGRICULTURE

SUZANNE D. PETERSON
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 5, 1986

STATE OF HAWAII

85 DEC 11 A8:30 OEQC RECEIVED

MEMORANDUM

To: Mr. Susumu Ono, Chairperson
Board of Land and Natural Resources

Subject: Draft Environmental Impact Statement (DEIS) for
Conservation District Use Application (OA-1947)
Golf Course
Nitto Kogyo Company, Ltd.
TMK: 4-5-42: Por. 1 and 6 Kaneohe, Oahu
Acres: 200

The Department of Agriculture has reviewed the subject DEIS and has no additional comments to offer. The concerns expressed in our review of the Conservation District Use Application - Conditional Use Permit for Proposed Golf Course in Resource and General Subzones (memorandum dated September 30, 1986) have been adequately addressed. We trust that the concerns raised by the Luluku Banana Growers' Association (their letter of October 22, 1986) have also been addressed.

Thank you for the opportunity to comment.

Jack K. Suwa
JACK K. SUWA
Chairperson, Board of Agriculture

cc: OEQC
Mr. Fred Shiroma, LBGA

222

HIENG

NOV 14 1986

Mr. Dean Uchida
Department of Land and
Natural Resources
1151 Punchbowl St., Rm. 131
Honolulu, Hawaii 96813

Gentlemen:

Golf Course on Iolani School Property
Kaneohe, 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.

Yours truly,

E.C.

Jerry M. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

cc: DHM Inc.

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING
HAWAII HOUSING AUTHORITY
P. O. BOX 17907
HONOLULU, HAWAII 96817

RUSSELL N. FUKUMOTO
EXECUTIVE DIRECTOR

IN REPLY REFER TO:

86:PLNG/7051

December 3, 1986

Mr. Dean Uchida
Deparment of Land & Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement for the Golf Course on Iolani School Property in Kaneohe.

We have reviewed the document and do not have any specific comments to offer at this time.

Sincerely,

RUSSELL N. FUKUMOTO
Executive Director

cc: DHM Inc.

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FB 86-969

November 17, 1986

Mr. Dean Uchida
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Subject: Draft Environmental Impact Statement
Golf Course on Iolani School Property
TMK: 4-5-42:1&6
Kaneohe, Koolaupoko, Oahu

We have reviewed the draft EIS for Golf Course on Iolani School property in Kaneohe and have no comments.

Thank you for the opportunity to review the draft EIS.

Very truly yours,

for HERBERT K. MURAOKA
Director and Building Superintendent

TE:jo
cc: J. Harada
DHM, Inc.

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 S. BERETANIA STREET, ROOM 309
HONOLULU, HAWAII 96814

FRANK F. FASI
MAYOR

FRANK K. KAHOOHANOHANO
FIRE CHIEF

LIONEL E. CAMARA
DEPUTY FIRE CHIEF

November 17, 1986

Mr. Robin Oura, Project Manager
LANDPRO
800 S. Beretania Street, Third Floor
Honolulu, HI 96813

Dear Mr. Oura:

SUBJECT: Environmental Impact Statement
Preparation Notice (EISPN)
Proposed Golf Course (TMK 4-5-42: 1 & 6)

We have reviewed the material provided and also the Draft Environmental Impact Statement supplied by the State Department of Land and Natural Resources for the proposed project.

We have no objections to the proposed development provided proper access and fire flow requirements are met.

Should you have any questions, please contact Battalion Chief Kenneth Word at 943-3838.

Sincerely,

Frank K. Kahoohanohano

FRANK K. KAHOOHANOHANO
Fire Chief

FKK/KAW:sb

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DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 523-4181

FRANK F. FASI
MAYOR

MICHAEL M.H. MOON
DIRECTOR

ROBERT MIYASATO
DEPUTY DIRECTOR

November 26, 1986

Mr. Dean Uchida
Department of Land & Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Subject: Iolani School Property - Conservation District Use Application for a Golf Course with Accessory Uses

Tax Map Key:	4-5-42: 1
Area:	225± Acres
Location:	Mauka of Hoomaluhia Park, between the Pali Golf Course and Likelike Highway, Kaneohe, Oahu
Existing Land Use:	Portion being used for banana farming, balance vacant.
Development Plan:	Preservation
Zoning Map:	P-1 Preservation
State Land Use:	Conservation
Proposal:	Championship golf course and accessory uses on 225± acres.

We have reviewed the proposed golf course in Kaneohe and do not have any objections to the development.

Sincerely,

for MIKE MOON

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SS-SY/DJA

November 20, 1986

Mr. Dean Uchida
Department of Land
and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Machida:

CONSERVATION DISTRICT USE APPLICATION
FOR GOLF COURSE WITH ACCESSORY USES ON
IOLANI SCHOOL PROPERTY

We have received and reviewed a copy of the Environmental Impact Statement for the development of a Golf Course with Accessory Uses on Iolani School Property, TMK: 4-5-42:1 & 6, in Kaneohe, Oahu.

We recommend that in the event the Golf Course facilities are used during evenings, sufficient lighting of walkways and parking areas be provided for public safety.

Thank you for the opportunity to provide comments.

Sincerely,

DOUGLAS G. GIBB
Chief of Police

cc: DHM Inc.

Cen

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DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

RUSSELL L. SMITH JR.
DIRECTOR AND CHIEF ENGINEER

ENV 86-241

November 24, 1986

Mr. Susumu Ono, Chairperson
Board of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Re: Draft EIS for Conservation District Use
Application (CDUA) No. OA-1947 for a Golf Course
With Accessory Uses at Koolaupoko, Oahu, Hawaii

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

1. The existing municipal sewers that will serve the proposed development are adequate.

2. The drainage discussion is satisfactory.

3. The City is closing portions of Auloa Road and Kionaole Road between the entrance of Pali Golf Course Maintenance Facility to a location a short distance away from Pali Highway. The closure is not expected to affect access to the proposed development based on the proposed entrance to the golf course.

Very truly yours,

RUSSELL L. SMITH, JR.
Director and Chief Engineer

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

JOHN E. HIRTEN
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

TE-7113
PL 1.0509

December 4, 1986

Mr. Dean Uchida
Department of Land and
Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Subject: Draft Environmental Impact Statement
Golf Course on Iolani School Property
Kaneohe, Oahu

This is in response to your request of November 6, 1986 for our review of the subject document.

We have reviewed the draft Environmental Impact Statement and are satisfied that the traffic impacts from the proposed project have been addressed.

We thank you for providing us this opportunity to review and comment on the project.

Sincerely,

JOHN E. HIRTEN

cc: DHM, Inc.

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REFERENCES

REFERENCES

1 Berger, Andrew J. 1986 Bird and Mammal Report, Iolani School Lands Project. October 1986.

2 Char, Winona P. Botanical Survey, Iolani School Land Proposed for Golf Course Development, Kaneohe-Kailua, Island of Oahu. October 1986.

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5 Department of Planning and Economic Development, State of Hawaii. The Economic Impact of Tourism in Hawaii: 1970 to 1980. Research Report 1983-2. April 1983.

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8 Department of Transportation, Highways Division, State of Hawaii. Hydrologic and Hydraulic Report for Interstate Route H-3, Kaneohe Interchange to Halekou Interchange FAIP No. I-H3-1(31). October 1983.

9 Y. Ebisu & Associates. Traffic Noise Study for the Proposed Nitto Kogyo Golf Course. August 1986.

10 Engineering Concepts, Inc. Traffic Impact Analysis Report for the Nitto Kogyo Golf Course. July 1986.

11 Land Study Bureau, University of Hawaii. Detailed Land Classification. December 1972.

12 Mink, John. Evaluation of Water Resources and their Development in Iolani School Lands, Kaneohe, Hawaii. August 1986.

13 Morrow, J.W. Air Quality Impact Analysis, Nitto Kogyo Golf Course. August 1986.

14 Murdoch, Charles L. and Green, Richard E. Environmental Fate of Fertilizers and Pesticides Recommended for Proposed Nitto Kogyo Golf Course, Iolani School Property. September 16, 1986.

15 Rodriguez, F.J. Final Environmental Impact Statement for the Proposed Iolani School Properties Project. May 1983.

16 Rodriguez, F.J. Final Environmental Impact Statement Addendum for the Proposed Iolani School Properties Project. November 1983.

17 Soil Conservation Service. Erosion and Sediment Control Guide for Hawaii. U. S. Department of Agriculture.

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20 U. S. Geological Survey. Water Resources Data, Hawaii and Other Pacific Areas Water Year 1984. 1985.

21 VTN Pacific. Environmental Impact Statement for Kamooalii Watershed Wells. Prepared for Board of Water Supply, City and County of Honolulu. September 1983.

APPENDICES

APPENDIX A

GOLF COURSES ON OAHU

APPENDIX A

GOLF COURSES ON OAHU

NAME	HOLES	GREEN FEE* WEEKDAY	GREEN FEE* WEEKEND
Public (Owned and Operated by the City & County of Honolulu)			
Ala Wai	18	$8.00	$12.00
Kahuku	18	$2.00	$ 3.00
Ted Makalena	18	$4.00	$ 6.00
Pali	18	$4.00	$ 6.00
(Cart not included in fee on public courses.)			
Military			
Kalakaua	18	mil $5 daily civ $10 daily	
Kaneohe Klipper	18	mil $5 daily civ $15 daily	
Leilehua	18	mil $5 daily civ $12 daily	
Navy Marine	18	mil $6 daily civ $15 daily	
Barbers Point	18	mil $5 daily civ $10 daily	
Ford Island	18	No Charge	
Fort Shafter	9	mil $5 daily civ $7 daily	
Hickam	18	varies with rank	
Hickam Par-3	9	mil $2.25 daily civ $3.50 daily	

*Green Fees include golf cart, unless otherwise noted.

NAME	HOLES	GREEN FEE* WEEKDAY	WEEKEND
Privately Owned (open to public)			
Bayview Golf Center	18	$5.00	$ 6.50
Hawaii Country Club	18	$16.00	$21.00
Hawaii Kai Championship	18	$27.00	$29.00
Hawaii Kai Executive	18	$8.50 (A.M.) $6.50 (P.M.) (cart not included)	$ 9.50
Honolulu International Country Club	18	$25.00 Guests w/Member $35.00 Guests w/out Member	
Makaha Valley Country Club	18	$20.00	$25.00
Mid-Pacific Country Club	18	$20.00 Guests w/Member $41.60 Guests w/out Member (cart not included)	
Mililani	18	$19.00	$23.00
Moanalua Golf Club	9	$10.00	$15.00
Oahu Country Club	18	$15.50 Guests w/Member $23.50 Guests w/out Member (cart not included)	
Olomana Golf Links	18	$16.00 (A.M.) $12.00 (P.M.)	$21.00
Pearl Country Club	18	$24.00	$29.00
Waialae Country Club	18	$27.04 Guests w/Member $72.80 Guests Sponsored by Member	
Resort			
Sheraton Makaha Resort & Country Club	18	$30.00 Guest $51.00 Non-Guest	
Turtle Bay Hilton Country Club	18	$27.00 Guest $29.00 Non-Guest	

*Green Fees include golf cart, unless otherwise noted.

APPENDIX B

Botanical Survey
'Iolani School Land Proposed
For Golf Course Development
Kane'ohe - Kailua, Island of O'ahu

BOTANICAL SURVEY
'IOLANI SCHOOL LAND PROPOSED
FOR GOLF COURSE DEVELOPMENT
KANE'OHE - KAILUA, ISLAND OF O'AHU

by

Winona P. Char

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

Prepared for: DHM, Planners

October 1986

B-1

Table of Contents

INTRODUCTION

The 'Iolani School land which is being proposed for a golf course development is an irregularly-shaped parcel which lies south of the City and County's Ho'omaluhia Park and the proposed Interstate Route H-3 Right-of-Way. It is bound on the east by Kionaole Road; its western boundary is near Piho Stream.

Several biological surveys have been conducted on the adjacent Ho'omaluhia Park and H-3 Right-of-Way (Corps of Engineers 1974, 1975; Department of Transportation 1974). In 1982 a residential development was proposed for parcels of 'Iolani School lands located behind Ho'omaluhia Park and along Likelike Highway. The proposed development was later dropped. In the botanical survey (Char 1982) which was prepared for the residential development no rare, threatened, or endangered plant species were found. Vegetation consisted largely of introduced species with scattered native plants occurring on the more inaccessible, steeper areas.

A botanical (flora) survey of the proposed golf course area was conducted in September 1986 to inventory the flora, describe the major vegetation types, search for threatened and endangered species, and identify areas of potential environmental problems or concerns. A team of two botanists was required to gather the technical data contained in this report.

SURVEY METHODS

Prior to undertaking the field survey, a search of the pertinent literature was conducted to familiarize the investigators with previous surveys made in

the general area. Recent topographic maps as well as an aerial photograph were studied for existing roads and trails.

In the field, a walk-through survey method was used. Areas which had not been previously surveyed were investigated more intensively. Criteria such as structure, composition, and associated plant species were used in identifying and describing each vegetation type.

Notes were made of the species present within each of the major vegetation types. Species which could not be positively identified were collected for later determination in the herbarium and laboratory. The species recorded are indicative of the season and environmental conditions of the time of the survey. A survey taken at a different time and under varying environmental conditions would no doubt yield slight variations in the species list.

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DESCRIPTION OF VEGETATION

The vegetation on the project area has been greatly disturbed in the past. In the Environmental Impact Statement (EIS) prepared for Ho'omaluhia Park (Corps of Engineers 1974), archeological studies by Bishop Museum found that the uplands (which include the present project area) were used and then abandoned until the late 1800's, when limited activities such as charcoal making took place. Pineapple, banana, and sugar cane were later grown on some parts of the project area. Later much of the project area was used for grazing dairy cattle. Old pastures (grassland vegetation), dirt roads, and cattle fences as well as abandoned plantings of cultivated plants are frequently encountered throughout the project area.

Four major vegetation types, dominated largely by introduced species, are recognized on the project area. A total of 175 plant species were inventoried. Of these, 146 (83%) are introduced (or exotic) species. The mixed forests and grassland, respectively, occupy the most area.

A. Vegetation Types

1. Mixed forests--Within the proposed project site this vegetation type covers the most area. The height of the mixed forest generally varies from 10 to 20 meters tall, with the larger statured trees found in the more sheltered areas along the stream. The forest consists of a mixture of tree species, with Java plum (Eugenia cumini) the most commonly occurring species. Other tree species found in the mixed forests include rose apple (Syzygium jambos), African tulip (Spathodea campanulata), octopus tree (Brassaia actinophylla), kukui (Aleurites moluccana), and hala (Pandanus odoratissimus). Understory vegetation consists of seedlings and saplings of tree species mentioned above and herbaceous species such as shampoo ginger (Zingiber zerumbet), basketgrass (Oplismenus hirtellus), Hilo grass (Paspalum conjugatum), and an assortment of fern species. Where the tree canopy cover is less dense and more light is able to reach the vegetation beneath, shrubs such as strawberry guava (Psidium cattleianum) and Christmas berry (Schinus terebinthifolius) may form a subcanopy layer.

Clusters of mango trees (Mangifera indica) can be seen standing above the rest of the forest. Some of the larger, older trees may reach heights of 30 meters or more and have diameters (dbh) greater than 2 meters. The trees are often associated with old cattle fences, dirt roads, and abandoned plantings of cultivated plants such as Heliconia spp., wedelia (Wedelia trilobata) and croton (Codiaeum variegatum).

Along the streams and on the slopes of major drainage areas, large, dense thickets of hau (Hibiscus tiliaceus) are found. Only the more shade-tolerant species such as basketgrass and the woodferns (Christella parasitica, Christella dentata) are found under the hau thickets.

Along the edges of the mixed forests, where it meets the grassland, mailepilau vine (Paederia foetida) is abundant, often covering the smaller trees and shrubs with a thick shroud.

2. Grassland--The grassland vegetation occurs principally on the broad, more or less gentle slopes within the project area. Californiagrass (Brachiaria mutica), forming an undulating carpet often 1 to 1.5 meters tall, is the dominant cover. However, in some localities broomsedge (Andropogon virginicus) may be dominant, especially on the steeper, well-drained slopes. Often a mixture of grass species such as Californiagrass-molassesgrass (Melinus minutiflora)-broomsedge may be found.

Locally common in this vegetation type are patches of swordfern (Nephrolepis multiflora). Other species which commonly occur in the grassland are Glenwoodgrass (Sacciolepis indica), Hilo grass (Paspalum conjugatum), Asiatic pennywort (Centella asiatica), and kyllinga (Kyllinga brevifolia). Large to small clumps or individual trees of Java plum (Syzygium cumini) are found scattered throughout the grassland.

3. Open scrub--An open scrub vegetation dominated primarily by the mat-forming uluhe fern (Dicranopteris linearis) is found on the hilltops scattered throughout the mixed forests. Where the fern cover is thin

or along the edges of the fern mat, broomsedge (Andropogon virginicus) and rice-grass (Paspalum orbiculare) may occur in small to large patches. Shrubs and small trees such as strawberry guava (Psidium cattleianum), guava (Psidium guajava), Java plum (Syzygium cumini) and Christmas berry (Schinus terebinthifolius) are found scattered throughout the open scrub. Native species which may occasionally be encountered include 'ohi'a (Metrosideros collina ssp. polymorpha), hala (Pandanus odoratissimus), 'akia (Wikstroemia aff. oahuensis), and neneleau (Rhus sandwicensis).

A rather large area covered by this vegetation type can be found on the hillside east of Ho'oleinaiwa Stream; however, most of these open scrub areas are small and are not readily picked up on aerial photographs of the project area.

4. Farmland--Only a cursory survey was made of this vegetation type as it is highly modified and not likely to harbor rare native species. Farmland occupies only a very small portion of the project area and is found between the HECO easement and an existing parcel of leased land along Kionmole Road.

Foliage and flower crops such as ti leaf (Cordyline terminalis) and red ginger (Alpinia purpurata) are grown. Weedy species associated with cultivated areas such as spiny amaranth (Amaranthus spinosus), swollen fingergrass (Chloris inflata), red pua-lele (Emilia fosbergii), buttonweed (Spermacoce assurgens) and Cuba jute (Sida rhombifolia) are frequently encountered, especially in the plots which are not being actively cultivated.

B. Threatened and Endangered Species

No plant species considered rare, threatened, or endangered (U. S. Fish and Wildlife Service 1980) by the Federal and State governments was found on the project area during the course of this survey.

Similar botanical surveys of adjacent areas (Corps of Engineers 1974; Department of Transportation 1974) or earlier studies (Char 1982) which included a portion of the present project area also yielded no rare, threatened, or endangered plant species.

DISCUSSION AND RECOMMENDATIONS

The vegetation on the project area is dominated largely by introduced species and has a varied history of past land use. A few native species occur throughout the project area, mostly on steeply sloping areas and in the open scrub. These native species, however, occur in similar environmental habitats throughout the islands, and none is considered rare, threatened, or endangered. Development of the area will have only a minimal impact on the total island populations of the species involved.

Soil erosion and run-off are primary concerns once the vegetation cover is removed. It is recommended that as much of the existing vegetation as possible be retained and incorporated into the landscape plans for the golf course. Vegetation cover along the streams will not be disturbed according to the development plans. Areas cleared for the golf course should be landscaped as soon as possible.

As much of the existing vegetation along the south boundary should be retained as possible to serve as a buffer or screen between the proposed instestate highway and the golf course.

Scientific name	Common name	Status	Vegetation types mf	gr	os	f
PTERIDOPHYTA						
ADIANTACEAE (Maiden-hair Fern Family)						
Adiantum hispidulum Sw.	maiden-hair fern	X	+	-	-	-
BLECHNACEAE (Blechnum Family)						
Blechnum occidentale L.	blechnum fern	X	+	-	-	-
GLEICHENIACEAE (False-staghorn Family)						
Dicranopteris linearis (Burm.) Underw.	uluhe, enuhe	I	+	+	+	-
HEMIONITIDACEAE (Gold Fern Family)						
Pityrogramma calomelanos (L.) Link	gold fern, silver fern	X	-	-	+	+
LINDSAEACEAE (Lindsaea Family)						
Sphenomeris chinensis (L.) Maxon	pala'a, palapala'a	I	+	+	+	-
LYCOPODIACEAE (Club Moss Family)						
Lycopodium cernuum L.	wawae-'iole	I	+	-	+	-
NEPHROLEPIDACEAE (Swordfern Family)						
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy swordfern	X	+	+	+	+
POLYPODIACEAE (Polypodium Family)						
Phlebodium aureum (L.) J. Small	laua'e-haole	X	+	-	-	-
Phymatosorus scolopendria (Burm.) Pic.-Ser.	laua'e, lauwa'e	X	+	+	-	-
Pleopeltis thunbergiana Kaulf.	pakahakaha, 'ekaha-'akolea	E	+	-	+	-
PSILOTACEAE (Psilotum Family)						
Psilotum nudum (L.) Beauv.	moa, pipi	I	+	-	+	-
THELYPTERIDACEAE (Woodfern Family)						
Christella dentata (Forsk.) Brownsey & Jermy	downy woodfern	X	+	+	-	+
Christella parasitica (L.) Levl.	woodfern	X	+	-	-	-

PLANT SPECIES LIST, IOLANI SCHOOL PROPERTIES: PROPOSED GOLF COURSE

In the plant species list, families are arranged alphabetically within each of three groups: Pteridophytes, Monocotyledons, and Dicotyledons. Taxonomy and nomenclature of ferns and fern allies (Pteridophytes) follow C. H. Lamoureux's unpublished checklist (1984); taxonomy and nomenclature of the flowering plants (Monocotyledons and Dicotyledons) follow St. John (1973) except where more recently accepted names are used. Hawaiian names used are in accordance with Porter (1972) or St. John (1973). The following information is provided:

1. Botanical name with author citation.
2. Common English or Hawaiian name, when known.
3. Biogeographic status of the species. The following symbols are used:

   E = endemic = native only to the Hawaiian Islands

   I = indigenous = native to the Hawaiian Islands and also to one or more other geographic areas

   P = Polynesian = plants of Polynesian introduction; all those plants brought by the Polynesian immigrants prior to contact with the Western world

   X = introduced or exotic = not native to the Hawaiian Islands; brought here intentionally or accidentally after Western contact.

4. Vegetation types. Four major vegetation types are recognized on the project area and are discussed in detail in the text. They are:

   mf = mixed forests

   gr = grassland

   os = open scrub

   f = farmland

   Within each of the vegetation types, the presence (+) or absence (-) of each species is given.

Scientific name	Common name	Status	Vegetation types mf	gr	of	f
MONOCOTYLEDONS						
AMARYLLIDACEAE (Amaryllis Family)						
Crinum sp.	crinum lily	X	+	-	-	-
ARACEAE (Arum Family)						
Alocasia macrorrhiza (L.) Sweet	'ape, apii	P	+	-	-	+
Colocasia esculenta var. antiquorum (Schott) Hubb. & Rehd.	taro, kalo	P	-	-	-	+
Philodendron andreanum Devansaye	velvet-leaf philodendron	X	+	-	-	-
Syngonium auritum (L.) Schott	syngonium	X	+	-	-	-
COMMELINACEAE (Spiderwort Family)						
Commelina diffusa Burm. f.	honohono	X	+	+	+	+
COSTACEAE (Crepe Ginger Family)						
Costus speciosus (Koenig) Sm.	spiral flag, crepe ginger	X	+	-	-	+
CYPERACEAE (Sedge Family)						
Cyperus alternifolius L.	umbrella plant, ahu'awa-haole	X	+	-	-	-
Fimbristylis dichotoma (L.) Vahl	tall fringe rush	I	+	+	+	-
Kyllinga brevifolia Rottb.	kyllinga, kili'o'opu	X	+	+	+	+
Kyllinga nemoralis (J. R. & G. Forst.) Dandy ex Hutch. & Dalziel	white-headed kyllinga	X	-	+	-	+
Pycreus polystachyos (Rottb.) Beauv.		I	+	+	+	-
DIOSCOREACEAE (Yam Family)						
Dioscorea bulbifera L.	bitter yam, pi'oi	P	+	-	-	-
Dioscorea pentaphylla L.	five-leaved yam, pi'ia	P	+	-	-	-
GRAMINEAE (Grass Family)						
Andropogon virginicus L.	broomsedge	X	-	+	+	-
Axonopus affinis Chase	narrow-leaved carpetgrass	X	+	+	-	-
Axonopus compressus (Sw.) Beauv.	broad-leaved carpetgrass	X	-	+	-	-

Scientific name	Common name	Status	Vegetation types mf	gr	of	f
Brachiaria mutica (Forsk.) Stapf	California grass, paragrass	X	+	+	-	+
Chloris inflata Link	swollen fingergrass, mau'ulei	X	-	-	-	+
Chloris radiata (L.) Sw.	radiate fingergrass	X	-	-	-	+
Chrysopogon aciculatus (Retz.) Trin.	golden beardgrass, pilipili-'ula	X	-	+	-	-
Coix lachryma-jobi L.	Job's tears, pupu-kolea	X	+	+	-	+
Digitaria adscendens (HBK.) Henr.	Henry's crabgrass	X	-	-	-	+
Digitaria sanguinalis (L.) Heist.	large crabgrass, kukaipua'a	X	-	-	-	+
Digitaria sp.		X	-	-	-	+
Echinochloa colona (L.) Link	jungle rice	X	-	+	-	+
Eleusine indica (L.) Gaertn.	goosegrass, manienie-ali'i	X	-	-	-	+
Melinis minutiflora Beauv.	molassesgrass	X	-	+	+	-
Oplismenus hirtellus (L.) Beauv.	basketgrass, honohono-kukui	X	+	+	-	-
Paspalum conjugatum Berg.	Hilo grass, mau'u-Hilo	X	+	+	+	+
Paspalum dilatatum Poir.	Dallis grass	X	-	+	-	+
Paspalum fimbriatum HBK.	fimbriate paspalum, Panama paspalum	X	-	-	-	+
Paspalum orbiculare Forst. f.	ricegrass, mau'u-laiki	X	-	+	+	+
Paspalum aff. plicatulum Michx.	browntop millet	X	-	+	-	-
Pennisetum purpureum Schumach.	napiergrass	X	-	-	-	+
Rhynchelytrum repens (Willd.) C. E. Hubb.	Natal redtop	X	-	-	-	+
Sacciolepis indica (L.) Chase	Glenwood grass	X	+	+	+	-
Setaria glauca (L.) Beauv.	yellow foxtail	X	-	+	+	-
Setaria palmaefolia (Koen.) Stapf	palmgrass	X	+	+	-	-
Sporobolus africanus (Poir.) Robyns & Tournay	African dropseed, rattail grass	X	-	+	-	-
HELICONIACEAE (Heliconia Family)						
Heliconia spp. (2)	heliconia	X	+	-	-	-
LILIACEAE (Lily Family)						
Cordyline terminalis (L.) Kunth	ti, ki	P	+	-	-	+
Cordyline terminalis var. ferra (L.) J. G. Baker	red ti	X	+	-	-	+

Scientific name	Common name	Status	Vegetation types mf	gr	os	f
MARANTHACEAE (Arrowroot Family)						
Calathea sp.		X	+	-	-	-
MUSACEAE (Banana Family)						
Musa x paradisiaca L.	banana, mai'a	P/X	+	+	-	+
ORCHIDACEAE (Orchid Family)						
Arundina bambusaefolia (Roxb.) Lindl.	bamboo orchid	X	-	+	+	-
Phaius tankervillae (Banks ex L'Hér.) Bl.		X	+	-	-	-
Spathoglottis plicata Bl.	Chinese ground orchid	X	+	+	+	+
Vanda sp.		X	+	-	-	-
PALMAE (Palm Family)						
Roystonea elata (Bartr.) Harper	Florida royal palm	X	+	-	-	-
PANDANACEAE (Screwpine Family)						
Pandanus odoratissimus L. f.	pandanus, hala	I	+	+	+	-
ZINGIBERACEAE (Ginger Family)						
Alpinia purpurata (Vieill.) K. Schum.	red ginger, 'awapuhi-'ula'ula	X	+	-	-	+
Hedychium coronarium Koenig	white ginger, 'awapuhi-ke'oke'o	X	+	-	-	+
Hedychium flavescens Carey	yellow ginger, 'awapuhi-melemele	X	+	-	-	-
Phaeomeria speciosa (Bl.) Koord.	torch ginger, 'awapuhi-ko'oko'o	X	+	-	-	-
Zingiber zerumbet (L.) Roscoe	'awapuhi-kua-hiwi, 'opuhi	P	+	-	-	-
DICOTYLEDONS						
AMARANTHACEAE (Amaranth Family)						
Amaranthus spinosus L.	spiny amaranth, pakai-kuku	X	-	-	-	+
Amaranthus viridis L.	slender amaranth, pakai	X	-	-	-	+

Scientific name	Common name	Status	Vegetation types mf	gr	os	f
ANACARDIACEAE (Mango Family)						
Mangifera indica L.	mango, manako	X	+	-	+	+
Rhus sandwicensis Gray	Hawaiian sumach, neneleau	E	+	-	+	-
Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	X	+	+	+	+
ARALIACEAE (Ginseng Family)						
Brassaia actinophylla Endl.	octopus tree	X	+	-	+	+
ASCLEPIADACEAE (Milkweed Family)						
Gomphocarpus physocarpus E. Mey.	balloon plant	X	-	-	-	+
BALSAMINACEAE (Balsam Family)						
Impatiens sultani Hook. f.	impatiens	X	+	-	-	-
BIGNONIACEAE (Bignonia Family)						
Spathodea campanulata Beauv.	African tulip tree	X	+	+	-	+
CARICACEAE (Papaya Family)						
Carica papaya L.	papaya, mikana	X	-	-	-	+
CARYOPHYLLACEAE (Pink Family)						
Drymaria cordata (L.) R. & S.	drymaria, pipili	X	-	-	-	+
COMBRETACEAE (Terminalia Family)						
Terminalia catappa L.	false kamani, tropical almond	X	+	-	-	-
COMPOSITAE (Daisy Family)						
Ageratum conyzoides L.	ageratum, maile hohono	X	+	+	-	+
Bidens pilosa L.	Spanish needle, ko'oko'olau	X	-	-	-	+
Bidens pilosa var. minor (Bl.) Sherff		X	-	-	-	+
Crassocephalum crepidioides (Benth.) S. Moore	crassocephalum	X	-	+	-	+
Eclipta alba (L.) Hassk.	false daisy	X	-	-	-	+
Elephantopus mollis HBK.	elephant's foot	X	+	+	+	-
Emilia fosbergii Nicolson	red pua-lele	X	-	-	+	+
Emilia sonchifolia (L.) DC.	lilac pua-lele	X	-	+	+	+

Scientific name	Common name	Status	Vegetation types mf	gr	os	f
Erechtites hieracifolia (L.) Raf.	fireweed	X	-	+	-	-
Erechtites valerianaefolia (Wolf) DC.	purple fireweed	X	-	-	-	+
Erigeron bonariensis L.	hairy horseweed, ilioha	X	-	+	-	+
Erigeron canadensis L.	Canada fleabane, ilioha	X	-	+	+	+
Eupatorium riparium Regel	pamakani	X	+	-	-	-
Pluchea odorata (L.) Cass.	pluchea, shrubby fleabane	X	+	-	-	+
Siegesbeckia orientalis L.	siegesbeckia	X	-	-	-	+
Sonchus oleraceus L.	sow-thistle, pua-lele	X	-	-	-	+
Synedrella nodiflora (L.) Gaertn.	synedrella	X	-	-	-	+
Vernonia cinerea (L.) Less.	ironweed	X	-	+	-	+
Wedelia trilobata (L.) Hitchc.	wedelia	X	+	+	-	+
Youngia japonica (L.) DC.	oriental hawksbeard	X	+	-	-	+
CONVOLVULACEAE (Morning-glory Family)						
Ipomoea cairica (L.) Sweet	koali	I	-	+	-	-
Ipomoea triloba L.	little bell	X	-	-	-	+
CRUCIFERAE (Mustard Family)						
Nasturtium sarmentosum (DC.) Schinz & Guillaumin	pa'ihi, ihi-ku-kepau	P	-	-	-	+
CUCURBITACEAE (Squash Family)						
Momordica charantia var. pavel Crantz	wild bitter melon	X	-	-	-	+
EUPHORBIACEAE (Spurge Family)						
Aleurites moluccana (L.) Willd.	kukui, tutui	P	+	-	-	+
Codiaeum variegatum (L.) Bl.	croton	X	+	-	-	+
Euphorbia glomerifera (Millsp.) L. C. Wheeler		X	-	-	-	+
Euphorbia hirta L.	garden spurge, hairy spurge	X	-	-	-	+
Phyllanthus debilis Willd.	phyllanthus weed	X	-	+	+	+
Ricinis communis L.	castor bean, koli	X	-	+	-	+
GOODENIACEAE (Naupaka Family)						
Scaevola gaudichaudiana Cham.	naupaka-kuahiwi	E	+	-	+	-

Scientific name	Common name	Status	Vegetation types mf	gr	os	f
LABIATAE						
Hyptis pectinata (L.) Poit.	comb hyptis	X	-	-	-	+
LAURACEAE (Laurel Family)						
Cinnamomum cassia (L.) Bl.	cassia bark	X	+	-	-	-
Persea americana Mill	avocado	X	+	-	-	+
LEGUMINOSAE (Pea Family)						
Cassia leschenaultiana DC.	partridge pea, lauki	X	-	+	+	+
Cassia occidentalis L.	coffee senna, 'auko'i	X	-	-	-	+
Crotalaria incana L.	fuzzy rattlepod, kukai-hoki	X	-	-	-	+
Crotalaria pallida Aiton		X	-	-	-	+
Desmanthus virgatus (L.) Willd.	virgate mimosa	X	-	-	-	+
Desmodium canum (Gmel.) Schinz. & Thell.	Spanish clover, ka'imi	X	+	+	+	+
Desmodium triflorum (L.) DC.	three-flowered beggarweed	X	-	+	-	+
Desmodium uncinatum (Jacq.) DC.	Spanish clover	X	-	+	-	-
Indigofera suffruticosa Mill.	indigo, iniko	X	-	+	-	+
Leucaena leucocephala (Lam.) de Wit	koa-haole, ekoa	X	+	+	-	+
Mimosa pudica var. unijuga (Duchass. & Walp.) Griseb.	sensitive plant, pua-hilahila	X	+	+	+	+
Mucuna gigantea (Willd.) DC.	sea bean, ka'e'e	I	+	-	-	-
Peltophorum inerme (Roxb.) Naves	yellow poinciana	X	-	+	-	-
Samanea saman (Jacq.) Merr.	monkeypod, rain tree	X	+	-	-	+
Stylosanthes guianensis (Aubl.) Sw.	pencil flower	X	-	-	-	+
LOGANIACEAE (Strychnine Family)						
Buddleja asiatica Lour.	Asiatic butterfly bush, dog tail, huelo-'ilio	X	-	+	-	+
LYTHRACEAE (Loosestrife Family)						
Cuphea carthagenensis (Jacq.) Macbride	cuphea, puakamoli	X	+	+	+	+
MALVACEAE (Mallow Family)						
Hibiscus tiliaceus L.	hau	I	+	+	-	+
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	-	+	-	+

Scientific name	Common name	Status	Vegetation types mf	wf	os	f
Sida acuta Burm. f	'ilima	X	+	+	-	-
Sida rhombifolia L.	Cuba jute	X	-	-	-	+
MELASTOMATACEAE (Melastoma Family)						
Clidemia hirta (L.) D. Don	Koster's curse, clidemia	X	+	-	-	-
Dissotis plumosa Hook. f.	dissotis	X	+	-	-	-
MORACEAE (Mulberry Family)						
Artocarpus altilis (Parkins. ex Z.) Fosb.	breadfruit, 'ulu	P	+	-	-	+
Ficus microcarpa L. f.	Chinese banyan	X	+	+	-	-
MYRSINACEAE (Myrsine Family)						
Ardisia crispa (Thunb.) A. DC.	hens eyes, Hilo holly	X	+	-	-	-
Ardisia humilis Vahl	shoebutton ardisia	X	+	-	-	-
MYRTACEAE (Myrtle Family)						
Eucalyptus sp.	eucalyptus, gum tree, pale-piva	X	+	-	-	-
Metrosideros collina ssp. polymorpha (Gaud.) Rock	'ohi'a, 'ohi'a-lehua	E	+	-	+	-
Psidium cattleianum Sabine	strawberry guava, waiawi-'ula'ula	X	+	+	+	+
Psidium cattleianum var. littorale (Raddi) Fosb.		X	+	+	-	-
Psidium guajava L.	guava, kuava	X	+	+	+	+
Syzygium cumini (L.) Skeels	Java plum, palama	X	+	+	+	+
Syzygium jambos L.	rose apple, 'ohi'a-loke	X	+	-	+	+
Syzygium malaccense (L.) Merr. & Perry	mountain apple, 'ohi'a-ai	P	+	-	-	-
ONAGRACEAE (Evening Primrose Family)						
Ludwigia octivalvis (Jacq.) Raven	primrose willow, kamole	I	-	+	-	+
OXALIDACEAE (Wood Sorrel Family)						
Oxalis corniculata L.	yellow wood sorrel, 'ihi	I	-	-	-	+
Oxalis martiana Zucc.	pink wood sorrel, 'ihi pehu	X	+	-	-	+

Scientific name	Common name	Status	Vegetation types mf	wf	os	f
PASSIFLORACEAE (Passion Flower Family)						
Passiflora edulis f. flavicarpa Deg.	yellow liliko'i	X	+	-	-	+
Passiflora ligularis Juss.	sweet granadilla, lemi-wai	X	+	-	-	-
Passiflora subpeltata Ortega	white passionflower	X	-	+	-	-
PROTEACEAE (Silk Oak Family)						
Grevillea robusta A. Cunn.	silk oak, 'oka-kilika	X	+	-	+	+
ROSACEAE (Rose Family)						
Rubus rosaefolius Sm.	thimbleberry	X	+	+	-	-
RUBIACEAE (Coffee Family)						
Coffea arabica L.	Arabian coffee	X	+	-	-	-
Morinda citrifolia L.	noni	P	+	-	-	-
Paederia foetida L.	maile pilau	X	+	+	+	+
Spermacoce assurgens R. & P.	buttonweed, spermacoce	X	-	-	-	+
SAPINDACEAE (Soapberry Family)						
Euphoria longana Lam.	longan, dragon's eye	X	+	-	-	-
SOLANACEAE (Tomato Family)						
Nicandra physalodes (L.) Gaertn.	apple-of-Peru	X	-	-	-	+
Solandra hartwegi N. E. Br.	cup of gold	X	+	-	-	-
Solanum nigrum L.	popolo	I?	-	-	-	+
THYMELAEACEAE (Akia Family)						
Wikstroemia aff. oahuensis (Gray) Rock	'akia	E	+	+	+	-
TILIACEAE (Linden Family)						
Triumfetta semitriloba (L.) Jacq.	bur bush	X	+	+	-	-
UMBELLIFERAE (Carrot Family)						
Centella asiatica (L.) Urban	Asiatic pennywort, pohekula	X	+	+	+	+

Scientific name	Common name	Status	Vegetation types			
			mf	KI	OS	f
URTICACEAE (Nettle Family)						
Pilea microphylla (L.) Liebm.	rockweed, artillery plant	X	-	-	-	+
VERBENACEAE (Vervain Family)						
Citharexylum caudatum L.	juniper berry, citharexylum	X	+	+	+	+
Lantana camara L.	lantana, lakana	X	+	+	+	+
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain, oi, owi	X	+	+	+	+
Stachytarpheta urticaefolia (Salisb.) Sims	oi, owi		+	+	+	+
Verbena litoralis HBK.	weed verbena, ha'uwi	X	+	+	+	+

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APPENDIX C

1986 Bird and Mammal Report
Iolani School Lands Project

1986 Bird and Mammal Report
'Iolani School Lands Project
By Andrew J. Berger

This report was prepared on instructions received from Ms. Duk Hee Murabayshi, President of DHM, Inc., in her office (1188 Bishop Street) on September 19, 1986. My field work on the 'Iolani School properties and on the adjacent Ho'omaluhia Park was conducted on September 24 and 25, 1986. A field reconnaisance of the park was essential because of the sighting there of several species of endangered endemic Hawaiian waterbirds.

General Vegetation and Topography

Winona P. Char (1982) prepared a thorough botanical report on the 'Iolani School lands and now is in the process of updating that report.

As a result of my field studies on September 24 and 25, 1986, I can confirm what I wrote in my earlier report (1981), and repeat much of that information because it is essential for understanding the comments on the birds that will follow, and, indeed, on the distribution of birds on the windward side of Oahu.

Although some koa (Acacia koa) trees have been planted in the park itself, there is very little native vegetation in the park or on the proposed construction sites. Char (1982) found "no rare or endangered plants" in the sites proposed for development. Some of the more conspicuous introduced plants in the area include Christmas berry (Schinus terebinthifolius), koa haole (Leucaena glauca), guava (Psidium guajava), mango (Mangifera indica), Java plum (Eugenia cuminii), octopus tree

(Brassaia actinophylla), sensitive plant (Mimosa pudica), Jamaica vervain (Stachytarpheta jamaicensis), ginger, and a wide variety of grasses and ferns. Kukui or candlenut trees (Aleurites moluccana) are widely scattered in the park but grow most profusely at higher elevations, primarily mauka of the proposed construction sites on the very steep slopes of the Pali. Hau (Hibiscus tiliaceus) forms extremely dense thickets, especially along stream beds, and pandanus (Pandanus odoratissimus) is widely distributed throughout the region.

Much of the area consists of rolling land but there also are steep gullies. The flat land closest to the HECO substation consists of a parklike area with little undergrowth and with Java plum trees being a dominant species there. An extensive grassland area west of that site consists of a wide variety of introduced grasses. Banana is the dominant plant in the Luluku area "J." As a summary we can say that there is no semblance of a native ecosystem either in the park or on the proposed construction site.

The Birds

Three groups of birds are found in the Hawaiian Islands: 1. endemic, 2, indigenous, and 3. introduced or alien birds.

I. Endemic Birds

These are birds that are unique to the Hawaiian Islands; they occur naturally in no other part of the world. Many of these endemic birds are classified as endangered or threatened with extinction by the U.S. Fish & Wildlife Service and by the

State Division of Forestry and Wildlife. Most of these endangered species are forest birds; few of them still exist on the island of Oahu; and there is no suitable habitat for these birds on or near the project site.

Four species of endangered Hawaiian waterbirds do occur on Oahu: Koloa or Hawaiian duck (Anas wyvilliana), Hawaiian gallinule or 'Alae 'Ula (Gallinula chloropus sandvicensis), Hawaiian coot or 'Alae Ke'oke' (Fulica americana alai), and Hawaiian stilt or Ae'O (Himantopus mexicanus knudseni).

There is no suitable habitat for these waterbirds on the 'Iolani School lands. In his thorough ornithological survey of Hawaiian wetlands, Shallenberger (1977) did not consider the small streams (e.g., Kamooalii, Hooleinaiwa, Piho, and Kuou streams) in the area to be worthy of study. Similarly, Archer (1984), in his analysis of quality rating of windward Oahu streams, wrote that (page 12): "O'ahu is known as having the poorest quality streams in the state"; he (his figure 4, page 24) considered only the Luluku stream and the Loko Waimaluhia reservoir worth surveying. Okamoto et al. (1983, pg. 7) said that "evaluation of a stream reach's potential for waterbird habitat and ecosystem value is based on the following basic criteria:

"1. Habitat Having High Potential for Hosting Waterbirds: Stream reaches which traverse swamps, marshes and other wetland areas.

"2. Habitat Having Low Potential for Hosting Waterbirds: All other stream reaches."

In their plate No. 11-7, page 13, Okamoto et al. indicated that their study extended from Loko Waimaluhia reservoir downslope to Kaneohe Bay.

Walker et al. (1978) and the U.S. Fish & Wildlife Service (1985) presented historical information on the endangered Hawaiian waterbirds and proposed methods for increasing the numbers of each species so that they could be removed from the endangered category. They discussed important waterbird habitat on each island (e.g., Nuupia Ponds and Waipio Peninsula on Oahu) and they proposed that State and Federal biologists "provide technical assistance to landowners or agencies of public lands to allow for the protection and enhancement of waterbird habitat values within constraints of primary use of the area; Ho'omaluhia reservoir was last in a list of nine potential areas on Oahu. These authors also point out, since 1939 (when hunting of ducks was banned), the two greatest limiting factors for the endangered waterbirds were: 1. the decrease in habitat because of human development, and 2. the depredations of introduced predators. The latter include the small Indian mongoose (Herpestes auropunctatus), roof rat (Rattus rattus), Polynesian rat (Rattus exulans), Norway rat (Rattus norvegicus), house mouse (Mus musculus), feral cat (Felis catus), and feral dog (Canis familiaris). To this list can be added the feral pig (Sus scrofa).

1. Koloa or Hawaiian Duck.

The Koloa was classified as a game bird until 1939, with a bag limit of 25 ducks per day. The species became extinct on Oahu during the 1950s. A Koloa restoration project was initiated at Pohakuloa, Hawaii, in 1972. As of April 1979, 347 captive-raised Koloa had been released on Oahu: 199 birds at Kawainui swamp, 103 at Waimea Falls Park, and 45 at Nuupia Pond on the Kaneohe Marine Corps Air Station. Birds from these release sites spread to the James Campbell National Wildlife Refuge at Kahuku and to Punahoolapa marsh. During 1982, 38 Koloa were released at Ho'omaluhia park. A biologist at the park told me on June 13, 1983, that they thought that young ducks had been raised successfully during 1982 and 1983, but that they usually see only 5 or 6 ducks at the reservoir. On September 25, 1986, I talked with Ms. Martha McDaniel at the park office, who said that she thought that there was one pair of Koloa on the reservoir. Two Koloa were counted on the reservoir during the July 29, 1986, summer survey by personnel of the State Division of Forestry & Wildlife. Hence, it is obvious that the Koloa spread out from their release sites to habitats that they find more suitable. I did not happen to see any Koloa (or any other species of Hawaiian waterbird) on the Loko Waimaluhia reservoir on September 25, 1986.

In order to increase the populations of the Koloa and the other Hawaiian waterbirds, successful reproduction is essential. Because of the presence of two aquatic predators

C-3

in the reservoir, the reservoir does not have a promising future for successful reproductive seasons. Both the introduced bullfrog and the large channel catfish prey on the downy young of any waterbirds that hatch. The small Indian mongoose and feral cats and dogs also prey on the young birds.

In any event, there is no evidence that the Koloa (or any other Hawaiian waterbird) inhabits any of the 'Iolani School project lands.

2. Hawaiian Coot

The endemic coot is a subspecies of the North American coot that has an extensive breeding range from Canada southward to Panama. Eight coots were recorded at the reservoir during the July 29, 1986, State waterbird census; I saw none there on September 25, 1986. These coots undoubtedly were using the reservoir for feeding and "loafing." I say this because coots inhabit ponds and marshes that have emergent vegetation, which they use for feeding, hiding, and nesting. There is almost no emergent vegetation in the reservoir that the birds could use. Coots do require deeper water than gallinules, in part because they build large, floating nests of aquatic vegetation. The same predators prey on the downy young coots as on the Koloa and gallinule: mongoose, feral dogs and cats, bullfrog, catfish, bass, black-crowned night heron, and, presumably, the cattle egret. Again, there is no suitable habitat for coots on the 'Iolani School lands.

3. Hawaiian gallinule and Hawaiian stilt

I know of no records of the occurrence of these

waterbirds anywhere near the project site (see Landgraf, et. al., 1986).

4. Pueo or Hawaiian Owl (Asio flammeus sandwichensis).

The Pueo is a permanent resident on all main islands in the Hawaiian chain. The birds occur from sea level to at least 8,000 feet on Mauna Loa and Mauna Kea on theisland of Hawaii, and the birds are tolerant of wide climatic conditions (Richardson and Bowles, 1964). The Division of Forestry and Wildlife considers the Pueo to be an endangered species on the island of Oahu but not on the other islands. The Pueo differs from most other owls in that it is diurnal in habit; hence, they are seen much more often than is the nocturnal barn owl (Tyto alba). Scott,et al. (in press) wrote that the Pueo "was most often in grasslands, shrublands, and montane-parklands. Less frequently, it was seen quartering low over the canopy of closed forests."

The usual prey of the Pueo consists of mice and rats. Owls swallow small prey whole, later regurgitating pellets containing hair and bones.

The Pueo is listed as a bird that has been seen at Ho'omaluhia park, although I have never seen it there or in any other part of leeward Oahu during a considerable amount of field work on the windward side of the Pali. The owls forage over a large area and it is my firm conviction that the proposed project would not have any adverse effects on the owl.

II. Indigenous Birds

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

1. Black-crowned night heron (Nycticorax n. hoactli)

The 'Auku'u is considered to be an indigenous, rather than an endemic, species because the Hawaiian birds have not been recognized as subspecifically distinct from North American birds. Hence, it is not classified as endangered or threatened even though its fate depends upon the preservation of suitable wetlands. I did not see any herons during my field trips to the study area (including the park), but two birds were reported on the July 29, 1986, waterbird census. Although the herons feed predominantly on aquatic insects, fish, frogs, and mice, they also sometimes prey on the downy young of terns and probably on the downy young of the endangered Hawaiian waterbirds. The heron does not inhabit the project site.

2. Golden plover (Pluvialis dominica fulva)

This "shorebird" nests in Alaska and Siberia. In Hawaii these birds winter from sea level to elevations as great as 10,000 feet on the island of Hawaii. The birds frequent lawns

in residential areas, golf courses, weedy pastures, open areas in the mountains, cane haul roads, and mud flats along the coast. They are common in the grassy areas of Ho'omaluhia but do not occur in forested areas or in the project region.

III. Introduced or Alien Birds

More than 170 species of alien birds have been intentionally released in the Hawaiian Islands since about 1800 (Berger, 1981a). Approximately 50 species have established breeding populations in the islands. The following species occur on the 'Iolani School lands and adjacent areas, including Ho'omaluhia park.

A. Order Ciconiiformes

Family Ardeidiae, herons and egrets

1. Cattle Egret (Bubulcus ibis)

This species was imported to Hawaii from Florida to aid "in the battle to control house flies, horn flies, and other flies that damage hides and cause lower weight gains in cattle" (Breese, 1959). A number of cattle egrets were released on Oahu in 1959 and 22 additional birds were released during July 1961. A total of 656 cattle egrets were counted on Oahu during the annual Christmas Count of the Hawaii Audubon Society on December 22, 1985 (Pyle, 1986), and 621 birds were reported on Oahu during January 1986 (Landgraf, et a., 1986). Cattle egrets sometimes forage for food in the park but they do not occur in forested areas. As pointed out earlier, it is suspected that they prey on the young of waterbirds.

B. Order Columbiformes

Family Columbidae, Pigeons and Doves

2. Lace-necked or Spotted Dove (Streptopelia chinensis)

This Asian dove was introduced into the Hawaiian Islands at an early date; the exact date is unknown, but the birds are said to have been very common on Oahu by 1879 (Caum, 1933). The species is still common on all of the islands and is classified as a game bird in Hawaii. Although this species occurs where rainfall exceeds 100 inches per year, the highest densities are found in drier areas where the introduced koa haole or kiawe (mesquite) is one of the dominant plants. Schwartz and Schwartz (1949), for example reported densities as great as 200 birds per square mile in dry areas on Molokai. This large dove does not inhabit forested areas but is common in open areas throughout the windward coast of Oahu.

3. Barred Dove (Geopelia striata)

This species is known as the Zebra dove in its native range in Australia. This dove is said to have been introduced to Hawaii sometimes after 1922 (Bryan, 1958). It now is common to abundant on all of the islands. The Barred dove also prefers drier areas where weed seeds are abundant. Schwartz and Schwartz (1949) reported densities as high as 400 to 800 birds per square mile in some areas on Oahu (e.g., Barber's Point to Makaha). This is an abundant species throughout the study area and in adjacent open areas.

C. Order Strigiformes

Family Tytonidae, Barn Owls

4. Barn Owl (Tyto alba pratincola)

The first barn owls were imported from California and released on Hawaii island in 1958. Birds were released at Hauula, Oahu, on two later occasions. Seven birds were imported from the San Diego Zoo and released during September 1959; 11 additional owls were imported from the San Antonio Texas Zoo and released during October 1960 (Tomich, 1962). The barn owls were introduced in the hopes that they would prey upon rats that were causing losses in sugarcane fields. Few studies of the food habits of the barn owl in Hawaii have been conducted, although one study on the island of Hawaii revealed that about 90 percent of the food consisted of house mice (Tomich, 1971). Byrd and Telfer (1980) reported that barn owls had killed more than 100 seabirds and their chicks on Kauai and on Kaula Island. In writing about the winter diet of a barn owl in Missouri, Fritzell and Thorne (1984) said that passerine birds were found in 98 percent of pellets and that only 10 percent had the remains of mice.

Barn owls are nocturnal in habits and I have never seen one during my daytime field work in windward Oahu. There are reports at the park, however, that barn owls have been seen in that region; Their occurrence there is irrelevant to an environmental assessment.

D. Order Passeriformes

Family Timaliidae, Babblers and Laughing-thrushes

5. Melodious Laughing-thrush (Garrulax canorus)

This species has long been called the Chinese thrush or Hwa-mei in Hawaii. It is, however, a member of the babbler family rather than the thrush family. It was introduced to Hawaii many years ago as a popular cage bird. "A number obtained their freedom at the time of the great fire in the Oriental quarter of Honolulu in 1900, and took to the hills behind the city" (Caum, 1933). No detailed study of this babbler has been made on Oahu, so that little is known about its distribution or abundance (Berger, 1981a). It now occurs, however, in both the Waianae and Koolau mountains. It seems to prefer the wetter areas where there are thickets and clumps of vegetation. The birds have a loud, attractive song, and they are more often heard than seen. This laughing-thrush is widely distributed along the Pali and I heard several birds sing and call from the more wooded areas of the project site.

Family Pcynonotidae, Bulbuls

6. Red-vented Bulbul (Pycnonotus cafer)

The source of these birds in Hawaii is unknown. The members of this family are included in the "prohibited entry" list of the State Department of Agriculture, although this bulbul is now a common species on Oahu. Several birds were first reported on the Oahu Plantation at Waipahu in 1966 (Elepaio, 27:55); by June of the following year, birds were seen near Fort Shafter, in Kailua, and at the Bellows Air Force Station

(Berger, 1981a). Berger (1975a) summarized the distribution and spread of this bulbul on Oahu as of 1975. More than 1,000 Red-vented bulbuls were counted on the Audubon Society's 1980 Christmas count; 1,972 birds were recorded on the December 1985 count (Pyle, 1986). This bulbul was the most conspicuous species seen and heard during my field studies. Bulbuls are largely fruit eaters so that they often become pests in fruit growing areas.

Family Turdidae, Thrushes and Bluebirds

7. Shama (Copsychus malabaricus)

According to Caum (1933), this attractive thrush was first released on Oahu by the Hui Manu in 1932; Bryan (1958) said that this species was introduced to Kauai in 1931 and that it was established on that island and in the Tantalus region of Oahu. Although no study has been made of the distribution of this thrush on Oahu, it now is widely distributed on both sides of the Koolau Range. The birds are noted both for their attractive plumage and for their beautiful singing. Shama thrushes typically prefer dense vegetation, and they are more often heard than seen. In areas frequented by people (for example, Paradise Park), however, the birds often perch in full view. The Shama is found throughout the vegetated slopes on the windward side of the Pali.

Family Sylviidae, Old World Warblers

8. Japanese Bush Warbler (Cettia diphone cantans)

This warbler, which is native to Japan and Formosa, was first released on Oahu in 1929. No detailed study of this species has ever been made in Hawaii, but it is now found in scattered areas in both the Waianae and the Koolau mountain ranges, where the birds prefer dense undergrowth in moderate to very wet areas (Berger, 1975b). The birds are very conspicuous during the period of the year when they are singing (generally January to mid-July) and very inconspicuous when they are not singing. The bush warbler inhabits the thickets in the project site and adjacent areas.

Family Zosteropidae, White-eyes and Silver-eyes

9. Japanese White-eye (Zosterops japonicus)

Caum (1933) wrote that the Japanese White-eye was first imported from Japan to Oahu by the Territorial Board of Agriculture and Forestry in 1929. Later importations were made by the Hui Manu and by private individuals. The White-eye rivals the House Sparrow and the European Starling in North America as successful exotic species, and the White-eye undoubtedly is the most common passerine species in Hawaii. It is found from sea level to tree line (on Maui and Hawaii) and it is found in the driest and the wettest habitats in the Hawaiian Islands. The Japanese White-eye is an abundant bird throughout the region.

Family Sturnidae, Starlings and Mynas

10. Common Indian Myna (Acridotheres tristis)

This myna is native to Ceylon, India, Nepal, and

adjacent regions. It was introduced from India in 1865 by Dr. William Hillebrand to combat the plague of army worms that was ravaging the pasture lands of the islands. It has spread and multiplied to an amazing extent; reported to be abundant in Honolulu in 1879, it is now extremely common throughout the territory" (Caum, 1933). The myna is still common to abundant in lowland areas, being most common in residential and urban areas as well as in the vicinity of human habitation in rural areas. Mynas occur in the park, in some of the project sites, and around the edges of the banana patches.

Family Ploceidae, Weaverbirds and Their Allies

11. Ricebird or Spotted Munia (Lonchura punctulata)

This Asian species was released in Hawaii by Dr. William Hillebrand about 1865 (Caum, 1933). Caum wrote that the ricebird "feeds on the seeds of weeds and grasses and does considerable damage to green rice." Although rice is no longer grown in Hawaii, the ricebird has become a serious pest by eating the seeds of sorghum (see House Finch for details). Ricebirds are common in open areas where there are weed seeds or grains, such as along roads and the edges of banana patches. They are common in the general areas but they do not occur in the heavily vegetated parts of the project site.

12. House Sparrow (Passer domesticus).

The House Sparrow (also called the English Sparrow) was first imported to Oahu in 1871 when nine birds were brought from New Zealand (where the species had previously been imported

from England). Caum (1933) wrote that "whether or not there were further importations is not known, but the species was reported to be numerous in Honolulu in 1879." The House Sparrow in North America (first intoduced to Brooklyn, New York, in 1852) became a serious pest and tens of thousands of dollars were spent in attempts to control the population--without much success. The sparrow apparently never became a serious pest in Hawaii; it is omnivorous in diet, eating weed seeds as well as insects and their larvae; therefore, they are partially beneficial in food habits. House Sparrows are associates of man and his buildings, so that the birds are uncommon in the project area.

Family Fringillidae, Cardinals and Buntings

13. Red-crested Cardinal (Paroaria coronata)

This species has long been called the Brazilian Cardinal in Hawaii, but its native range also includes Paraguay, Uroguay, and parts of Bolivia and Argentina. The species was released several times between 1928 and 1931 (Caum, 1933). This cardinal is very common on Oahu and small numbers inhabit Ho'omaluhia. Basically, however, it is a bird of residential areas and of open regions with scattered trees and shrubs in rural areas.

14. Cardinal (Cardinalis cardinalis)

This is the Virginia Cardinal, Kentucky Cardinal, and the Kentucky Redbird in the eastern part of North America. The Cardinal was released several times in Hawaii between 1929 and 1931 (Caum, 1933). This species is a common bird in

urban and rural areas and in both wet and dry areas of Oahu, and it is widely distributed in the project region.

15. House Finch (Carpodacus mexicanus frontalis)

The House Finch was introduced to Oahu from California "prior to 1870, probably from San Francisco" (Caum, 1933). The House Finch now is an abundant species on all of the islands, and probably is the second most common song bird in the islands. Although they sometimes eat overripe papaya and other soft fruit (hence the vernacular name of Papayabird), the House Finch is predominantly a seed eater. House Finches and Spotted Munias caused great damage to experimental crops of sorghum on Hawaii and Kauai during 1971 and 1972. A report by the Senate Committee on Ecology, Environment, and Recreation reported that "ricebirds and linnets [House Finches] caused a 30 to 50 percent loss in the sorghum fields at Kilauea on Kauai last year . . . . seed-eating birds at Kohala ate 50 tons of sorghum grains in a 30-acre experimental field that was supposed to produce 60 tons" (Honolulu Advertiser, March 14, 1972, page B-2). The House Finch is a common bird throughout the project area, and, indeed, in all of windward Oahu. Hence, "there are now five species of seed-eating birds on the island of Oahu that will make the growing of small grain crops nearly impossible: House Finch, Spotted Munia, and in other regions of the island, Red-eared Waxbill (Estrilda troglodytes), Black-headed Munia (Lonchura malacca atricapilla), and Java Sparrow (Padda oryzivora).

C-9

The Mammals

I. Endemic Mammals

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

II. Introduced Mammals

1. Pigs (Sus scrofa)

Pigs were first brought to the islands by the early Polynesian settlers; later, the English released European pigs (Tomich, 1969). Feral pigs have been responsible for the destruction of native forests for the past 200 years. Pig trails and droppings are common in some of the stream beds that drain this windward slope of the Pali. Mueller-Dombois et al. (1981: 310) noted that "in the Kilauea forest [on Hawaii], the effect of feral pigs is very noticeable." They added (page 316): "There is little doubt that the widespread pig digging in the Kilauea forest has been a major factor in reducing the native ground-cover vegetation. The present total cover was estimated as only 7.7 percent. . . . Pig digging undoubtedly has an effect on the invasion of exotic plant species."

2. Other Introduced Mammals

All of the other introduced species of mammals have proven highly detrimental to man, his buildings, products,

agricultural crops and/or to the native birdlife. None is an endangered species and none are of concern as far as an environmental assessment is concerned. In fact, it would be a great boon to the islands if it were possible to exterminate all of them.

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

Summary and Conclusions

1. The majority of the vegetation in the project site and on adjacent lands consists predominantly of introduced trees, shrubs, vines, grasses, and ferns. There is no semblance of any endemic ecosystem.
2. There are no endemic forest birds at the project site.
3. Although several species of endemic Hawaiian waterbirds are found in small numbers on Lake Waimaluhia in Ho'omaluhia park, the lake does not provide suitable habitat for the reproduction of these species. First, there is very little emergent vegetation to provide safe nesting places for these aquatic birds. Second, both the bullfrog and the channel catfish eat the downy young of these birds. Finally, there is no suitable habitat for these waterbirds on the 'Iolani School lands.
4. The proposed project would have no adverse effects on the night heron or the golden plover.
5. None of the 15 species of introduced or alien birds found in the project area is an endangered species and a number have proven to be serious pests to agriculture in Hawaii. The destruction to sorghum crops by the Spotted Munia and the House Finch already has been mentioned. The doves and the Myna have been implicated in spreading the seeds of such noxious plants as Lantana camara. The Red-vented Bulbul and the Japanese White-eye cause considerable damage to ornamental flowers and to fruit crops (see Keffer et al., 1976).

The Barn Owl has been reported to kill seabirds on Kauai, and the Cattle Egret is suspected of killing the downy young of the waterbirds.

To be sure, some of the introduced bird species apparently cause no damage to crops or to the endemic birds, and their presence provides pleasure to many people. The proposed project might actually provide habitat for more of the introduced bird species.

6. All of the land mammals that occur in the project region are introduced alien animals. Most of them are predators on birds and several are destructive to agriculture and forest lands and/or to man and his buildings. None of these mammals is of concern in this environmental assessment.

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APPENDIX D

Archaeological Inventory Survey of an Inland Parcel
Kaneohe-Kailua, Oahu, Hawaii

ARCHAEOLOGICAL INVENTORY SVRVEY
OF AN INLAND PARCEL, KANEOHE-KAILUA,
OAHU, HAWAII

by

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September 1986

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ABSTRACT

An archaeological inventory survey was conducted on a 200 acre parcel located inland near the base of the Pali within Kaneohe and Kailua ahupua'a on the windward side of Oahu. Concurrently, historical background research was conducted to provide an early historical perspective on traditional land use practices as well as documentation of other post-contact and recent land use on the parcel. The project was carried out at the request of OHM, Inc., a Honolulu land use and environmental planning firm. A golf course is presently being planned for the parcel by Nitto Kogyo Co., Ltd. Iolani School holds title to the parcel.

The historical study provided no evidence suggestive of the parcel's importance for habitation, agriculture, or other activities by traditional Hawaiian communities. The earliest significant use of the parcel occurs after the turn of century when commercial activities develop. Between 1912 and 1914 a pineapple plantation was started in a large area, and shortly afterward another segment began to be used for grazing dairy cattle. Land used for truck farming is also documented in the 1920's. Historic photographs enabled the compilation of a detailed historical land use map accurately depicting the area affected by these activities.

The archaeological survey confirmed historical findings, locating only four small sites of which at least two are probably historic. These sites include a small terrace complex, two charcoal kilns or seepage wells, a habitation complex, and a rock wall. In addition, four possible site locations were noted. Due to extremely heavy vegetation, further fieldwork will be needed to determine whether or not these locations, consisting mostly of small stone alignments, are actually sites or just natural features.

The archaeological investigations are briefly discussed in terms of findings in adjacent areas. It is noted that much of upland Kaneohe ahupua'a has now been surveyed. Recommendations are given in a final section for further field and historical investigations to evaluate site significance and to mitigate adverse impacts that will be caused by the proposed golf course construction.

ACKNOWLEDGEMENTS

The authors wish to acknowledge and thank a number of people who have provided valuable assistance to the present investigation. Mrs. Agnes Griffin, Ms. Martha Yent, Mr. Earl Neller, Mr. Wendall Kam, and Dr. Ross Cordy of the State Historic Preservation Office helped us in many ways. We are especially indebted to Ms. Carol Silva, who translated several documents for this report. Mr. Charles Okino of the State Survey Division located early maps of the project area, which greatly aided our research. Mr. Salwyn Chinn, U.S.G.S. Water Resources Division, greatly contributed to our investigation by conserving and making available to us early aerial photographs of Kaneohe and Kailua ahupua'a. We are grateful for the help provided by the Bishop Museum photo collection personnel, the library staff, and the geography division. We wish also to thank the personnel of the State Archives, who spent many hours collecting and filing research material which we examined. Additionally, we acknowledge and thank the personnel of the Hawaii-Pacific Collection of Hamilton Library, who located a number of military photographs for us to examine. Ms. Eileen Root of the Kaneohe Library also enormously helped us with that library's valuable collection of early photographs and documents pertaining to the history of windward Oahu. We would further like to thank Ms. Jane Allen and Mr. Charles Streck, who shared with us information from their research in the vicinity of the project area, and also Mr. Ande Beggerly, who assisted in the production of the land use map. We would especially like to thank Mr. Tom Sakamoto, who has lived adjacent to the project area since the 1920's, and who shared many of his memories with us. Our sincerest thanks to all of those who have been involved in this study.

LIST OF FIGURES

PHOTOGRAPHS

BACKGROUND

Introduction

An archaeological site inventory survey was conducted on a portion of Iolani School lands on the windward side of Oahu. Tax Map Keys for these land parcels are 4-5-42:1 and 4-5-42:6. Spread over both Kaneohe and Kailua ahupua'a in the district of Koolau Poko, the project area is bordered by the Pali foothills, the old Pali Road, Hoomaluhia Park, and Likelike Highway (see maps, Figures 1 and 2). A private golf course development is currently being proposed by Nitto Kogyo Co., Ltd. for the northeast corner of the parcels. Preparation of an Environmental Impact Statement (E.I.S.) is being undertaken by DHM, Inc. The firm of J. Stephen Athens, Ph.D., was contracted to carry out preliminary archaeological studies. These included both a surface site inventory and an investigation of history and land use on the affected parcels.

Principal Investigator for the project was J. Stephen Athens. Kanalei Shun served as the Field Director and Jeffrey Yamauchi, B.A., was Field Assistant. Patricia Price-Beggerly undertook the historical investigations, which included informant interviews. The land-use study was initiated prior to fieldwork in order to provide guidance and background information for the field investigations. A brief preliminary report (Shun et al. 1986), summarizing the results of both field and historical investigations, was prepared immediately upon completion of fieldwork.

The present report will provide full descriptive details of all investigations. Kanalei Shun was primarily responsible for preparation of the sections concerning the field investigations, while Patricia Price-Beggerly wrote the section on historical land use. J. Stephen Athens drafted the section dealing with the recommendations. The concluding section is the combined effort of all three authors. Drafting was undertaken by Patricia Spears.

Scope of Work

Archaeological field investigations were aimed at obtaining a complete inventory of all surface remains of potentially significant archaeological and historical sites. All investigations and the preparation of this report were done in conformance with standards established by the Society for Hawaiian Archaeology's "Minimum Requirements for Reconnaissance Survey". These requirements call for a surface survey of a

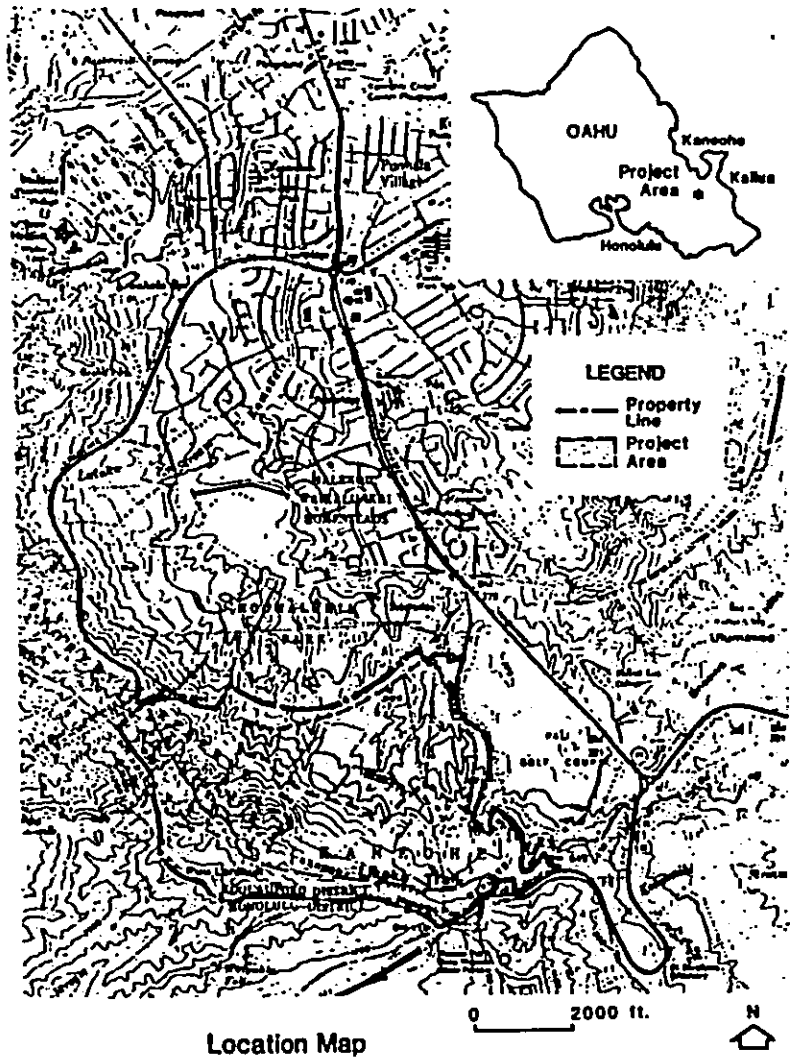

Figure 1. U.S.G.S. quad map showing location of project area (shaded). From DHM, Inc.

project area in order to (1) determine the presence/absence and general nature of archaeological remains, (2) arrive at a preliminary evaluation of these remains and determine whether further archaeological investigations are necessary, and (3) record data from those sites that do not warrant further work.

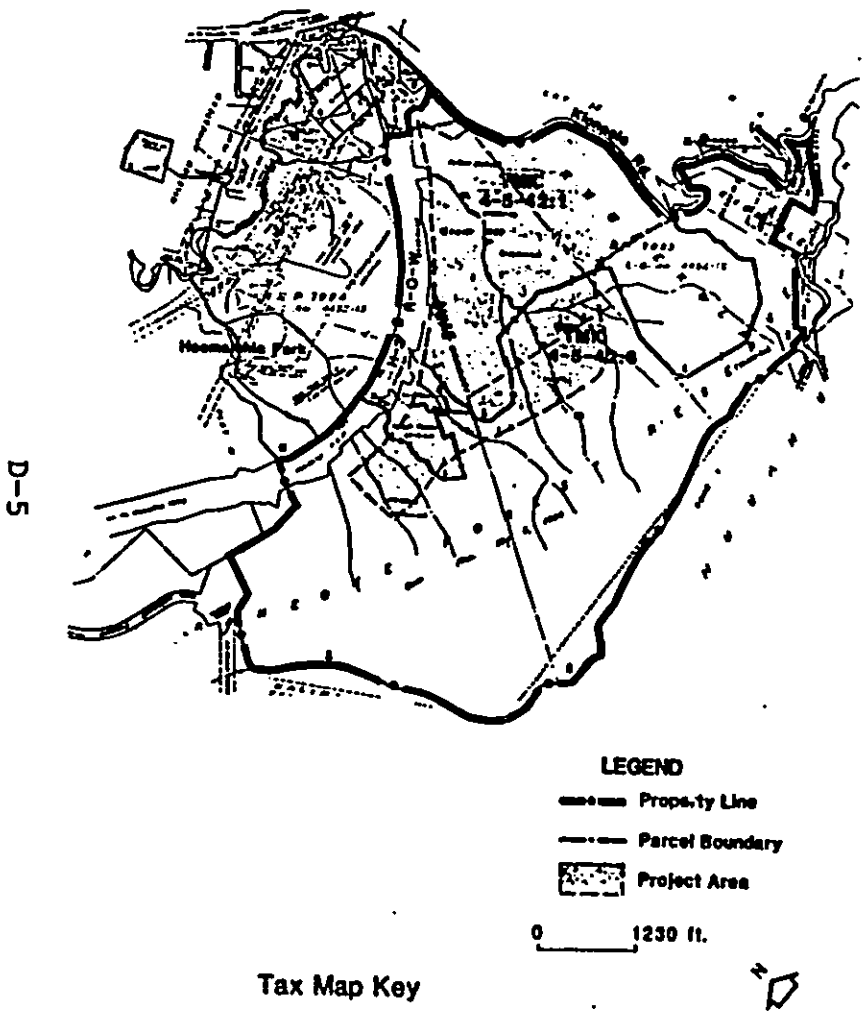

Figure 2. Tax Map Key of project area (shaded). From DHM, Inc.

THE PROJECT AREA

Physical Setting

The proposed golf course development project encompasses some 200 acres of land. The project area is bounded on the east by Kionaole Road, which is the Old Pali Road (Figures 1 and 2). The western boundary lies approximately between two upper tributaries of Hooleinawa Stream. The 500-feet contour lines roughly define the southern boundary. The northern edge of the project area lies just outside, ranging from 50 to 100 feet (15 to 30 meters), of the upper edge of the H-3 (Alternative A) right-of-way. The lower elevations in the project area average approximately 300 feet above sea level. Photograph 1 provides an overview of the project area taken from the Pali lookout (all photographs have been placed at the end of this report).

The project area is heavily dissected by a number of narrow and steeply-sloped gullies and stream beds and drain into Hooleinawa and Kamooalii Streams. The terrain is by and large very rugged, making field investigations quite strenuous. Photograph 2 shows an aerial view of the project area taken in 1972.

At the present time there are a number of wooden houses on a leased area at the southeast section of the project parcel. One of the houses is the residence of the caretaker. Elsewhere in the project area there are no residences or on-going agricultural activities.

Vegetation

Vegetation in the project area was extremely dense and in some areas it may have hindered the recognition of archaeological sites. The vegetation may be generally characterized as consisting of very mixed plant communities. Three vegetation zones were discernable.

The first zone consisted of the very upper and southern margins of the project parcel, beginning around the 450/475-foot contour lines. This zone contained very little relatively flat ground and was largely dominated by forest type vegetation of hau (Hibiscus tiliaceus L.), guava (Psidium guajava L.), strawberry guava (Psidium cattleianum Sabine), mountain apple (Eugenia malaccensis L.), and screw pine pandanus or hala (Pandanus odoratissimus Lindl.). Several patches of coffee (Rubiacese), were observed in the western half. Native cotton

(Gossypium tomentosum Nutt.) was noted as an isolate. Ground cover was minimal and when present, consisted mostly of several unidentified fern (with the exception of lauae, Microsorium scolopendria [Burm.] Copel) and grass species and/or torch ginger (Zingiberaceae).

The second vegetation zone had several relatively flat areas and consisted of the sections west of Hooleinawa Stream below roughly the 475-foot contour lines. This zone also included Hooleinawa Stream's alluvial flats. The same suites of plant communities as above dominated in the gullies and stream valleys. In the relatively flat areas, above the gullies and stream-beds, the vegetation consisted mostly of false staghorn fern (Dicranopteris linearis Burm.) and other unidentified fern and grass species. The staghorn grew to heights of over 2 meters. Ohia-lehua (Metrosideros collina [Forst.] Gray subsp. polymorpha [Gaud.] Rock) and naupaka-kuahiwi (Scaevola gaudichaudiana Cham.) were also observed in these areas.

In the third zone, those sections east of Hooleinawa Stream, the same woody plants as above were again dominant in the gullies and stream valleys draining into Kamooalii Stream; however, christmas berry (Schinus terebinthifolius Raddi), rose apple (Eugenia jambos L.), and african tulip (Spathodea campanulata Beauv.) were also present. The ground cover in these low lying areas consisted mostly of unidentified grass and fern species. Ape (Alocasia macrorrhiza [L.] Schott) were observed growing along the edges and in the stream bed of the lower reaches of Kamooalii Stream. In the relatively flat areas above the gullies and stream valleys and in the gullies at the eastern extremities of the project area, a mixed community of grasses (most likely a Panicum sp.), unidentified ferns, thimbleberry (Robus rosaefolius Sm.) and sensitive plant (Mimosa pudica L.) has taken over the vegetation cover. The grasses often reached heights of over one meter.

Mango (Mangifera indica L.) and java plum (Eugenia cuminii L.) trees specked the project area either singularly or in groves, being restricted to no particular zone. The extremely large size of the mango trees indicated that they have been around for some time. Other plants scattered throughout the project area either in isolation or in patches were ti (Cordyline terminalis [L.] Kunth), kukui (Aleurites moluccana [L.] Willd.), banana (Musa spp.), royal palm (Roystonia regia [HBK.] Cook), bird of paradise (Strelitzia reginae Banks), wild orchid (Arundina bambusifolia Lindl.), Clidemia hirta (L.) D. Don, and Heliconia spp.

Vegetation in the project area reflects plant species of both the prehistoric and post-contact periods in Hawaii. Neal (1965) states that hau, hala, ti, ohia-lehua, kukui, mountain

apple, and probably naupaka-kuahiwi were used as economic plants by the indigenous Hawaiians. In former times, the Hawaiians ate ape as a famine food (Neal 1965:156). Some banana species in the project area may also be native though no such determination was made in the field.

Grasses and ferns usually take over after forest clearing. The panicum grass is a post-contact introduction used as stock feed and its dominance in the eastern section of the project parcel is most probably directly related to the use of the area for cattle grazing. Guava and strawberry guava are post-contact plants. Their presence in the upper sections of the project parcel may be due to their hardy nature, enabling their establishment over the more fragile native flora. The rest of the plants in the project area were introduced after contact either as commercial cultigens (e.g. coffee) or as ornamentals (e.g. bird of paradise).

Previous Archaeological Research

Rifford (1986) recently completed an annotated summary of previous archaeological investigations in the general area of the proposed golf course. Four of the references in this summary are directly relevant to the present project. Two of these include the investigations of Rosendahl (1976) and Streck 1982), who conducted archaeological fieldwork in areas just north of the present project parcel. The other references relate to a project conducted on an upland agricultural system in the Luluku area to the west. Two preliminary reports (Allen-Wheeler 1984, 1985) have resulted from this work but a final report has not been completed. All of these investigations, together with those of the present project, amount to almost continuous systematic archaeological coverage for the upper portion of Kaneohe ahupua'a.

Rosendahl (1976) brought together under one volume the archaeological investigations of several researchers from 1972 to 1975 in what is presently Hoomaluhia Park. These investigations involved archaeological survey, test excavations, and data recovery excavations. The southern edge of these projects is the lower (makai) edge of the H-3 (Alternative A) right-of-way, which borders Hoomaluhia Park.

In all, the investigations of Rosendahl's report located 30 previously unrecorded archaeological sites, several of which were discovered close to the southern boundary of their project area (Rosendahl 1976:1-4, Figure 3-4). These sites included charcoal kilns, terrace complexes, rock mounds and alignments, retaining walls, and an enclosure and stone platform (Rosendahl 1984:Table

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1-3). Sites 50-Oa-G5-56 and -57, both terraces complexes (McCoy and Sinoto 1976:3-19 to 3-20), were located closest to the H-3 right-of-way in an area just north of the present project parcel.

Streck (1982) conducted an archaeological reconnaisance survey on the H-3 Highway (Alternative A) right-of-way. The roughly 300-ft (90 m) right-of-way extended from Likelike Highway to Kamehameha Highway at the northeast corner of the present project area. In all, he identified 12 previously unrecorded archaeological sites or site complexes as well as 3 probable archaeological features. Of these sites, Streck indicates site 50-Oa-G5-78 (and a very small portion of site G5-79) and one probable feature (labelled as Possible #1) as extending south of the right-of-way, possibly into the northern extremities of the present project area. Site 50-Oa-G5-84 may also extend into the present project area pending confirmation of the exact ground location of the western boundary.

Site G5-78 is described as probably associated with agricultural activities. The site consisted of possible agricultural terraces and boulder alignments and two possible circular basalt-lined depressions (Streck 1982:7-8). Streck's probable feature of "possible agricultural areas" (1982:9), labelled as Possible #1, appears to be near the same location as McCoy and Sinoto's (1976) sites G5-56 and -57, which consist of terrace complexes; However, it was not possible to precisely correlate their maps, and it remains uncertain whether these are the same sites.

Attempts were made during the survey to relocate Streck's site G5-78. It was not encountered despite the careful attention given to relocating it. This may be due to the site having been originally incorrectly located. Streck (1982:2-3) cites several difficulties in the degree of accuracy in this site's location. On the other hand, the dense vegetation may have obscured the site completely during the present project.

HISTORICAL AND TRADITIONAL BACKGROUND RESEARCH

Introduction

The project area is situated within the two ahupua'a of Kane-'ohe and Kai-lua, District of Ko'olau Poko, Island of O'ahu, Hawai'i. Portions of the 'ili of Ka-ule-kole, and Ka-la-heo (apana 4), which are subdivisions of Kai-lua ahupua'a are found within the project area, along with a number of unnamed 'ili associated with Kane-'ohe ahupua'a.

Land unit designations such as those referred to above are extremely important in historical research due to the fact that until quite recently they were the units of recordation by government agencies regarding title and various other transactions. As such, there is often substantial information pertaining to rights of possession, economic pursuits, and traditional land use contained within these documents. Because ahupua'a and 'ili records comprise such a substantial portion of the data on which this study is based, a brief description of the traditional land system in Hawaii will be presented so that the historical context of the subsequent research findings may be fully appreciated.

Traditional Hawaiian Land Divisions

For purposes of management the Hawaiians divided each island into a number of units defined most frequently by geomorphological features such as a stream, a ravine, or a mountain ridge. The largest division of an island was a district or moku. Moku (districts) were divided for landholding and management purposes into ahupua'a and these were ruled by a chief or konohiki. The ideal form of an ahupua'a was that of a pie shaped wedge extending from the sea to the mountains. This arrangement afforded the inhabitants access to a wide variety of resource zones in the island environment.

Malo (1971) notes that the ahupua'a were divided into 'ili or 'ili 'aina which were further subdivided and re-subdivided into a number of smaller units of land. An 'ili which was contained within one geographical unit was termed an 'ili pu'a. However, if the 'ili was divided into several separate, non-contiguous subdivisions these divisions were designated as 'ili lele. One of these sections might be located along the coastline, a second in the lowlands with a third in the mountains. The designation 'apana 4' noted in the Introduction

above with respect to the 'ili of Ka-la-heo, indicates that only a lele of Ka-la-heo, part 4 in this case, lies within the project area.

A number of historical and traditional literature reviews pertaining to the ahupua'a of Kane-'ohe and Kai-lua have been produced in recent years (Cordy 1977, Devaney et al. 1976; Ewart and Tuggle 1977; Kelly 1976, 1979, 1980; Kelly n.d.; McCoy and Sinoto 1972). These reviews offer general knowledge regarding the ahupua'a and detailed information regarding the 'ili contained within the particular project area of their report. All of the reviews focus on land situated near the coastline or seaward of the present project. Most of the studies address lands which were intensively and extensively utilized by pre-contact Hawaiians as well as early European settlers. Because of this, these areas generally have abundant historical documentation. In contrast, the more marginally utilized areas tend to be less well documented in varying degrees.

The land ownership records, the 'chains of title,' and historical and traditional accounts contained in all the above mentioned reviews are relevant to the present study since they address the ahupua'a of Kane-'ohe and Kai-lua, illustrating changes taking place in the natural and cultural environments of areas adjacent to the present project. However, it would be redundant to reiterate the same general information here. This study, therefore, will concentrate on historical and traditional information concerning the specific project area (TMK 4-5-42:por. 1 & 6), focusing on changes of land use through time. General information regarding the two ahupua'a will be limited to a brief overview.

This study is organized chronologically to emphasize the interrelationships among changes in vegetation, geomorphology, land use, and land ownership as it is reflected in traditional legends and historical documents. Identification and examination of the environmental aspects of these relationships is particularly important to archaeological research since evidence for the alteration of the landscape may be an important clue for determining the distribution and nature of prehistoric and historic cultural activities, locations of sites, and other details. In addition, this study will be concerned with the documentation of specific loci of habitation and land use in so far as these may be determinable from the documentary sources.

Tradition and Legends: Pre-A.D. 1778

Traditional information regarding Kai-lua and Kane-'ohe has been noted in the previously cited research. Unfortunately, legends associated specifically with the project area are limited. One traditional account, however, does offer insight into pre-contact vegetation patterns. It will be used as a base line to demonstrate how land use associated with European economic practices changed the ancient landscape.

The traditional accounts relate that the plain between the Old Pali Road and Kane-'ohe in the 'ili of Ka-ule-kola is the site of a rivalry between two young men over the love of a young girl (Sterling and Summers 1978). This plain is identified as the location of the sacred hala (Pandanus sp.) grove of Kekele. Kekele was the wife of the famous Kai-lua born, supernaturally strong, trickster, Kaulu. Kaulu is said to have been a voyager who visited distant lands and brought to Hawaii the edible soil of Ka-wai Nui (Beckwith 1976:440). An account of the hala grove is provided by Fornander (quoted in Sterling and Summers 1978):

> . . . when Kaulu took unto himself a wife, Kekele by name. Kekele was a very handsome woman whose breath and skin were as sweet as the inamona. She was a very quiet woman. Her favorite flowers and vines were the hala, maile, ieie and all the fragrant leaves. When she retired at night she used to sleep with her hala wreaths and would wear them until they were dried up; therefore the hala at Kekele was planted for her and it grows to this day.

European Contact and the Hawaiian Bill of Rights: 1778-1839

At the time of European contact the eight main islands of Hawaii were divided into independent polities. By right of conquest, each paramount chief held ownership over all the lands within his jurisdiction. Upon obtaining lands a paramount chief would select those lands which he desired and then divide the remaining lands among chiefs who had rendered him assistance. These chiefs, after retaining a portion for themselves, divided the remainder of the land among the lesser chiefs, and they in turn did likewise to the tenant-commoners who were their supporters. These allotments were on a revocable basis and it was not unusual for a paramount chief or lesser chief to give or take away land without explanation (Chinen 1966).

When King Ka-mehameha I united all the islands under his control at the beginning of the nineteenth century, he used the land system already in existence for dividing and distributing parcels. With few exceptions this system was continued by his son, Liholiho, King Ka-mehameha II. By the time Kauikeaouli, King Ka-mehameha III, ascended the throne, there was a large foreign population in the islands. Many of these residents had acquired land through gifts from the King, but were unsure whether they would retain it from day to day. Don Francisco de Paula Marin, a trusted retainer of Ka-mehameha I, included several entries in his journal indicating that he had either received land or had had it unexpectedly revoked by the king (Conrad 1973).

Eventually, many of the foreigners, who were accustomed to possessing land in fee simple, challenged the rights of the king and chiefs to arbitrarily dispossess them. This challenge eventually led Ka-mehameha III to initiate land reform, and this resulted in the Bill of Rights of 1839. This bill secured protection to all people and to their property, which now could not be taken from them except by provision of the law. The bill and a series of acts passed by the government in the next two decades ushered in a new era of government and unrevocable private ownership of property.

The earliest historical evidence concerning the ownership of the ahupua'a of Kai-lua and Kane-'ohe, where the project is located, was recorded by Ii (1959). In his history of Hawai'i, Ii presents a list of the lands which Ka-mehameha I gave to his followers after conquering O'ahu at the beginning of the 19th century. Both Kai-lua and Kane-'ohe ahupua'a are absent from the list. Although the evidence is not unequivocal, the list does suggest that Ka-mehameha retained these lands for himself.

The physical description of the project area at that time is unknown. A number of Europeans visted the Nu'u-anu Pali in the early 1800s and descended to the windward side of O'ahu, but few recorded a description of the project area. The difficulties encountered along the trail were considerable, and the accounts of travellers concentrate on the harrowing experience of their descent rather than on accounts of the windward landscape. An exception to this preoccupation with the physical difficulty of the trip is offered by the missionary Hiram Bingham. He and A. Thurston visited the Kane-'ohe area ca. 1820 and recorded the following glimpse of vegetation present in the vicinity of the project area:

> . . . the enclosed area, now the place of streams, green hills and lawns. . .
>
> . . . we descended into the valley beyond the dense wood at the foot of the precipice. . .(Bingham 1848:130).

Personal Property is Established: 1840-1860

As noted above, the Bill of Rights of 1839 provided protection from seizure of property without legal recourse. Additional actions of the King and his Council established a Constitutional Monarchy, a constitution, a legislative body consisting of nobles and common people, and a supreme court. An important feature of this new government was a declaration that although all the land belonged to the King it was not his own private property.

One of the most important steps in the evolution of the system of land tenure was the enactment of the Statute of December 10, 1845 which established the Board of Commissioners to Quiet Land Titles. One of the functions of this board was to settle land disputes. Thus all persons with claims to interests in lands were required to present their claims to the Commissioners. In the preface to its "Principles" the Commission declared that three classes of persons had vested rights to the land; the government (King), the landlord (chiefs and konohiki), and the tenant. During the first few years of its existence the Land Commission handled claims mainly for leasehold interest.

The major division of the lands did not occur until after completion of the Great Mahele of 1848 which divided the land between the King (Crown Lands), the Government, and the Chiefs; the Resolution of the Privy Council, December 21, 1849, which allowed the Land Commission to award fee simple titles to all native tenants who occupied and improved any portion of Crown, Government or Konohiki Lands; the passage of the Act of July 10, 1850, authorizing the sale of lands in fee simple to resident aliens; and the Act of August 6, 1850, authorizing the award of kuleanas to native tenants.

During the 1840s-1860s land title was obtained within the project area through several means: the designation of Government Land, a Mahele Claim, a purchase of Government Land, rights of inheritance, and land sales.

At the time of the Mahele of 1848 when the king and chiefs divided the lands of the Hawaiian kingdom among themselves, Queen Hazaleleponi Kalama, wife of Ka-mehameha III, claimed the ahupua'a of Kane-'ohe and Kai-lua. On August 29, 1850 the Privy Council by resolution awarded her title to these lands in fee simple and exempted them from division and commutation, as follows:

Land Court Award	Book	Page	Apana	Royal Patent	Lands
4452	10	471	12	7983	Kailua, K, Oahu
		472	13	7984	Kaneohe, K, Oahu

(Indices of Awards, Hawaii State Archives Lands of Aliis and Chiefs - Book 1).

The 'ili of Ka-la-heo was designated as Government Land within the ahupua'a of Kai-lua during the Great Mahele (Indices of Awards 1929:7).

When government land became available for purchase ca. 1840s, requests were received from various people to purchase the 'ili of Ka-la-heo. A poignant letter to the Minister of Interior dated November 10, 1847 from Kahunahana requested permission to purchase portions of the 'ili of Ka-la-heo. This letter, reproduced below, was written prior to the Great Mahele and suggests that native Hawaiians were also experiencing a degree of insecurity regarding their lands.

Honolulu,
20th November, 1847

His Highness
Keoni Ana
Minister of Interior

Love to you

I make appplication of you for the purchase in fee simple from the government my patches and my small piece of kula, in the half ili aina of Kaiaheo, at Kailua, Koolau Poko, Island of Oahu.

Five dollars an acre for my taro land, without taking into consideration my cultivating and putting the place in good shape, and two dollars an acre for the kula land.

I greatly want to acquire the place I am living on, so that I may be independent and my work protected and without having any fear of its being acquired by others.

When the area of land is ascertained then I will buy, I do not want others to acquire the place where I am living.

With thanks

Kahunahana

The Interior Department Letter Book 13 page 85 with no date indicates that a 12.21 acre portion of the 'ili of Ka-la-heo was purchased by Kahunahana for $14.50 under Royal Patent Number 1107 dated May 26, 1853. The portion of the 'ili purchased by Kahunahana lies seaward of the present project area as noted on Lyon's 1874 map (see Appendix 1).

A second request to purchase seaward portions of the 'ili of Ka-la-heo was received by the Minister of Interior from Kealo dated October 10, 1849, his request was denied (Interior Department Book 2 page 541).

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The major portion of the 'ili was eventually sold to Kokahe after a number of transactions. In 1853 the Privy Council agreed to sell Kokahe one-half of the land of Ka-la-heo. A list of grants of government land recorded on May 26, 1853, indicates that the 'ili of Ka-la-heo 1 was sold to Kokahe for $207 and Royal Patent 1106 was awarded (Interior Department Letter Book 13 p. 85). Kokahi's purchase included Apanas 1, 2, 3, and 4 as noted on the Lyon's 1874 map (Appendix 1). In the tax assessment record of 1859 Apana 1 is designated as loi (irrigated terrace) while Apanas 2, 3, and 4 are designated kula (dry land). Apana 4 is the portion of the 'ili which is located in the project area.

Kokahe died in March 1855 soon after his purchase of the 'ili. Although he died intestate, Poka, his brother, presented to the court a fraudulent document which was accepted on May 12, 1855 by Judge Lorrin Andrews (1st Supreme Court Probate 2142) to be a valid Last Will and Testament of Kokahe. This document has been translated from Hawaiian to English for this report by Carol Silva and is presented in Appendix 3 . The document and testimony gathered during probate of the will from Poka, Kelisu (Kokahe's daughter), and Kamekua (Appendix 2) indicated that Kokahe left land, 1 horse, 1 mule, 1 canoe, and a portion of a house the ownership of which was shared by Poka. Kamekua testified that he had been present during the writing of the document and had seen Kokahe sign the will (Appendix 2). The validity of the document was sworn to by testimony from Poka and Kamekua. The document and testimony indicated that the land was to be awarded to Poka to hold in trust until Kokahe's daughter, Kelisu, was old enough to assume responsibility for her legacy. The probated acceptance of this will was subsequently cancelled, as noted below, by order of the court on August 24, 1855 after new testimony was presented.

After the will was accepted in May by Judge Andrews, a warrant of arrest was issued on June 19, 1855, for "the bodies" of Poka and his accomplice Nakilaku who were charged with forgery. The arrest warrant (Appendix 4) stated that Poka was sick, "and so low as to render his arrest inadvisable." Nakilaku, however, was brought to court, entered a plea of 'not guilty', was arraigned and held in the fort awaiting trial (Appendix 5).

Nakilaku was tried in the Supreme Court on July 11, 1855, with G. M. Robertson, Acting Chief Justice of the Supreme Court, presiding (Appendix 6). The prosecution called one witness, David K. Kauwai, who testified that Kekahe's daughter had asked him to determine if the will was true. Subsequently he asked Nakilaku about the will and was told that he, Nakilaku, had written it and signed Kokahe's signature at the request of Poka.

The physical environment of the project area during these years seemed little changed from the earlier ca. 1820 description by Bingham. Bille (n.d.) visited the Nu'u-anu Pali area ca. 1845 and noted the pandanus grove at the windward base of the trail in the 'ili of Ka-ule-kola..

> . . .the road passed through a dense coppice of Pandanus trees laden with large fruits. . . (Bille n.d.).

A second description of the project area during this time is recorded in a letter from A. Bishop to A. G. Thurston dated November 3, 1851. This letter (see Appendix 11) also indicates that a dense hala grove was still present at the base of the Nu'u-anu Pali. Portions of the letter are recorded below:

> As to Kalaheo . . . the upper piece is right under the pali of Lanihuli a little to the left of the Nuuanu pass as you go to Kaneohe. I believe there is a house on it, but am not sure perhaps there may be a little taroland but I did not go around it, it was overgrown with the Halatree I could not take any courses. I measured the north side and took triangular bearings to the pali. (Interior Department - Lands, 1851 November 3).

In 1853 Bates visited Kane-'ohe by way of the Pali Trail and described the scenery somewhat differently. It is unknown if the cattle he mentioned are being pastured within the area of the project or if they may have been located in the vicinity of 'ili of Kaeleuli.

> . . . From the precipice, the plains below present the features of a fine landscape. They are marked by heavy undulations, and rent in many places by shallow ravines. Hundreds of cattle may be seen feeding on the rich pasture with which these plains are covered. . . (Bates 1854:104).

Kaauwai further testified that during the conversation he had urged Nakilaku to visit Poka and persuade him to return the property to Keliau. Kaauwai also visited Poka on the day of his conversation with Nakilaku and requested that Poka return the property to Kokahe's daughter. Poka told Kaauwai that he would return it as soon as he was well, but Kaauwai stated Poka was intoxicated at the time of the conversation.

No witnesses were called for the defense. J. W. Marsh, attorney for Nakilaku, pleaded his case, submitting that Nakilaku's confession to Kaauwai was not sufficient evidence to convict his client. The prosecution argued, however, that the confession was not made under duress, but had occurred in a casual conversation. After twenty minutes of deliberation the jury found Nakilaku guilty of forgery (Appendix 7). On July 14, 1855 he was sentenced to two years imprisonment at hard labor (Appendix 8). The fate of Paku is unknown .

After Nakilaku's trial, Keleau, petitioned the court with an application for a Letter of Administration which was heard by Judge Andrews on August 14, 1855. Two witnesses testified for her petition, Papa and Kamekua (Appendix 9). Papa stated that Kokahi had died in March and that he had no "real" wife and this his son was actually a child of his sister. He identified Keleau as Kokahe's true child by a former wife and further stated that she was in possession of the property and had been since the death of Kokahe. The second witness was Kamekua. It is unknown if this is the same person that had testified during the first probate and had sworn that he saw Kokahi sign the document. In August he declared he had seen Kokahi die in "July last". He further stated that part of Kokahe's property was in his possession, part in Papa's possession, and part in Keleau's. The outcome of the August hearing was that Judge Andrews granted Letters of Administration to Kileau's husband, Mahiole.

The tax assessments for portable and real property appear to contain some discrepancies at this time. They indicate that Kokahe and his heirs were assessed taxes for his Ka-le-heo, Apana 1-4, property during the years 1859, 1860, 1861, 1862, and 1863. The Apana 4 portion of the land, however, was sold by his daughter Keleau and her husband Maihole to George Harbottle in November 1857. A copy of this transaction which was specially translated from Hawaiian to English for this report by Carol Silva is presented in Appendix 10. The description of the land included in the Harbottle document indicates that the Apana 4 portion of the 'ili of Ka-la-heo was considered to be the area named Kekele. This place name is mentioned in traditional accounts to be a sacred hala grove, as mentioned earlier.

In 1859-1860 a Russian traveler, A. V. Vysheslavtsev, visited the Kane-'ohe area. He recorded an additional description of the project area which he viewed from the pass and the Pali Trail. His description of thick, impenetrable vegetation suggests that the above description by Bates did not include the area of the former pandanus grove. A picture of the hut is included in the translation of his book. This hut may be site number 358 visited by McAllister's ca. 1932 (McAllister 1971:182).

> . . . The vegetation below is thick, appearing to form an impenetrable green velvet carpet. On the left the sheer cliffs, which extend far into the distance, descend into the valley in green slopes. A hut was visible on one of the hills with a few palm trees surrounding it like a candlelabra. That hut was the object of our outing. (Wiswell 1983:109.)

Economic Pursuits Alter the Landscape: 1860-1880

1860-1870

It is unclear from Bates and Vysheslavtsev's accounts whether the green slopes they describe represented grasslands, ferns, or the pandanus groves. By 1866, however, the grove was no longer present. An eye witness account attributed the destruction to the presence of animals.

> Kekele is the land just below Nuuanu, so fragrant with the hala blossoms and fruit used for leis. It was a rich land a while ago but now there are not many plants because animals are permitted there (Puulewa, W.N. quoted in Sterling and Summers 1978:221).

Destruction of the Hawaiian ecosystem due to the presence of introduced fauna is well documented. Whether the animals mentioned here represent wild or domesticated animals is unknown. Documentation of cattle ranching within the project area has not been found for this time period.

At this time the major portion of the project area was owned by Queen Kalama. The Queen took a personal interest in developing her windward lands into a sugar plantation (Taylor 1957). If she also owned herds of cattle which were being pastured within the area of the project, it was not reflected on the tax assessment records. These records indicate that she owned only two mules and two horses in 1855. She may have allowed stockmen to use her lands or they may have been considered open range by ranchers in adjacent areas. In 1867 (March 19) she entered into an agreement with C. C. Harris to establish the Kaneohe Plantation which would utilize her Kane-'ohe and Kai'lua lands to raise sugar cane (Hawaiian Registry of Conveyances, Book 23 Page 204). The agreement indicates that each had equal proportions of the enterprise and that Harris was designated as the manager. It is highly unlikely that land situated within the project area was utilized for sugar production since the topography is extremely irregular and other areas owned by the plantation would have offered better soils, availability of water, and flatter terrain.

1870-1880

Queen Kalama died in October 1870 without leaving a will. During probate her lands in Kane-'ohe and Kai-lua were awarded to Charles Kanaina. Kanaina subsequently sold his inheritance to C. C. Harris in May 1871 for $22,448.00. The following property was included in the transaction.

> . . . the Ahupuaa of Kaneohe LCA 4452 Apana 13
>
> . . . the lands, appurtenances and improvements, cattle, horses, carts, ploughs, farming utensils and all other property for carrying on Kaneohe Plantation. Also all the Ilis Kuo, Leles, Fish ponds and Fishing rights to the said Ahupuaa of Kaneohe.
>
> . . . also the Ahupuaa of Kailua which she possessed at the time of her death. . . LCA 4452 Apana 12 together with the Ilis Kuo, Leles, Fishponds, Fishing Rights, and all appurtenances and improvements. . . (Hawaiian Registry of Conveyances, Book 34 p. 52).

Within a few years of the Harris purchase an argument developed between the Government and Harris over the lands he had acquired from Kanaina and others. Harris claimed all the lands within the ahupua'a of Kane-'ohe and Kai-lua by Queen Kalama's Mahele claim, the Land Court Awards, and subsequent deeds to himself. The Government, however, claimed that by virtue of the act passed in Honolulu on the 7th of June 1848 the government was entitled to certain 'ili within the ahupua'a mentioned. The argument was finally settled when C. C. Harris agreed to pay the government $750.00, as noted:

> . . . And whereas the aforesaid Charles C. Harris being animated by a desire to compromise and arrange the difference which exists regarding the title to the said ilis has consented to pay for the use of the Hawaiian government the sum of $750 in consideration of the release of any title or claim that the government may have in any land within the boundries of the said Ahupuaas.
> (Hawaiian Registry of Conveyances, Book 45 p. 186).

1880-1890

Charles C. Harris died in 1881 after many years of involvement in Hawaiian government and business. His government offices included service in the House of Representatives, Attorney General, Privy Council Member, Membership in the House of Nobles, Commissioner of Crown Lands, Bureau of Public Instruction, Minister of Finance, Minister of Foreign Affairs and Secretary of War and Navy, Chief Justice of the Supreme Court, and Chancellor of the Kingdom. His Kane-'ohe and Kai-lua lands were inherited by his daughter Nannie R. Rice. Although an absentee landlord residing in Massachusetts, Mrs. Rice continued to purchase land within the study area.

In January 1885 Edward Harbottle and his wife Kuahao sold a parcel of land situated at Kekele, 'ili of Ka-la-heo (Apana 4), ahupua'a of Kai-lua, O'ahu, to Nannie R. Brewer (nee Harris) of Boston for $1,000 (Hawaiian Registry of Conveyances, Book 91 pp. 415-417). This land was a portion of the land purchased by George Harbottle from Kokahe'a daughter in 1857. The remainder of Kokahe'a land within the 'ili of Ka-la-heo, meanwhile, had

been wrongfully claimed by the Reciprocity Sugar Co. and it was necessary for her once again to rely on the courts to validate her claim to her father's land. On October 24, 1887, she brought suit against the company in the Supreme Court of Hawaii. The court ordered the Reciprocity Sugar Co. to release and quit claim the land and it was returned to Mahiole and Keleau (Hawaiian Registry of Conveyances, Book 110 p. 304).

It is interesting to note the dichotomy between the rights of ownership and the control of property as it applied to two women; one a commoner, Keleau, and one a queen, Kalama, during the 19th century. When Queen Kalama claimed her lands during the Great Mahele she was free to administer them as she pleased (Taylor 1959e). Like Keleau, it was necessary for the Queen to initiate a suit in court to clear title to her estate. Once established, however, she had full control of her property (Taylor 1957). On the other hand, while Keleau resorted to the courts to wrest her lands away from the avarice of her uncle Poka and later the Reciprocity Sugar Co., in the end the control of these lands were granted by the court to her husband, Mahiole.
(variously spelled Mahiole, Maihole).

Throughout this period visitors and residents continued to indicate that the slopes had become denuded, that the Hawaiian vegetation communities had been disturbed, and that cattle were present in the vicinity of the project area. Briggs, a visitor to the area in 1881 described the scenery from the vantage point of the Nu'u-anu Pali and the trail down the cliffs toward Kane-'ohe. Cooke described the Pali roadway and a guava grove at the base of the hill.

> From points of vantage we could see bleached human bones lying at the foot of the precipice. . . All these years their bones have lain there whitening in the sun.
>
> After reaching the foot of the pass we made a little better time. We came to a place where the trail forked. The path to the left led to Kaneohe, and we continued down on the right, past the old residence of Mr. John Cummins, where, as manager of a cattle ranch . . . (Briggs 1926:31).
>
> . . . The road was made of huge blocks of rough rocks with cracks in between, and was covered with moss. . . There was no balustrade at the side to keep the wagon from going over the edge!

> . . . Papa was . . . relieved when we all finally got down the Pali safely and gathered under the mango grove at the foot of the road at the end of the descent (Cooke 1964:29).

The bones mentioned by Briggs, above, were later buried under a soil avalanche during the construction of the road (Sterling and Summers 1978:226).

Preparing for a New Century and a New Economy: 1890-1930

1890-1900

Many citizens of windward O'ahu considered the repair and reconstruction of the Pali Road to be a necessity for economic development of the area. A number of events had delayed reconstruction of portions of the road for several years, and many letters had been sent to the Minister of Interior complaining about the condition of the roadway (Moetteler 1976:169-171).

A reflection of the 'march of progress' toward improvement of the road is apparent in the transfer of portions of the land located in the 'ili of Ka-ule-kole, an 'ili situated within the project area, from the Kaneohe Ranch Company to the Minister of Interior, James A. King. The purpose of this transfer was to facilitate the maintenance of the newly constructed 'Old Pali Road' (Hawaiian Registry of Conveyances, Book 193 p.309).

1900-1930

The 20th century ushered in a new but brief pineapple industry in Windward O'ahu, as well as, vegetation denudation and large scale transfers of land ownership.

The initial date of pineapple cultivation within the project area is not certain. A photo in the state archives dated 1914 shows pineapple growing in the project area at that time. Two descriptions, however, give conflicting accounts as to when this industry started. Alexander states that pineapple flourished by 1914.

> . . . At last we reached the foot of the Pali . . . I looked over the surrounding hills, but looked in vain for the great areas of guava through which but a few months ago we had fought and cut our way. As far as the eye could reach pineapple plantations had taken the place of the forest of wild guava (Alexander 1914 quoted in Devaney et al. 1976).

Three years later MacCaughey described the vegetation differently.

> . 66 . We neared the gullied base of the Pali and the rolling coastal plain that lies between the mountains and the sea. The vegetation rapidly changes from the ku-kui and ki of the humid upper slopes to the monotonous "guava scrub" that has long usurped large tracts of the contoured lowlands. Here the guava grows as a stout shrub, six to twelve feet high and formed pure stands of thickets or "chaparral," even-topped and eventually crowding out the woody plants. Associated with it are such other hardy immigrants as the lantana, klu, and ki-awe. Its foliage does not form a dense shade, so the various coarse forage grasses grow well under it. Cattle trails run through these extensive thickets in every direction and, like roadways through fields of tall sugar-cane, are frequently more of a perplexity than a help to the wayfarer. At Kala-heo our road dipped somewhat sharply, crossed a wooden bridge then rose. . . (MacCaughey 1917:184).

Though the date of the onset of the pineapple industry is not certain, the fact that it was short lived is quite clear. Pratt attributed the downfall to insects and poor soil. Mr. Tom Sakamoto, a local resident also attributed the failure to poor soil (personal communication). Dean indicated that the "poor" soil was due to the lack of an organic matrix within the soil.

> . . . the land was used for pineapples, even up to the area near the Pali, but manly bug and other problems, as well as poor soil, led to their abandonment (Pratt 1965:66-67).
>
> . . . As you look down from the Pali you see a region which a few years ago was planted in pineapples and yielded a good crop, but it has never yielded satisfactorily since then, there has been failure after failure. . . pineapple . . . needs an . . . adequate supply of organic matter (Dean 1926:409-412).

Whatever the reason for the demise of the pineapple industry the result was large scale denudation of the foothills which were exposed to accelerated natural erosion after cultivation was discontinued. The extent of pineapple cultivation within the project area is evident in a ca. 1920 photograph (Photo 3); this area has also been delineated on the land use map (Figure 3). The effects of just a few years of erosion on ground left bare after pineapple cultivation is evident on aerial photographs dated ca. 1926-1928 (Photos 4 and 5).

During this time large scale land transactions were also being undertaken. In 1917 (April 2) Harold K. L. Castle purchased a large number of land parcels from Nannie R. Rice and her husband for the amount of $345,000.00 (Hawaiian Registry of Conveyances, Book 452 pp. 424-439). Included were lands originally transferred to Queen Kalama during the Great Mahele and the 'ili of Ka-la-heo originally purchased from the government by Kekahe. Lands included in this transaction which lie within the project area are noted below:

> 1. . . . LCA 4452 Royal Patent 7983. . .Ahupuaa of Kailua . . . same premises conveyed to C. C. Harris by deed of Charles Kanaina, dated May 1, 1871, of record in the Hawaiian Registry of Conveyances in Book 34 pages 52-54.

HISTORICAL LAND USE

(Patricia Price-Beggerly)

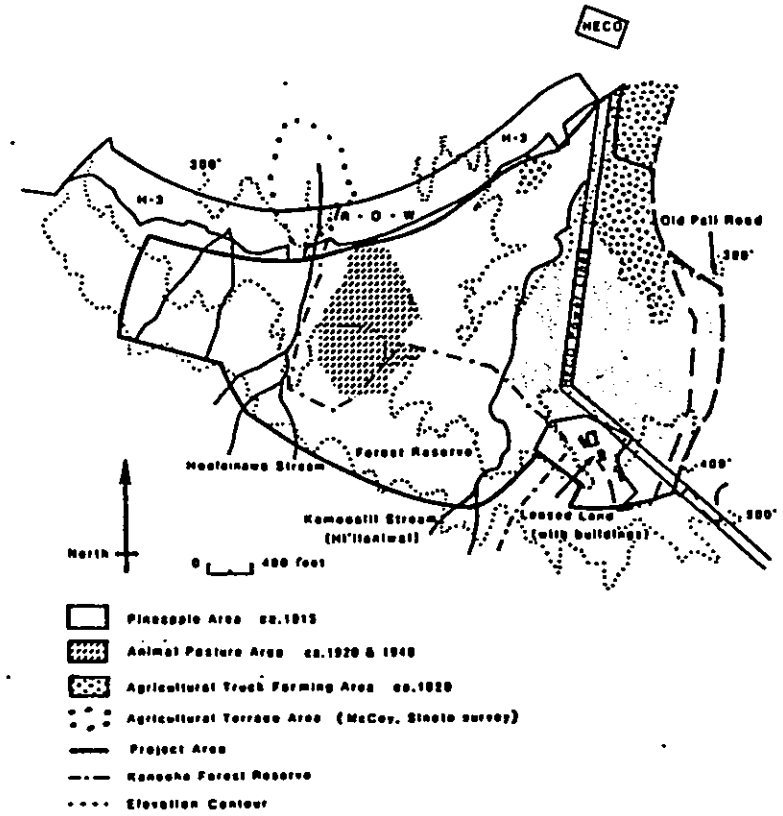

Figure 3. Historical land use map.

2. The premises described in LCA 4452 Royal Patent 7984, being the Ahupuaa of Kaneohe, being the same premises conveyed to C. C. Harris, by deed of Charles Kanaina, dated May 1, 1871 of record in said Registry in Book 34 pages 52-54.

3. Those certain parcels of land situate within said Ahupuaas of Kailua and Kaneohe known as Government Remnants, being the same premises described in that certain deed from the Ministry of Interior to C. C. Harris, dated February 28, 1876, of record in said Registry in Book 45, pages 286-287.

24. Apana 4 of Royal Patent (Grant) 1106, to Kokahe, being known as Kekele a Lele of Kalaheo, situated at Kaneohe, Koolau poko aforesaid, being the same premises conveyed to Nannie R. Brewer (now Nannie R. Rice) by deed of Edward Harbottle dated January 10, 1885, and recorded in Book 91, pages 415-417.

86. All that part of the Old Pali road, at Koolau poko, Oahu, which has been abandoned, being from the point when the new road leaves the old road about one hundred feet above the spring to the junction of the new road with the old one at the lower end, being the same premises conveyed to said Nannie R. Rice by deed of James A. King, Minister of the Interior, dated August 11, 1898, of record in Book 186, pages 199-201.

. . . excepting and reserving . . . all of those two strips of land situate in the District of Koolau poko aforesaid, known as the Nuuanu Pali Road and the Branch Road from Nuuanu Pali Road to the Old Waimanalo Road, conveyed by said Nannie R. Rice to the Minister of Interior for and

on behalf of the Republic of Hawaii, in that certain Exchange Deed dated August 11, 1898, of record in Book 186, pages 199-201.

. . . excepting . . . certain grant of right of way for power lines made by and between said Nannie R. Rice, the Hawaiian Electric Company, the Kaneohe Ranch Company, Limited, James B. Castle and David Rice, dated September 21, 1915, of record in Book 468, pages 240-245

During this period a number of Japanese Americans leased land within the project area and established truck farms. Most of the farms were located in the 'ili of Ka-ule-kola and fronted on the Old Pali Road. Many of the farm plots are discernable on the ca. 1926-1928 aerial photographs (Photos 4 and 5) and are noted on the land use map (Figure 3). The original leases were usually short term, three to six month leases, but most of them were retained for several years. Two were renewed on a long term basis in 1951. The family of S. Sakamoto still leases land within the 'ili (Tom Sakamoto, personal communication). The following list presents the names of the leasees, the year they commenced, and the amount of acreage leased (data from Honolulu City and County Tax Assessment Records):

NAME	YEAR COMMENCED	ACREAGE
Y. Kawasato	1922	6.5
Susumu Kashiwabara	1922	2.67
Taro Ishiki	1924	5.9
S. Sakamoto	1929	4.52
Tonio Tanimoto	1929	5.30
S. Wakabayashi	1929	5.95

1930-1940

A realization by the government of the importance of forests to the well being of the area prompted the establishment of a forest reserve on the mauka portions of the project area. In 1938 this reserve was formally established by Proclamation. Other portions, however were allocated to dairy farming and diversified truck gardens (see Figure 3). The largest portion of leased land (311.34 acres) was awarded to Hygenic Dairy by Kaneohe Ranch commencing in March 1939 (see Photos 6 and 7).

The War Years: 1940-1945

World War II brought great changes to the Islands one of which was the mass transfer of land from private to military control. By the end of the war the military held temporary possession of ca. 340,000 acres which were established through 1,660 leases (Allen 1950). Old time residents remember vast areas of land which were used for military installations in the Kane-'ohe area. One of these residents stated there was a military camp located in the vicinity of the project area (Tom Sakamoto, personal communication). Allen (1950:228) states a training camp, "was opened late in 1943 at the base of Oahu's famous Pali."

Up to the Present: 1950-1986

H. K. L. Castle retained possession of the land until his death. His estate transferred land within the project area to Iolani Schools in 1974 (Honolulu City and County. Tax Assessment Records).

The present vegetation is probably best classified as a open transitional secondary forest. Vegetation of interest include vast areas of false staghorn fern which reflect the prior floristic disturbance; introduced plants which are indicative of historic economic patterns, such as coffee, introduced species of bananas, and immense guava trees with girths up to 50 cm. The presence of scattered pandanus and ti (Cordyline terminalis) is some indication that early Hawaiian vegetation is partly becoming reestablished.

Discussion and Implications for the Archaeological Record

This review of historical documents and traditions associated with the project area, although of a preliminary nature, has furnished limited though significant information regarding the interrelationships among vegetation, geomorphology, land use, and land ownership. It is now possible to use the information to predict the probability of the presence of archaeological and historical sites that may still be extant within the area.

Review of the traditional and documentary data suggest that the project area was never heavily populated. A sacred hala grove, however, apparently formerly existed within the project

area. Early historic documents mention this grove and also indicate that at least one house site may have been located in the vicinity of the project area (Bishop 1851, Wiswell 1983). Vyshelavtsev noted the house was surrounded by palm trees (Wiswell 1983). Bishop (1851) suggests that a house site, some taro land, and dense hala groves were located near the old Pali Trail. A site visited by McAllister in the 1930s (Site 358) was described as a series of terraces associated with four coconut trees, several mangoes, much pandanus and a little taro (McAllister 1971:182). McAllisters' map indicates it may be in the vicinity of the project area. Presently there are no coconut groves within the project area. However, there is a small grove southeast and up-slope of the project.

It is very unlikely that archaeological sites still remain in areas which were used for pineapple cultivation. As the photographs indicate (see Photos 3, 4, and 5), these areas were stripped of their native vegetation and any surface sites which may have been present in the early 1900s were removed through intensive cultivation practices. It is possible, however, that sites such as irrigation systems located along the waterways which bordered the pineapple fields, were not destroyed. If such sites existed, it would be expected that they are now buried under soils eroded from the ridges and slopes after the cessation of pineapple cultivation.

A number of photos (see Photos 1, 6, and 7) and descriptions of the landscape at the base of the Pali have indicated that cattle were present in the vicinity of the property slated for development. No documentary evidence has been recovered regarding who may have utilized the area for raising cattle prior to 1939 when Hygenic Dairy leased a portion of the land. The fact that Nannie R. Rice's enterprise was called the Kaneohe Ranch Company suggests that cattle ranching was a major endeavor of this establishment. Her ranch, however, included thousands of acres, and it is unknown which portion of the acreage was used for grazing. On the tax map there is an area within the project boundaries which is noted as a pastoral reserve; early photographs show cattle present in this area as well as the higher elevation lands within the project boundaries (Photos 1, 6, and 7). It is possible that lands most appropriate for cattle grazing would also have been the areas selected by ancient Hawaiians for dryland gardens. This type of cultivation would have necessitated clearing the ridges and slopes of vegetation and in some cases the construction of terraces. The nature of these sites are such that they would probably have been destroyed if the area was used intensively for pasturage. Based on the analysis of historic documents, photographs, government documents, and the landforms present within the proposed development area, it is suggested that

areas which have been used for pastures are not likely to contain undisturbed structural remains. It should be noted however, that archaeological sites are occasionally found within areas which have been used for grazing; the integrity of these sites, however has usually been compromised. This is due mainly to the tendency of cattle to knock over stone walls, to scatter cultural material within the soil, and to cause accelerated erosion through vegetation disturbance.

It has been noted that beginning in the 1920s acreage within the project area has been leased to diversified truck gardeners. The soils considered to be fertile and suitable for gardening today were probably considered as ideal for cultivation in the past. Although the soils in these areas have experienced a great deal of disturbance in recent years, it is possible that remnants of past cultural behavior lie below the level of modern cultivation. In recent years a number of archaeological sites have been recovered from beneath fields which were formerly in sugar cane cultivation, beneath historic buildings, and even beneath airplane runways. It cannot be assumed therefore that areas in cultivation today will not contain buried archaeological sites. Based on the documentary research and geomorphological analysis it is recommended that archaeological monitoring be conducted in areas which have recently been cultivated.

Recommendations for Further Study

This documentary research has been of a preliminary nature and much further study is recommended. A number of journals and diaries which record the early history of O'ahu were examined to establish a baseline against which to view subsequent change. A major source of these diaries and early photos is located at the Library of the Hawaiian Mission Children's Society. Unfortunately, both the Society and the Hawaiian Historical Society share their facility which was closed due to construction during the time period of the present research. Further study of documents and photographs maintained by these archives is therefore highly desirable. In particular, further study is needed to clearly delineate the impact that cattle may have had on cultural resources within the project area. Additional information also is expected to be forthcoming from examination of leases that may have been awarded by major landholders to individuals or companys for a variety of economic endeavors. Finally, documents associated with the war years need to be studied further to more clearly determine what type of military installations were located in the area and their impact on the cultural and natural resources.

THE SITE INVENTORY SURVEY

The field survey was conducted between July 28 and August 8, 1986 for a total of 10 working days. The field crew consisted of Kanalei Shun, J. Stephen Athens, and Jeffrey Yamauchi. Tomasi Patolo volunteered his services for one day.

Method

The land use history (see above) revealed that a significant portion of the project area has undergone extensive surface and subsurface disturbance since the early 1900's due to pineapple cultivation and grazing by dairy cattle. These disturbed areas are clearly definable in aerial and ground photographs taken during the period. As a result it was possible to accurately plot them on both the project map and an overlay made from a 1972 aerial photograph. Because of this documentation, archaeological ground survey was concentrated in the areas of minimal disturbance; only cursory inspections were made of the disturbed areas. The presumably undisturbed areas were primarily confined to the gullies, riverine areas, and portions along the upper elevation margins and western side of the project area.

Field survey was conducted using systematic transects across the project area. Because of the very rugged terrain and the extreme density of vegetation in some areas, uniform spacing of the transects was not always possible. In general, however, crew members were spaced 10 to 15 meters apart in the more densely vegetated areas, whereas in other more open and/or flat areas spacing was between 20 and 30 meters.

Four previously unrecorded sites were located in the project parcel. Each site was minimally cleared to enable the recording of a brief description, measurement of features, drawing of a sketch map, and the taking of photographs where feasible. Each site was given a temporary field designation and marked with multiple strips of pink flagging tape. An aluminum tag with the site designation and date of recording was also left at the location near the flagging tape. Each site was located as accurately as possible on the overlay of the 1972 aerial photograph (Figure 4). Field notes and photographs taken during the survey are on file with J. Stephen Athens, Ph.D. At the end of the field survey the four sites were given permanent site designations as provided by the Hawaii State Historic Preservation Office.

ARCHAEOLOGICAL SITE LOCATIONS

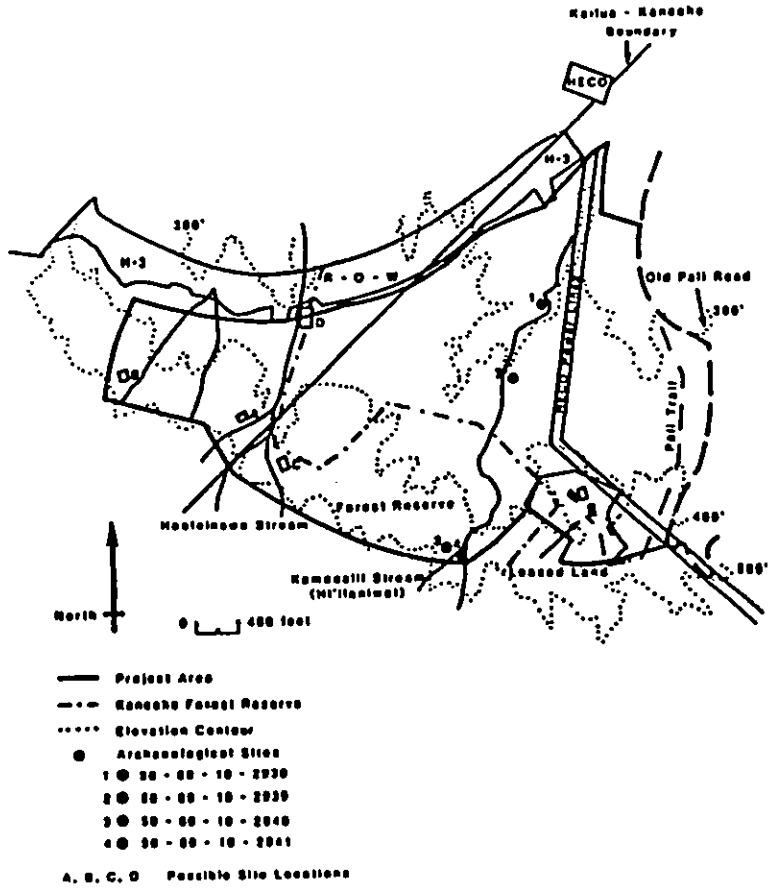

Figure 4. Archaeological site locations in the project area.

Survey Results

Besides the four sites located, several possible sites were also found in the areas between the tributary stream beds and gulches at the upper and south portion of the project area. These locations contained a few boulders conceivably forming alignments and terraces; however erosional deposition, ground cover, and generally dense vegetation (particularly hau or hibiscus trees), made it impossible to discern whether or not these were sites or just natural features. These areas are marked with letters A, B, and C on Figure 3. The area marked "D" is the approximate location of Streck's (1982) site G5-78. The descriptions of the four sites are as follows:

Site 50-80-10-2938: Terrace Complex

The temporary field designation for this site is JSA-1. The site is in the midst of a very dense hau tree grove and consists of a terrace with a retaining boulder wall (Photo 8) and at least one possible terrace with no retaining wall. The wall runs parallel to Kamooalii Stream with an orientation of roughly 340 degrees east of north (Figure 3). It is located about 2 meters from the west edge of the stream. At this point the stream bed is "S" curved and the site is located at the lower end of the curve as the stream meanders east.

The retaining wall has partially collapsed leaving two intact sections at either end. A large mango tree, which is partly responsible for the partial collapse, grows between the two sections. The southern section is approximately 2 meters long, and is constructed of 2 to 3 courses of boulders. The other section is approximately 3 meters long and is constructed of 4 of 5 boulder courses. Both sections are roughly 70 cm high. The wall is no more than 60 cm wide.

West of the retaining wall, about 5 meters distant, is a raised area of no more that 30 cm in what may be an earthern terrace. The dense hau made further investigations very difficult.

The function of the complex is probably related to agricultural activities. The complex may possibly have a pre-contact date based on construction technique of the retaining wall and the location of the site near a stream.

Site 50-80-10-2939: Two Charcoal Kilns or Seepage Walls

This site consists of two well defined depression features located on an alluvial flat on the east side of Kamooalii Stream.

feature A is circular and is further away from the stream. The wall of this feature is reinforced and faced with small boulders and cobbles. The wall is collapsed in several places. The feature is 2.7 meters in diameter and 65 to 70 cm deep (Photo 9). At the north end of the feature is an opening roughly 55 cm wide. The opening is accentuated by two rock alignments extending outwards for 50 cm.

Feature B is roughly 10 meters northwest of feature A. It is U-shaped, with the opening to the west. The western edge is defined by a large well-rounded basalt boulder. The boulder measures 70 by 15 cm. The edges of the U-shaped structure are lined with single rocks no more than 30 cm high. The feature is 1.9 meters wide. Several mountain apple trees were growing within the depression.

The function of these features is presently uncertain. McCoy and Sinoto (1976:3-14) found several such features, which they inferred to be seepage wells of probable Hawaiian origin. However, similarly constructed features found in Micronesia (Athens et al. 1983) were interpreted by local informants as charcoal kilns from the Japanese era. McCoy excavated a large one course high circular stone feature, 8 meters in diameter. He concluded that the feature was used for preparation of guava charcoal (McCoy and Sinoto 1976:4-21 to 4-24). The field designation for this site is JSA-2.

Site 50-80-10-2940: Habitation Complex

This site consists of two terraces, a possible remnant of a basalt pavement, earthern terraces, and a possible charcoal kiln/seepage well. The field designation for this site is JSA-3. The site complex is located on a relatively small flat area above an upper tributary of Kamooalii Stream in the south portion of the project parcel.

The lower terrace measures roughly 22 meters and is oriented about 320 degrees east of north (Photo 10). The terrace is enclosed at both ends by a wall measuring no more than 3 meters. The terrace is constructed with large boulders 2 to 3 courses high; they reach no more than 75 cm in total height. The second terrace is about 6 meters to the west. It is 18 meters long, and its north and south ends terminate roughly 2 meters short of the edges of the lower terrace. The second terrace is a one course boulder alignment, 30 cm in maximum height. At the north end of the terrace, the alignment continues west for roughly 2 meters. The two terraces are situated in a grove of mango, strawberry guava, and guava trees. The features probably are part of a habitation site.

Twenty meters to the north of the terraces there appears to be a remnant of a boulder pavement which is extremely disturbed by the root system of a mango tree. A dirt jeep road runs just to the west of this feature. The remnant pavement measures approximately 2 by 2 meters and may possibly be associated with the terraces. Immediately to the east of the terraces, the land slopes rather sharply towards the stream bed. The slope is densely covered with grass and fern. The slope appears to contain terraces, possibly related to agricultural activities. No boulder retaining walls were noted. At the base of the slope continuing east and across the stream, there is a circular pit roughly 3 meters in diameter. The pit measures 3 meters on the south side and 70 cm on the north. The function of the pit is unclear and may or may not be associated with the rest of the site. This site was given the field designation of JSA-3. It is tentatively inferred to be pre-contact.

Site 50-80-10-2941: Rock Wall

This site is located between two tributaries of Kamooalii Stream. It is located no more than 30 m east of site 2940. The field designation for this site is JSA-4.

The rock wall measures 15 meters long and 80 cm wide and high. It is constructed 3 to 4 course high. It begins at the base of a rather steep slope and goes north crossing one of the streams and continues on the other side for about 4 meters more. On the south edge of the stream the wall appears to be a part of a rectangular enclosure measuring 5 by 2 meters. The enclosure is on the west side of the wall with the longer side running north-south. An orchard of coffee and mountain apple grows on both sides of the wall.

The function of the wall and enclosure is unclear. They are tentatively inferred to be post-contact based solely on the presence of coffee.

CONCLUSIONS

The results of both the land use study and archaeological field investigations suggest that the project parcel was only marginally utilized for habitation and/or agriculture until the advent of pineapple cultivation and dairy cattle grazing in the early part of the 20th century. In particular, there is no information that would suggest that the area was ever of major significance to traditional Hawaiian populations either before or after western contact. Archaeological survey documented the presence of only 4 small sites and several possible sites. The historical study, while indicating the legendary symbolism of a formerly existing pandanus grove (remnants of which may still be present) in the project area, nevertheless did not reveal any evidence for habitation, agricultural use, or other use of the area either during the pre-contact period or during the early historic period. Archaeological survey confirmed the historical findings.

An important aspect of the present project concerned the use of historical information to delineate areas of intensive land use on the project parcel during the modern era. Based on information derived from land use records, aerial and ground photographs, and other documentary sources, a composite map was prepared showing areas of intensive ground disturbance. Archaeological field survey was then concentrated in areas of minimal disturbance where sites, if present, would more likely be preserved on the surface.

Although subsurface testing was not conducted, there is very little information to suggest the possibility of buried archaeological deposits. In this respect, the most probable areas for locating subsurface deposits is in the lower elevation areas, particularly the locations used by truck farmers in the early part of the present century. However, because of the relatively low probabilities of finding deposits in this area as well as its large size, it is recommended (see below) that archaeological monitoring during construction would be the best way to evaluate the possibility of subsurface archaeological manifestations.

The major problem encountered during field survey was extremely dense vegetation. Although considerable effort was made to carefully examine the ground surface for archaeological manifestations, there is nevertheless the possibility that some small sites or indistinct features could have been overlooked.

To conclude, the present project has provided an intensive investigation of the archaeology and historical land use of the project area. Very few sites or other indications of traditional

Hawaiian use of the area was found. The lack of data, however, is not without considerable significance. With the completion of the present project much of upland Kaneohe has now been surveyed for archaeological sites. And as with the present study, historical documents also have been carefully scrutinized for evidence of traditional Hawaiian land use. But unlike most other areas, the parcel of the present project shows little of the intensive agricultural activities and habitation remains that are found in the other areas. The reason for this is unclear. There appear to be no major environmental differences with the other areas. Perhaps the parcel's location on the border between two ahupua'a is significant. It is also possible that the project parcel is merely an "interstitial" area, and that an expanded survey area would reveal the same patterns of land use as found at Tuluku and other nearby areas. Because of this uncertainty, the need for further archaeological survey and historical investigations in adjacent unsurveyed parcels cannot be overemphasized.

RECOMMENDATIONS

The proposed development of a golf course will clearly result in considerable ground disturbance throughout much of the project area. The purpose of the present archaeological and historical study has been to assess the possible adverse impacts this may have on archaeological sites in the project area. In order to do this, the concern has been primarily one of identification of sites and an understanding of how the area was utilized in the past. A complete evaluation of site significance can only be carried out with detailed information on the physical characteristics of the sites, knowledge of their function and age, and a reliable assessment of the subsurface deposits that these sites may contain. Because this information is lacking for the sites in the project area, it would be premature to evaluate the significance of those sites. Nevertheless, it is clear from presently available information that none of the sites would require either in situ preservation or an extensive program of data recovery. The value of the sites primarily rests with the data they contain for scientific research. All of the sites have very little value for public education or display purposes, or cultural or religious significance.

An adequate program of significance evaluation and mitigation of adverse impacts would minimally include the following:

1. Prior to any additional fieldwork, it is highly recommended that an instrument survey be conducted to determine whether sites -2940 and -2941 are actually within the project area. Because of their proximity to the southern boundary, it is possible that these sites could in reality lie outside the project area. This should be determined with certainty. If these sites should in fact be outside the project area, additional fieldwork and data recovery may not be necessary at these sites.

2. It is necessary to determine whether or not the four possible site locations are in fact sites. This will involve clearing vegetation around the suspect features, mapping, and undertaking subsurface testing (primarily stratigraphic trenches). If any of the locations are determined to be sites, they should then be accurately located on the the project map with an instrument survey to make certain that they are in fact located within the project area. Recommendations should then be made concerning the possible need for additional data recovery at any locations that are determined to be sites.

3. Further archaeological documentation should be obtained from the four sites (or two sites, pending instrument survey)

found during the survey. In particular, the sites should be cleared, instrument mapped, and test excavated to fully evaluate their significance (i.e., determine the exact number of features and provide detailed description, and determine function and period of use). Recommendations should then be made concerning the possible need for additional data recovery. This should be done prior to any construction and land alteration activities.

4. During initial land clearing and bulldozing for golf course construction, a professional archaeological monitor should be present on an intermittent basis to observe a) the subsurface conditions in the northeastern project area presently under cultivation, b) subsurface conditions in the 'flat' areas above the gulches that were formerly used for pineapple and cattle grazing, and c) other areas that appear to be of potential archaeological interest based on prior archaeological observations and monitoring investigations. Such areas have the potential for containing subsurface sites now buried by on-going processes of soil deposition due to former intensive pineapple cultivation and livestock grazing in the project area. While this potential may be fairly limited, a program of intermittent monitoring would enable what is a relatively extensive area to be securely evaluated for the presence subsurface archaeological and historical sites in a cost effective manner. It may also disclose previously unrecorded sites hidden under extremely dense vegetation.

   To achieve the desired results, a monitoring program requires close coordination among the contractor, developer, and the archaeologist. Any newly discovered sites, of course, will require the implementation of suitable mitigative measures prior to complete destruction by land alteration activities.

5. Additional historical research should be undertaken to supplement and expand upon findings of the land use study undertaken for the present project. In particular, the following topics should be addressed: a) review of relevant historical documents at the Hawaiian Mission Childrens Society and Hawaiian Historical Society, b) better information on the impact of cattle on cultural resources in the project area, c) information concerning leases related to commercial activities in the project area, and d) military documents and other records associated with possible military activities at the project area.

PHOTOGRAPHS

Photo 1. Overview of project from Pali lookout. The large meadow (center left) was used to pasture dairy cattle from about 1920 to 1940. View to northwest.

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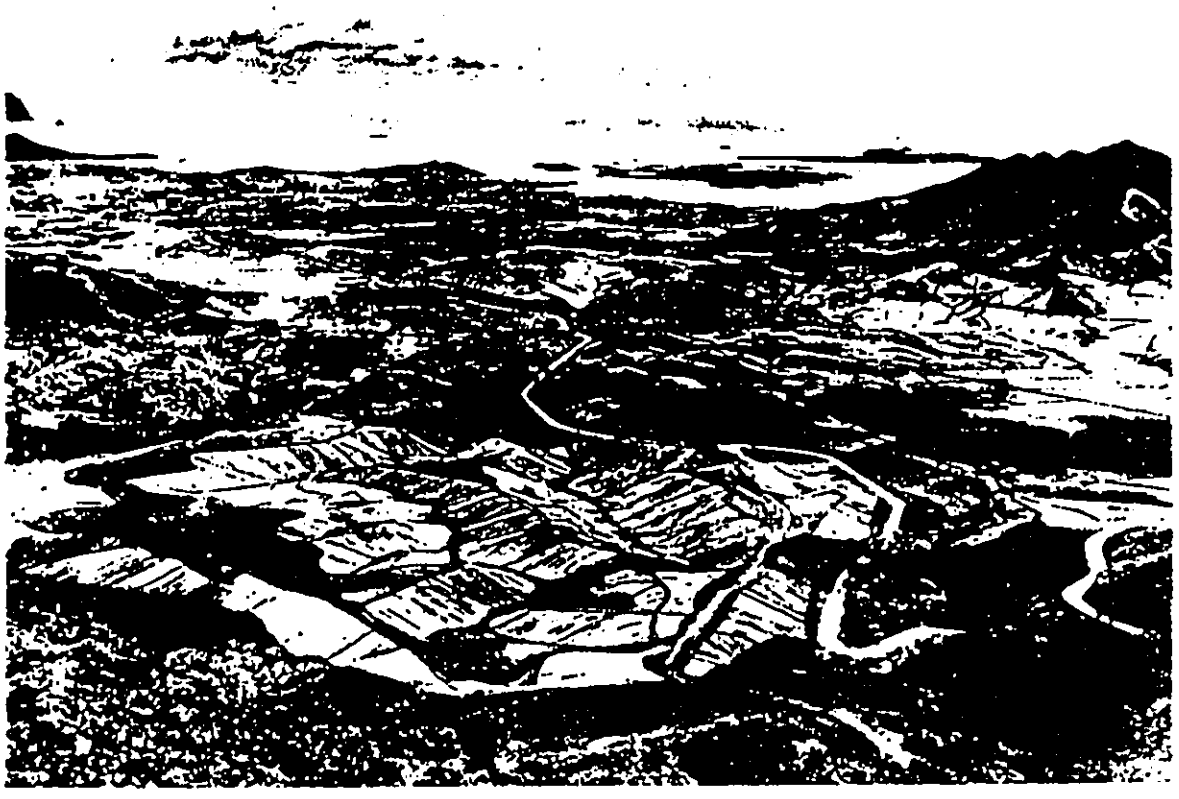

Photo 3. Pineapple cultivation in project area ca. 1912-1914. Eaton Hagoon Collection, Hawaii State Archives.

Photo 2. Aerial photograph of project area, 1972.

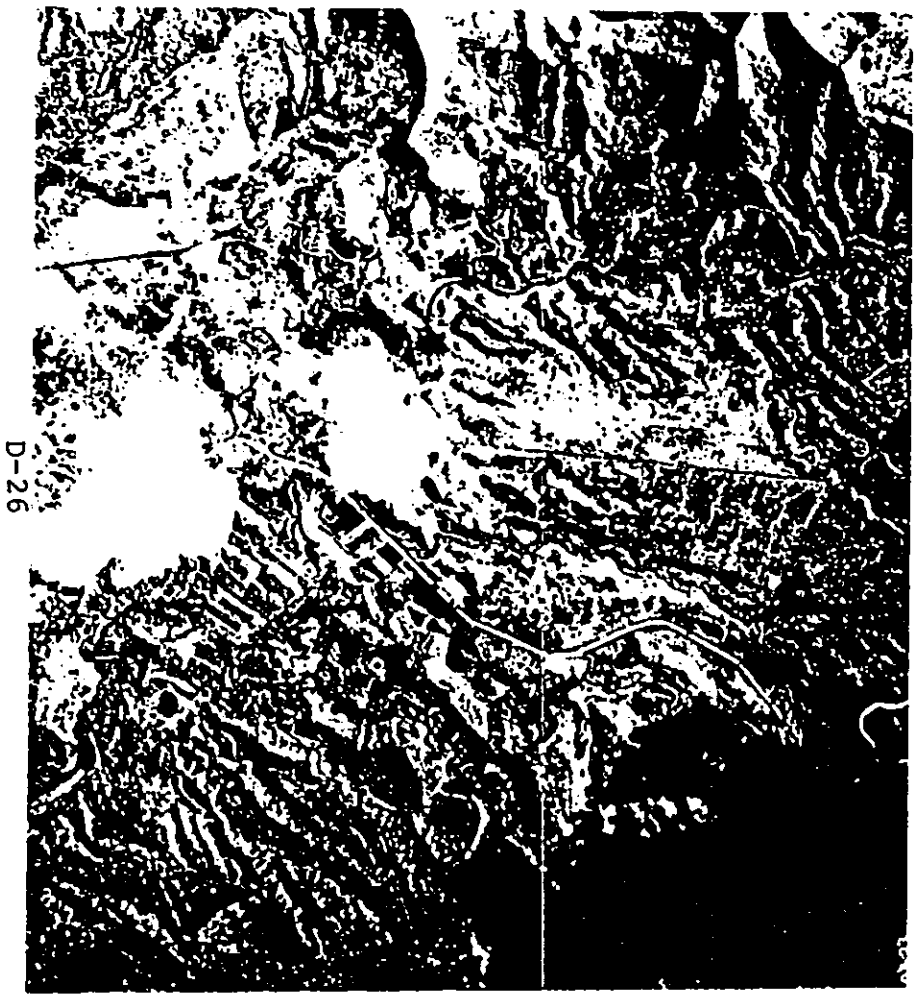

Photo 4. Aerial photograph of project area, ca. 1926-1928.

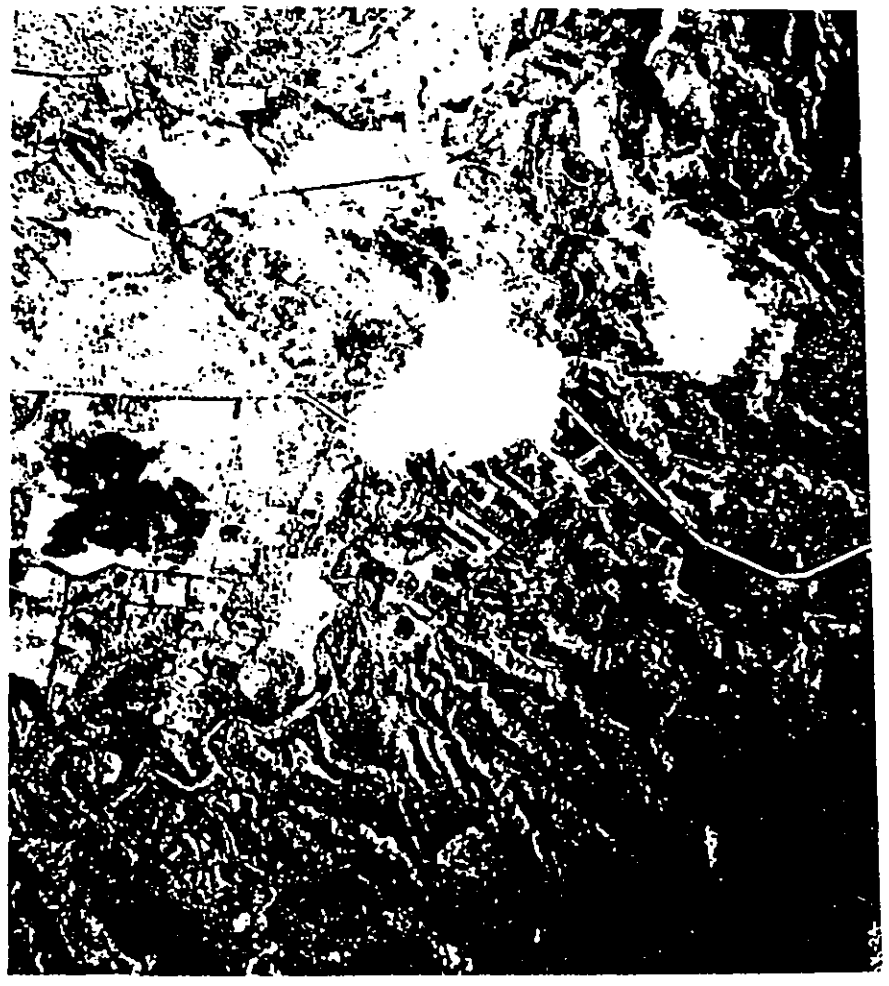

Photo 5. Aerial photograph of project area, ca. 1926-1928.

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Photo 6. Project area ca. 1930 (foreground). Photo by Tai Sing Lou, Bishop Museum.

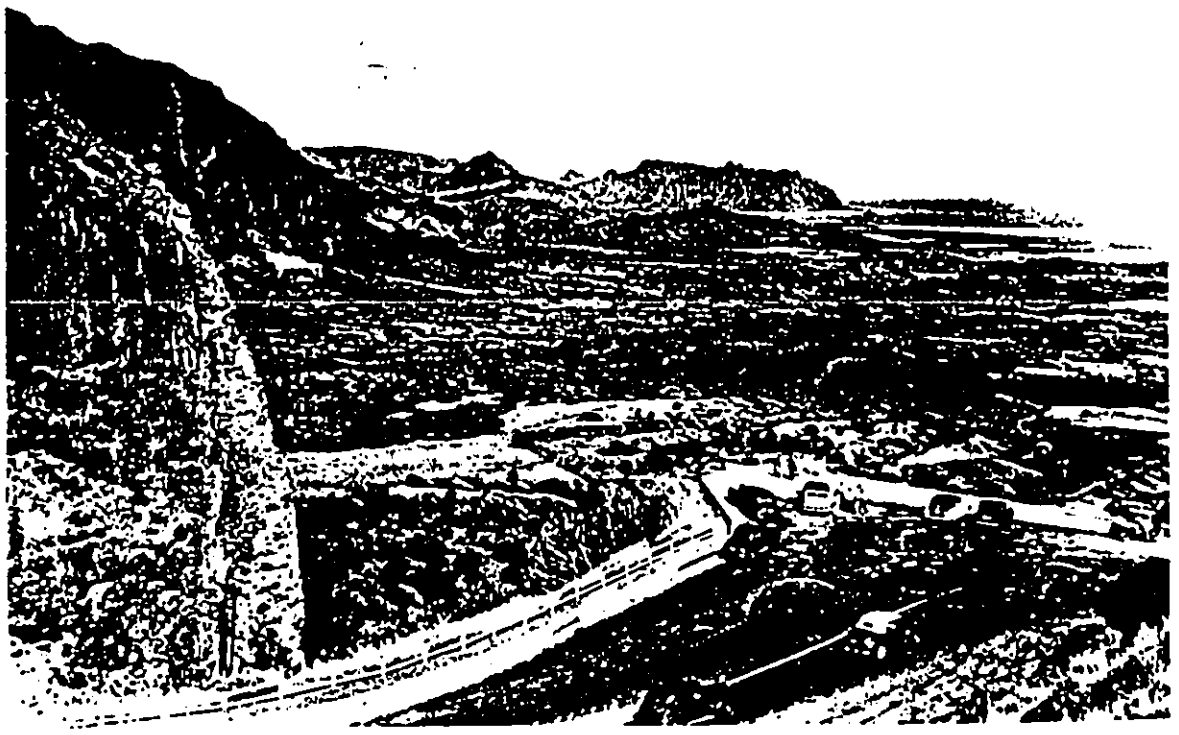


Photo 7. Project area ca. 1942. Photograph from Hawaii State Archives.

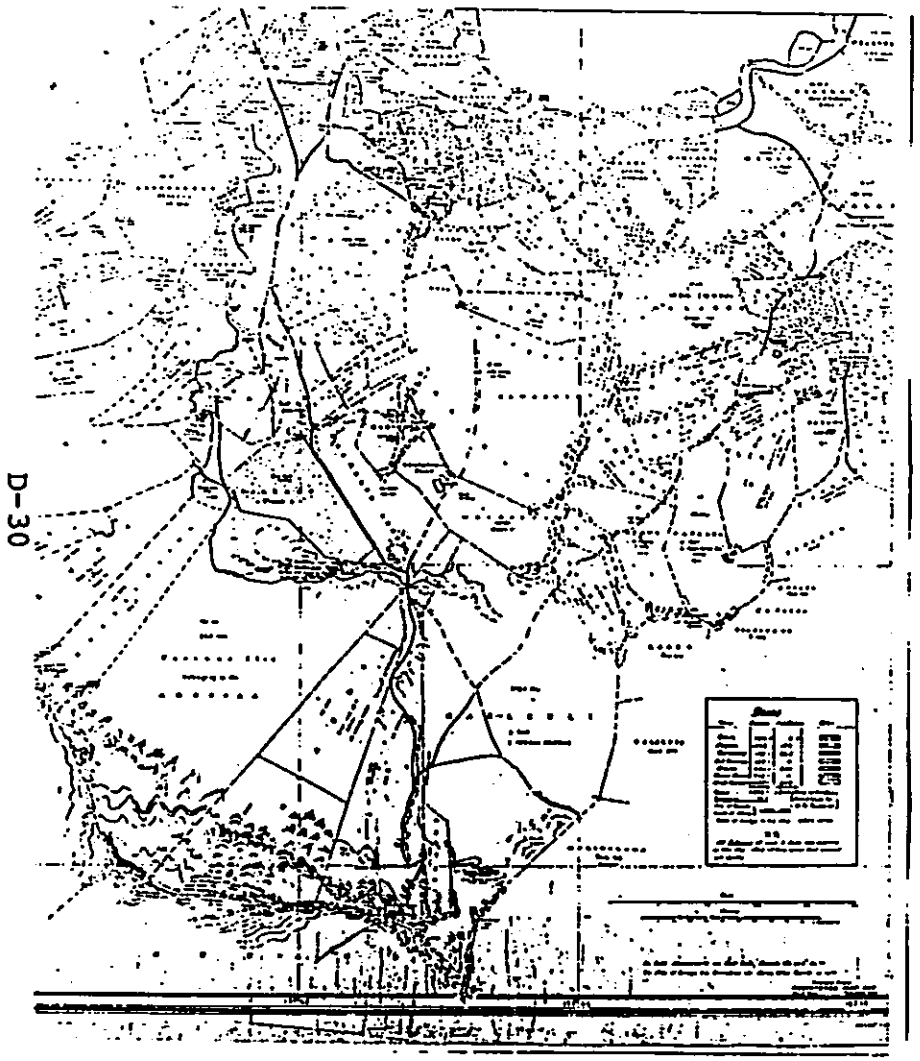
Photo 8. Terrace wall in hibiscus grove, site 50-80-10-2938. View to west.

Photo 9. Feature A, circular cobble wall, site 50-80-10-2939. This could be either a charcoal kiln or seepage well. View to west.

Photo 10. Lower terrace wall of site 50-80-10-2940. View to west.

APPENDIX 1

Kaneohe, Oahu with west Kailua
Portions of map prepared by
C. J. Lyons, 1876
(named land sections are "111)
Registered Map 585



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APPENDIX 2

Supreme Court at Honolulu
Probate 2142
Testimony Presented in the matter of the
Estate of Kokahe of Kailua
11 May 1855

Supreme Court at Honolulu
Probate 2142
Testimony Presented in the matter of the
Estate of Kokahe of Kailua
11 May 1855

Supreme Court
In the matter
of the proof of the will
of Kokahe of Kailua
Late deceased

Chambers
11 May 1855
before
Hon. Lorrin Andrews
Associate Justice

Poka appeared in support of his application and offered a paper as the will of deceased for proof.

Poka sworn says

I knew the deceased I saw him die, he left no wife -- He died some time last March he left 2 daughters and 1 son -- one of the daughters was his own child the other two children were foster children. He left some lands, 1 horse, 1 mule 1 canoe. He lived in a house a part of which belongs to me -- There was a will made. He gave the property to Poka his younger Brother. The idea was that he was to have the property for the child as soon as she was old enough to take care of it. Deceased mind was in a good state when he executed the will, afterward he was delerious.

Postponed for want of further evidence.

J. W. E. Barnard
Clerk Supreme Court
May 12, 1855

Keliau sworn, says
I know the deceased, I did not see him die but he died on the 27 March. He left no wife. I am the deceased own daughter.

Kamekua sworn, says

I know the deceased, I saw him die, he died sometime in March. He left no wife, but he left a child of his own, and he had two children that have been living with him -- he made a will -- I saw the man write it, but I don't know his name. I saw the deceased lay hold of the pen while the man assisted him to write his name. He lived at Kalaheo in Kailua. He left 1 horse, 1 mule, 1 canoe, 1 house, a tract of land. The property was given to Poka, he was a younger brother of deceased. Deceased was in a sound state of mind when he made his will. I know of no dispute about the will.

APPENDIX 3

Supreme Court at Honolulu
Probate 2142
In the matter of the Estate of Kokahe, 11 May 1855
Last Will and Testament
Kokahe of Kailua

Supreme Court at Honolulu
Probate 2142
In the matter of the Estate of Kokahe, 11 May 1855
Last Will and Testament
Kokahe of Kailua

[Text translated from Hawaiian to English by Carol Silva]

I, the undersigned, bequeath my possessions to Poka, my biological younger brother --- my real properties and my chattels to be assigned to him completely and forever.

No person shall be able to contest this without good reason while I live.

The content of this instrument to my younger brother is true and to this I affix my signature.

March 24, 1855 — His mark
Kaleheo, Kailua — Kokahe

[End of translation]

The above is certified a true copy of that on file in my office at the Courthouse in Honolulu, Oahu.

Thus do I affix my signature and seal of the Supreme Court at Honolulu on this 12th day of May, 1855.

J. W. E. Barnard
Clerk, Supreme Court

Hawaiian Island Oahu

Be it remembered that on the 12th day of May A. D. 1855 the within written instrument was duly proved before me in the Probate Court of the Hawaiian Islands, as and for the last will and testament of Kokahe of Kailua, Island of Oahu late deceased.

In testimony whereof I have hereto set my hand and caused to be affixed the seal of the Supreme Court the day and year last before written.

(s) Lorin Andrews
Judge of Probate

[Written sideways along left margin of document]

Cancelled by the Order of the Court this 24 day of August 1855.

APPENDIX 4

Arrest Warrant
Police Court of Honolulu
Poka and Nakilaku
19 June 1855

Police Court of Honolulu
I hereby certify that a warrant of arrest was issued by me for the bodies of Poka & Nakilaku, charged with Forgery.
That Poka was returned sick and so low as to render his arrest inadvisable. Nakilaku was brought into Court on the 19th of June 1855 and arraigned before the Police Magistrate of Honolulu, and without examination or previous questioning proceeded to make a statement of what he called the facts in the case which with the evidence of J.H.? L. Barnard Clerk of the Supreme Court is herewith transmitted.
On the evidence before the Court the prisoner was committed to await his trial at the next term of the Supreme Court of the Hawaiian Islands.
Witness my hand this 20th day of June 1855.
J. L. Kanaina
Police Magistrate
of Honolulu

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APPENDIX 5

Preliminary Hearing
Police Court of Honolulu
Rex vs. Nakilaku
19 June 1855

(Copy)

Police Court. 19th June 1855

Rex
vs
Nakilaka

Charged with Forgery
Pleads Not Guilty

Phineas says, that one day I came to write something about Kupaniki property. I met Poka, Poka said "you and me go to Kohala: Kokahi is dead." Poka wanted me to go to Kohala & write the property down. I would not go, the next day met Poka again. he wanted me to go and I would not go. Monday was the first day I met Poka on Wednesday Poka wanted me to write. I asked the wife of Kokahi, if he left anything to Poka, she said yes. I then asked what property there was and set down. I then wrote these things down. I did not tell them to sign their names to it, I did not sign the will. I only wrote down the things they said were left to Poka. I saw Poka sign the will. I saw Poka write Kokahi name at the bottom of the will, a boy and a woman by name of Kapaii signed the will.

Jno. E. Barnard (Clerk of Supreme Court) sworn, the will of Kokahi was presented for Probate by Poka, the first witness was Kapa.. After stating when Kokahi died, he said there was a will made giving the property to Poka, and that Kokahi was in sound mind when he made the will but was afterwards delirious, this was seen then postponed to the [illegible]

(2)

Kokahi die, that he made a will and he saw the man write it he did not know the name of the man who wrote the will. I saw the man hold the pen while Kokahi wrote his name. This is the will now produced, the will is signed by Kokahi his mark Nakilaka

Committed to the Jail to await his Trial at the next term of the Supreme Court.

APPENDIX 6

Trial Testimony
Supreme Court of the Hawaiian Islands
The King vs. Nakilaku
11 July 1855

of the July term of the Supreme Court of the Sandwich Islands.

Nakilaku is accused of forgery Committed at Honolulu

On or about the 19 day of June A.D. 1855 Nakilaku within the jurisdiction of this Court fraudulently made what purports to be the will of Kekaka with the intent to defraud and prejudice another in his right, Contrary to section first and section twenty of the XXXI Chapter of the Penal Code the Statute of his Majesty Kamehameha IV his crown and Dignity

Mitchell
L. E. Bingham
D. H. Haaheo

I hereby find the above to be a true bill this second day of July 1855.

G. M. Robertson
Acting Chief Justice of
the Supreme Court

RECEIVED AS FOLLOWS

The King vs Nakilaka } 11. July 1885.
Forgery.

The prisoner being arraigned, pleads not guilty.

Jurors drawn, and sworn,

~~[illegible]~~ H. Naha.	Kuakaha.
Kapilikiu.	Keiwai.
Nahakuelii.	Kaa.
Keolaloa.	Napahi.
P. Naone.	Palikiko.
Holopololei.	Mikalemi.

J. E. Barnard, sworn -

D. K. Kaaumoui, sworn - Knows the prisoner - and his handwriting. This paper is in his hand - also the signature of the deceased - In the latter part of May ~~last~~ I had a conversation with prisoner - he told me he wrote the will of Kokahi, signature & all. He said he came with Poka in the ~~street~~ - he asked prisoner to go up to his house. Said he would go there when he got time. Prisoner went to Pokahi [illegible]

died at Koolau several months before that. I told prisoner to get Poka to return the property to the daughter of deceased - he said he would. Same evening I met Poka & asked him if prisoner had been there. Poka said he had not been there. I told Poka to return the property. he said he would. Poka was drunk & intoxicated.

Cross Exd. I know nothing about the will before the Court. I never had anything to do with the case. Kokahi's daughter told me to see whether the will was true or not, - not as a lawyer's business.

Prosecution rests.

Mr. Marsh summed up to the jury -
The prisoner cannot be convicted on the confession made to Kaaumoui.. 1 Greenleaf p. 200.

Verdict - Guilty.

Rex vs Nakilaka

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APPENDIX 7

Trial Testimony - Jury Decision
Supreme Court of the Hawaiian Islands
The King vs. Nakilaku
11 July 1855

Supreme Court. — July 11th 1855

The King
vs.
Nakilaku. — Forgery

Case called on for trial the prisoner being arraigned upon the Indictment plead Not Guilty, whereupon the following Jurors were drawn

Hipa	Kealaloa
Kuakaha	Napahi
Kapilikea	P. Nawe
J. Kuwai.	Palikiko
Nahakualii	Holopololei
Ioka.	Mikalemi.

and there being no objection offered to either of them they were duly sworn to try this cause

A. B. Bates Counsel for the Pros.
J. W. Marsh Counsel for the Pris.

H. Barnard, sworn, says.

the Supreme Court. This paper said to be forged was produced before Judge Andrews on the 12th May last, for Probate. Can't state positively if Nakilioku was present at the time —

Davide Kaawai, sworn, says:

I knew the deceased

I know his hand writing. Nakiloko wrote the will under the name of the deceased. I have had a conversation with the Pris. on the subject in the latter part of May or beginning of June, when he told me that he had written the will & signed the deceased's name. He said he was going to see Kupaniu's property, when he met Poka in the Street. Poka asked him to go to his house, he told him he would [illegible] when he [illegible] times. Then,

to see into this will, to ascertain if it was a true will or not

Prosecution rests

J. W. Marsh addressed the Jury on behalf of the Prisoner, and submitted that the confession of the Prisoner to the witness that he had made the will, was not sufficient, & quoted

Greenleaf on Evid.ce ss. 260

Mr Bates thought that the evidence was suff.t the prisoner not being then under duress, but a confession occurring in a casual conversation

The Court charged the Jury who retired in the custody of the deputy Marshal to consider their verdict, he being duly sworn to take charge of them

RECEIVED AS FOLLOWS

& after an absence of twenty minutes returned into Court with a Verdict of Guilty

Jn. E. Barnard
Clerk Supreme Court

Eia ka mea i holo ia makou ka poe Jure. Ua hewa ka mea i hoopiiia o Nakilaku

Holopololo
Kaipahi
Kuakoko
Kapaliikea
P. Naava
W.B. Nahakaalii
P. Kiwa
O. Mikalemu
Palekaka
U. Ka
Keolaloa

APPENDIX B

Sentence
Supreme Court of the Hawaiian Islands
The King vs. Nakilaku
14 July 1855

RECEIVED AS FOLLOWS

Supreme Court — 14 July 1855

The King
vs.
Nakilaku.

Larceny.

The Prisoner being brought up for sentence, the Court did sentence him to two years imprisonment at hard labor.

Jno. E. Bernard
Asst Sup. Court

APPENDIX 9

Supreme Court at Honolulu
Application for Letter of Administration
Keleau

Supreme Court at Honolulu
Application for Letter of Administration
Keleau

Supreme Court
In the matter
of the Estate
of Kokahe of Kailua
Late deceased

24th August 1855
at Chambers
before
Hon. Lorrin Andrews
Judge of Probate

Keleau appeared in support of her application for Letter of Administration.

Papa sworn says

I knew Kokahi, he is now dead -- He died in the month of March. He has no real wife. He left a Son, but it is the child of his Sister -- Deceased made no will that I know of -- He left one horse -- 1 fish net -- 1 canoe 1 mule 1 house -- Several lots of land -- that is all I know of. I know of no other heir but his daughter who is now present and named Keleau -- She is his true child by a former wife -- she has got possession of the property, she has had it since the death of Kokahe.

Kanekua sworn says

I knew Kokahe I saw him die -- He lived at Kailua -- He died in July last -- He has no wife living -- I know only of a daughter living named Keleau -- Deceased left 1 horse 1 canoe 1 mule 1 House a large tract of land part of the property is in my possession, part in Keleau's and part in the possession of Papa -- Keleau is the only heir that I know of to the property -- she has a husband named Mahiole, He is now present.

The Court granted Letters of Administration to Mahiole the Husband of Keleau, without Bonds.

J. W. E. Barnard
Clerk Supreme Court

APPENDIX 10

Land Transfer
Maihole and Kelesu to George Harbottle
January A.D. 1885

Land Transfer
Maihole and Kelesu to George Harbottle

January A.D. 1885 — George Harbottle
Kushao Harbottle

[Text translated from Hawaiian to English by Carol Silva]

Maihole and Kelesu to George Harbottle

This is an instrument of conveyance of land made on this 19th day of November in the year 1857 between Mahiole residing in Kailua, Koolaupoko, island of Oahu and Kelesu, his wife -- assigned as party of the first part and George Harbottle residing in Honolulu, Kona on this island, assigned as party of the second part.

The aforementioned party of the first part make known that for $150.00 is given into their hands by the party of the second part aforementioned; prior to the transfer of this deed, a receipt for payment must be first given and that shall serve as the agreement of sale -- to quit title, release and convey their property. And with this instrument, it is agreed to sell, release and transfer forever the property to the aforementioned party of the second part and to his heirs, assigns and recepients as determined by the estate -- all part and parcel at Kekele, Kalaheo within the district of Kailua, Koolaupoko, island of Oahu. Thus are the boundaries of this land parcel.

Royal Patent 1106

Kekele a "lele" (disconnected parcel) of Kaleheo.

Beginning at the East corner, run N 75 degrees W 12 chains to the boundary of Wawakaokana then S 35 degrees W 50 chains to the boundary of Lumpou then to the cliff of Lanihuli the S 70 degrees E 32.40 chains to the base of the cliff Lanihuli then N 12 degrees 30 minutes E 51.60 chains to the boundary of Kaulekola continuing until the starting point is reached.

Contained within this land is 101 acres more or less as described by the set boundaries -- each as property of Kelesu and all appurtenances. All rights and privileges connected with this property, dower rights shall be relinquished/waived as stipulated by law and as agreed upon by the aforementioned party of the first part relative to this land. Kelesu, the afore-mentioned, whose name appears on this document and all his/her appurtances and attachments transfers to the administrator of estate forever to settle, pay out and manage all affairs and conflicts arising from disagreement with their real property afore-mentioned with the party of the second part and his heirs and successors forever.

This being signed by the aforementioned party of the first part in their hand and sealed with their seal on the day and year specified -- signed and sealed and acknowledged as true.

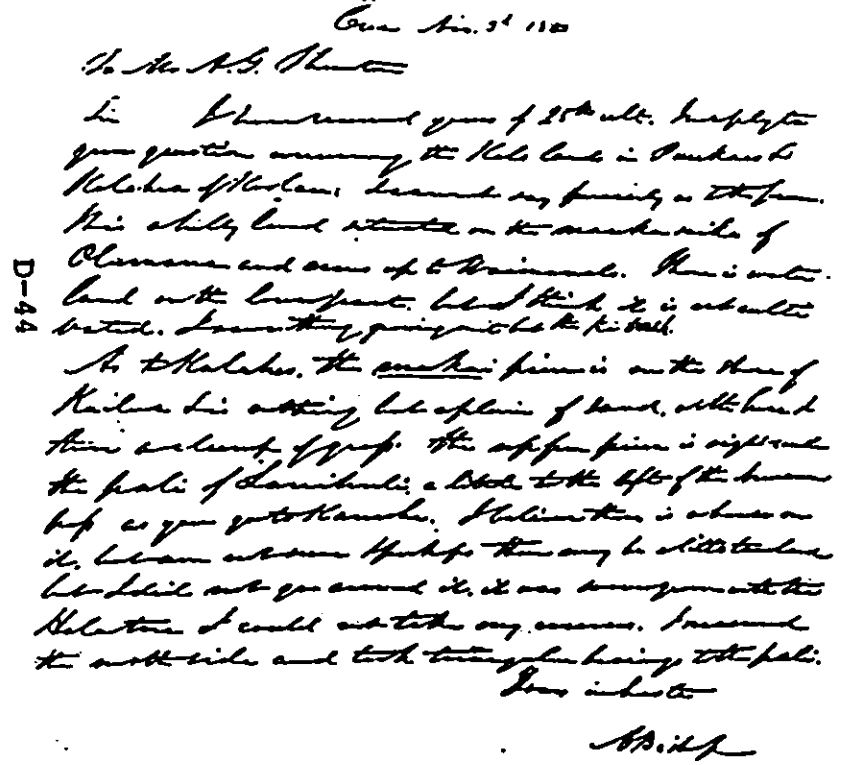
Maihole

Kelesu

(Hawaiian Registry of Conveyances Book 10 Pp. 9-10)

APPENDIX II

Letter from A. Bishop to A. G. Thurston
November 3, 1851



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Kaneohe Regional Library

Hawaii State Archives

University of Hawaii, Polynesian Collection

MAP AND AERIAL PHOTOGRAPH COLLECTIONS:

State Survey Office

State Historic Preservation Office

Bernice P. Bishop Museum - Geography

U.S.G.S. - Water Resources

INTERVIEWS:

Mr. Tom Sakamoto

APPENDIX E

Evaluation of Water Resources and their Development in Iolani School Lands Kaneohe, Hawaii

EVALUATION OF WATER RESOURCES AND THEIR DEVELOPMENT IN IOLANI SCHOOL LANDS KANEOHE, HAWAII

Prepared for:

Mitto Kogyo Company, Ltd.

Prepared by:
John Mink
August 1986

Environmental Setting

The proposed golf course lies below the precipitous front of the Koolau Range between the Nuuani Pali and Wilson Vehicular Tunnels in the sector east of the proposed H-3 Highway and south of existing Kamehameha Highway. The land is between elevations of about 250 and 500 feet and extends from moderately sloping alluviated lowlands to steep talus slopes. Kamooalii Stream and several of its tributaries cross the property. The streams have high gradients and deeply incised valleys near the mountain front, but the gradient becomes gentler and the valleys shallower in the main portion of the golf course.

Average annual rainfall in the area is 75 to 100 inches, much of which falls in winter storms but an appreciable fraction of which is associated with normal trade wind orography. In spite of the apparently high rainfall, irrigation of the golf course will be required because long dry periods are common between rainfall events sufficient in volume to wet the ground. The estimated dry period irrigation demand in winter time will be 250,000 gpd and in summer 350,000 gpd. If the interval of continuous irrigation were restricted to 10 hours per day, the required pumping capacities would be about 420 gpm and 585 gpm, respectively.

The capacities would be lower if storage were provided to allow continuous pumping.

General Geology and Hydrology

The proposed golf course is within the rift zone of the Koolau vocanic dome. Parent basement rock consists of thin basaltic lava layers that congealed on the flanks of the original volcano. These lava units are on the order of 10 feet thick and composed of dense to rubbly aa and highly vesicular pahoehoe. In the rift zone the layered rocks are intersected by nearly vertical slabs of dense basalt (dikes), ususally a foot or less thick but sometimes as much as 10 feet thick. The dikes are poorly permeable and act as hydraulic barriers, trapping groundwater within permeable lava compartments.

Unaltered primary lavas constitute the principal aquifers in Hawaii except for areas within and close by calderas of original volcanoes. Calderas were centers of volcanic activity, and rocks associated with them are dense, massive and frequently metamorphosed by hydrothermal solutions. Suffusion with secondary mineralization is commonly a by product of the hydrothermal alteration. The caldera lithology, as a result, exhibits poor aquifer characteristics.

The Koolau caldera is centered in Kawainui Marsh, close enough to the golf course property to have affected the condition of the primary rocks there. The principal effect is

suffusion with secondary minerals. Permeability and water bearing properties are severly diminished when fractures and other open spaces in the rock mass are filled with mineral precipitates.

Parent basaltic rock lies below a blanket of talus at the base of the steep mountain slope and below alluvium in the lower reach of the drainage basin. Talus and alluvium are poorly to moderately permeable. The interface between the bedrock and the overlying sediments consists of a weathered mantle having the appearance of the original rock but which, in fact, has been altered to clays and iron-aluminum hydroxides. This mantle, called saprolite, is poorly permeable. Thus all of the local lithological features suggest that the subsurface is inhospitable for the formation of exploitable aquifers. Nevertheless, groundwater occurs and is being developed, for example at the Board of Water Supply Kuou wells, and an additional quantity may be exploitable where the negative hydrological features are attenuated.

Groundwater Development

In the region between Likelike Highway, Kam Highway and the Pali Highway two large capacity wells at Kuou, half a mile west of the golf course, are connected to the Board of Water Supply distribution system, while two exploratory drilled near the property by the Board in the last year failed as producers. The Kuou wells (State nos. 2348-02 and 2348-03) have been in operation for 30 years and evidently

penetrate into an aquifer that is not perversely affected by secondary mineralization and closely spaced dikes. The exploratory wells (State nos. 2247-01 and 2248-01) apparently encountered unfavorable hydrological conditions, although part of the problem with 2248-01 may have been caused by the way in which the well was cased. In addition to these deep wells, a successful shallow well in alluvium of the lower drainage of Kamooalii Stream where H-3 meets Kam Highway was drilled by the Board of Water Supply. Pumpage from this well would probably noticeably diminish the low flow of Kamooalii Stream.

The Kuou wells are at ground elevations of 274 and 293 feet and have depths of 418 and 280 feet, respectively. Both are artesian, and the free water table rises to approximately 300 feet, about 10 to 30 feet above ground level. The better well (2348-03) is capable of yielding 1500 gpm; the other (2348-02) yields about half as much. These rates are possible only when a single well is pumping and the other is off.

The most easterly of the failed wells (2247-01, also called Kamooalii II by the Board of Water Supply) is just beyond the border of the property, between the old Pali Road and the City and County Pali Golf Course. It was drilled from a ground elevation of 358 feet to a depth of 526 feet. The driller's log suggests that the boring penetrated talus-alluvium and weathered primary rock but may not have reached unaltered bed rock. Secondary mineralization is pervasive . The initial water table stood at 171 feet above sea level.

The well yielded no more than 10 gpm at a drawdown of 130 feet during a pump test. Considering it a failure, the Board sealed and abandoned it in May, 1985.

The other exploratory well (State no. 2248-01, also called Kamooalii I by the Board) was drilled within the proposed golf course boundaries from a ground elevation of 467 feet on the east bank of Hooleinawa Stream, a major tributary of Kamooalii. It was drilled to a depth of 737 feet and fitted with 14 inch diameter casing. The driller's log indicates that nearly the entire penetration is in alluvium-talus and weathered rock. The water table stands 299 feet above sea level, about the same as at Kuou. The well was completed by installing 615 feet of blank casing and 60 feet of perforated casing. Grout was emplaced to a depth of 220 feet. The blank casing extends through 131 feet of saturated material; the grout excludes 52 feet of saturation.

During testing the well yielded just 40 gpm at a drawdown which reached 430 feet without stabilizing after 3 days of pumping. This production rate is inadequate to qualify for a Board of Water Supply system well. The well has not been abandoned, however; it is capped for protection and can be fitted with a permanent pump.

Potential Groundwater Development

The Board of Water Supply intends to drill another exploratory well, referred to as Kuou II, 1500 feet west of Kamooalii I and within about 1200 feet of the active Kuou

wells. The site is about 800 feet west of the boundary of the golf course property. Evidently an effort is being made to drill on the axis of a ridge leading from the mountain front in order to maximize the probability of hitting fresh bed rock. If site conditions are more like those at Kuou than those to the east, an acceptable pumping rate may result.

In the golf course area the most favorable location for an exploratory well is in the southwestern lobe of the property at an elevation of approximately 400 feet on the axis of the ridge separating Hooleinawa Stream from the next tributary (unamed) west of it. A well at this site could be expected to strike the start of the bedrock section within a few hundrd feet of the surface. The permeability, and therefore the exploitability, of the bedrock would be dependent on the thickness of the saprolite and the pervasiveness of secondary mineralization. These features are unknowable until exhibited during drilling. Nevertheless, an exploratory well will have a reasonably good chance of success at providing several hundred gpm if it is designed to allow seepage from the full extent of the saturated zone.

The exploratory boring should be large enough to hold a 10 or 12 inch diameter casing that is capable of accomodating a pump rated at about 350 gpm against several hundred feet of head. The minimum depth of drilling would be 400 feet, but allowance for greater depth would have to be included in the specifications.

The expected irrigation demand in winter is equivalent

to continuous pumping at 174 gpm and in summer to 243 gpm. A pump capacity of 300 gpm would be sufficient for combined irrigation and potable water needs if adequate storage were available.

Effect of Groundwater Withdrawals on Stream Flow

The entire golf course property is in the Kamooalii drainage basin. The main channel of Kamooalii bisects the property, while a main tributary, Hooleinawa, forms its western boundary. Another important tributary, originating near the Pali vehicular tunnel, flows through the eastern segment of the golf course. All of the streams are perennial, though their low flows are hardly more than a trickle. The Kamooalii drainage passes into Loko Waimaluhia reservoir in Hoomaluhia Park.

Flow measurements are available from US Geological records for the main Kamooalii Stream at various elevations, the tributary leading from the Pali tunnel, and for Piho Stream about 800 feet west of the golf course. The measurements indicate that most of the base flow (taken as the 90 percentile flow) of the streams originates as groundwater seepage between elevations of about 100 and 200 feet. Higher elevations account for 10 percent or less of the total. Dry weather flows, which are representative of groundwater seepage, are given in Takasaki, et al (1969) for Kamooalii at different elevations. The proportion of flow at various elevations are as follows:

Elevation (ft.)	Percent of Base Flow
400	5 to 10
300	10
200	27
150	52
100	90

The main stream and its tributaries gain base flow until the 90 percentile accumulation at the main gaging station at elevation 39 feet is 4.1 mgd.

A well at elevation above 350 feet is not likely to measureably affect base flow. The free water table at this elevation stands about 300 feet above sea level. The maximum base flow reduction expectable if all local groundwater were intercepted by wells would be on the order of 10 percent of the drainage to the reservoir.

Effect of Irrigation on Water Quality

Much of the proposed golf course will overlie artesian groundwater. Seepage through semi-confining clays finds its way into stream channels to provide perennial flow. Irrigation water that is surplus to evaporation-transpiration requirements of plants will combine with this upward seepage to drain into stream channels rather than to leave the area as deep infiltration.

To avoid burdening the streams with fertilizer nutrients or undesireable biocide residues which might accompany excess irrigation applications, maintenance of the golf course will have to be carefully programmed. Controlled irrigation practices will prevent the loss of water by vertical seepage. The biocides that might be needed should be of the class that breaks down into harmless residues.

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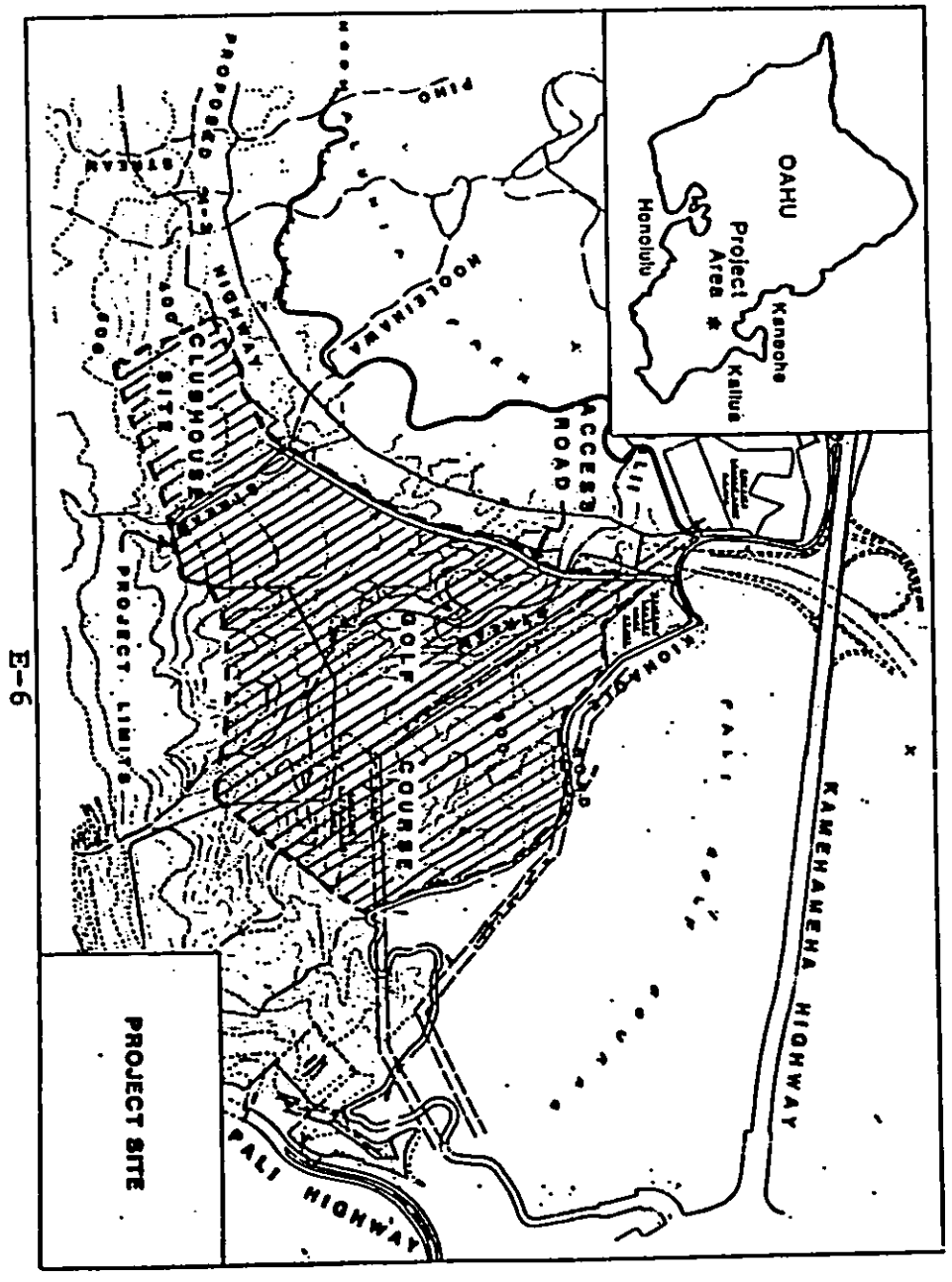
RECEIVED AS FOLLOWS

Kamooalii Watershed Wells : 1"= 2000'

Source: VTN, Pacific. EIS for for Kamooalii Watershed Wells, Sept. 1983.



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APPENDIX F

Environmental Fate of Fertilizers and Pesticides Recommended for Proposed Nitto Kogyo Golf Course Iolani School Property

ENVIRONMENTAL FATE OF FERTILIZERS AND PESTICIDES RECOMMENDED FOR PROPOSED NITTO KOGYO GOLF COURSE IOLANI SCHOOL PROPERTY

A REPORT TO

ENGINEERING CONCEPTS INCORPORATED

SEPTEMBER 16, 1986

Charles L. Murdoch, Ph. D.

Richard E. Green, Ph. D.

ENVIRONMENTAL HAZARDS OF FERTILIZERS AND PESTICIDES

Contamination of ground waters which might enter potable water supplies is normally of greatest concern in application of fertilizers and pesticides to soils. It appears from the hydrological study, however, (see Environmental Setting section, page 8, last paragraph) that the primary movement of groundwater in the golf course area is upward. Ground water seeps through semi-confining clays and finds its way into stream channels to provide perennial flow. Irrigation water surplus to evapotranspiration will combine with this upward flow to drain into stream channels and leave the area as stream flow rather than as deep infiltration. Kamooalii stream and its tributaries drain the entire golf course area. As the Kamooalii drainage passes into the Loko Waimaluhi reservoir in Moomaluhi Park, environmental impact of fertilizers on fish and wildlife in the reservoir would be of primary concern.

Below are listed fertilizers and pesticides likely to be used in golf course maintenance (see 1981 University of Hawaii Turfgrass Recommendations), toxological data and soil behavior for these materials, how they would be used in golf course maintenance, and how hazards can be minimized.

A. FERTILIZERS:

The primary fertilizer elements of concern for contamination of ground and surface water are nitrogen and phosphorus. Phosphorus is attached tightly to iron and aluminum hyoxides in most Hawaiian soils and moves little if any in these soils. Phosphorus, therefore will not cause problems with contamination of drainage waters. Ammonium nitrogen likewise moves little in soils. The primary form of nitrogen which moves readily is the nitrate form. Because of high nitrogen use rates by turfgrasses, 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 of nitrate nitrogen from surface runoff.

FERTILIZER AMOUNTS

a. Greens: (area= approximately 3 acres) Approximately 130 pounds actual nitrogen applied every two weeks. Total yearly application of 1.7 tons actual nitrogen per year.

b. Tees: (area= approximately 5 acres) Approximately 215 pounds actual nitrogen every three weeks. Total yearly application of 1.9 tons actual nitrogen per year.

c. Fairways: (area= approximately 50 acres) Approximately 1.5 tons actual nitrogen every two months. Total yearly application of 9 tons actual nitrogen per year.

d. Roughs: (area fertilized= approximately 30 acres) Approximately 0.7 tons actual nitrogen 3 times per year. Total yearly application of 2.1 tons actual nitrogen per year.

Although other fertilizer elements will be needed in fertilizing the golf course, because nitrogen is the only element which is likely to move in surface drainage water, only nitrogen requiremente are given. Total yearly nitrogen requirements are given; however because of rapid use of nitrogen by turfgrasses, There will be little carry over from one application to the next. The greatest danger of nitrate contamination of surface drainage would be in instances where rainfall occured soon after application of soluble nitrogen sources. Slow release nitrogen fertilizers are available such as ureaformaldehyde, IBDU, and sulfur coated urea which release nitrogen at a rate similar to nitrogen use by turfgrasses, thus reducing the likelihood of soluble nitrogen being transported by surface waters. Several fertilizer manufacturers also formulate complete fertilizers (ones containing N, P, and K) with the nitrogen component in a slow release form. This type of nitrogen fertilizer would virtually eliminate any hazard of soluble nitrogen contaminating drainage waters.

B. PESTICIDES

Several disease, insect, and weed pests of turf in Hawaii require periodic application of pesticides. Major pests and chemicals for their control are shown in the 1981 Hawaii Turfgrass Recommendations. Most of the pesticides used on golf courses are non-restricted pesticides. It may be necessary for certain pests to use restricted pesticides. In many cases chemicals are classified as restricted only because they are more concentrated than the same chemicals sold for general use in a more dilute form. If applied in accordance with label recommendations, hazards from pesticide application can be minimized.

DISEASES

a. Algae: Because of high rainfall and cloudiness during winter months, algae will likely be a major problem. Pesticides used for algae control include Kocide 101 (copper hydroxide) at the rate of 8 ounces/1000 sq. ft. and Dithane M-45 (mancozeb) at 6 ounces/1000 sq. ft.

Kocide 101 is of low toxicity to mammals and to fish and wildlife. It breaks down rapidly to elemental copper which is not known to pose environmental hazard.

Dithane M-45 is moderately toxic to mammals and toxic to fish. Soil persistance is not known, but it is likely not highly persistent. Care must be taken not to apply sprays containing Dithane M-45 directly to streams and ponds.

Algae is not a problem during dry periods of the year. Algacides would likely be required during the wettest periods of the year (November through March, page 34 of Use Application and Environmental Report). Dithane M-45 is applied on a 7 day frequency until the algae problem is eliminated. Kocide 101 is applied on a 10 to 14 day frequency as needed.

b. Leaf spot diseases (Bipolaris spp. and Dreshula spp.).

Dithane M-45 and Daconil 2787 (chlorothalonil) applied at 4 ounces/1000 sq. ft. are the most commonly used fungicides for the leaf spotting diseases. Dithane M-45 has been described previously. Daconil 2787 is of low toxicity to mammals (LD 50 = 10,000 mg./kg.) (LD 50 in this and all following instances used rats as the test animal). It is toxic to fish, aquatic invertebrates and marine/estuarine organisms. Care must be taken not to apply sprays directly to streams and ponds.

Fungicides for leaf spotting diseases are applied on a 7 to 14 day frequency. Leaf spot diseases occur more frequently during wet periods of the year also.

c. Large brown patch (Rhizoctonia solani).

Dithane M-45 and Daconil 2787 are the most commonly used fungicides for control of large brown patch. These chemicals have been described previously.

Large brown patch occurs more frequently during warmer months. It is not as common as the other diseases in Hawaii. Two to 3 applications of fungicides on a 7 to 10 day frequency are required to control this disease.

d. Pythium blight (Pythium spp.).

Dithane M-45 at 8 ounces/1000 sq. ft. and Subdue (metalaxyl) at 3 ounces/1000 sq. ft. are chemicals most often used for pythium blight control. Dithane M-45 has been described previously. Subdue is of low toxicity (LD 50 is 669 mg./kg.). It is toxic to fish. The half life in soil is approximately 3 weeks.

Pythium blight also occurs more frequently during periods of wet weather. Dithane M-45 on a 5 day frequency or Subdue on a 10 to 21 day frequency are applied at first symptoms of Pythium blight and continued until predisposing conditions are past.

INSECTS

a. Turf caterpillars (lawn armyworm, grass webworm, fiery skipper).

Diazinon (various trade names) at the rate of approximately 5.5 lb. ai./acre, chlorpyrifos (Dursban) at approximately 1.0 lb. ai. acre, and carbaryl (Sevin) at approximately 8.7 lb. ai./acre are the most commonly used insecticides for turf caterpillar control. Diazinon is moderately toxic (LD 50= approximately 300 to 400 mg./kg.). It is also moderatily toxic to fish and wildlife. Diazinon is not tightly held on soils. The half life, however is very short. Chlorpyrifos is also moderately toxic (LD 50 = approximately 100 to 200 mg./kg.). It is toxic to birds and wildlife and extremely toxic to fish. It is retained tightly on organic matter in soils and moves little from the site of application. It is fairly residual in soils (half life = approximately 80 - 100 days). It is broken down rapidly (hours to days) when exposed to sunlight. Carbaryl is of low toxicity (LD 50 = approximately 500 to 800 mg./kg.). it is not held tightly in soils but is rapidly hydrolyzed.

Insecticides are applied for caterpillar control only when evidence of their feeding injury is seen. Outbreaks usually occur on limited areas and it should not be necessary to treat the entire golf course to eliminate an outbreak of turf caterpillars. One application of either of the insecticides listed above is sufficient to control a population of caterpillars.

b. Grubs (hunting billbug).

Diazinon at approximately 5.5 lb.ai./acre and carbaryl at approximately 8.7 lb. ai./acre are the most commonly used insecticides for hunting billbug control. Properties of these insecticides were described above.

The hunting billbug is the only grub (larvae of a beetle) which causes problems in turf in Hawaii. Outbreaks occur only infrequently. In practice no more than 2 to 3 insecticide applications to limited areas would be required per year for control of this insect.

c. Rhodesgrass scale.

Diazinon at approximately 5.5 lb. ai./acre and chlorpyrifos at 1.0 lb. ai./acre are the insecticides most frequently used for Rhodesgrass scale control. Properties of these insecticides are described above.

Rhodesgrass scale is normally only a problem in drier areas. It is unlikely to cause problems in this high rainfall location. No more than 1 to 2 applications per year, and these only to limited areas will be required for control of this insect.

WEEDS

A number of weeds must be controlled in golf course turf. There are several types of herbicides used on different types of weeds. Non-selective herbicides which control all types of vegetation are sometimes used on waste areas of golf courses. They may also be used as spot sprays or with "wiper" applicators in fairways and roughs to control weeds which are difficult to control with selective herbicides. Selective herbicides are those which selectively control certain types of weeds in established turf without damaging the turf. There are three basic types of selective herbicides; a. preemergence herbicides applied after turf is established but before weeds germinate. These herbicides are effective in controlling germinating seed of annual weeds only., b. postemergence herbicides selective for controlling grassy weeds and sedges in established turf, and c. postemergence herbicides selective for control of broadleaf weeds in established turf.

a. Non-selective vegetation control. Glyphosate (Roundup, Kleenup, etc.) at approximately 1.5 to 3.0 lb. ai./acre is the most common herbicide for non-selective weed control in waste areas and for spot sprays of difficult weeds in golf fairways. Glyphosate is broken down rapidly in soils (hours to days). It is of low toxicity to mammals (LD 50= 4,300 mg./kg.). It is not toxic to fish and wildlife. A formulation of glyphosate (Rodeo) is labeled for use in aquatic weed control.

Non-selective control of weeds in golf courses usually involves only limited areas. The same area would likely be treated no more than 2 times/year.

b. Preemergence control of annual weeds.

Bensulide (Presan, Pre-M, Premerge, etc.) at 10 lb. ai./acre, oxadiziazon (Ronstar) at 2 to 4 lb. ai./acre, simazine (Princep, Caliber 90) at 1 to 2 lb. ai./acre, and metribuzin (Lexon, Sencor) at 0.75 to 1.0 lb. ai./acre are the most commonly used preemergence herbicides in Hawaii.

Bensulide is of low toxicity to mammals (LD 50= 770 mg./kg.). It is toxic to fish and of low toxicity to birds. It is of long residual (half life 4 to 6 months) in soil. It is strongly adsorbed on soils and moves little. Ronstar is of very low toxicity to mammals (LD 50= 8,000 mg./kg.). It is moderately toxic to fish and of low toxicity to birds. It is residual in soils (half life 1 to 6 months) and is strongly adsorbed on soils. Simazine is of very low toxicity to mammals (LD 50= 5,000 mg./kg.). It is relatively nontoxic to fish and wildlife. It is labeled for control of algae in aquariums. Simazine is not strongly adsorbed to soil and may move from where applied. The half life in soil is 2 to 3 months. Metribuzin is of low toxicity to mammals (LD 50= 1,930 mg./kg.). It is of low toxicity to fish and wildlife. Metribuzin is not strongly adsorbed on soils and may move readily. It is moderately residual in soil with a half life of approximately 3 months.

Bensulide is the only one of the preemergence herbicides recommended above which is labeled for use on golf course greens and tees as well as fairways. Ronstar, simazine, and metribuzin are used on golf course fairways only.

Preemergence herbicides are applied no more than 2 times per year.

c. Selective postemergence control of grassy weeds and sedges.

MSMA (Bueno 6, Super Dal-Erad, Weed hoe, Mesamate, etc.) at 2 lb. ai./acre is the herbicide used to control most grassy weeds and sedges in turfgrasses in Hawaii. MSMA at 2 lb. ai./acre plus simazine at 2 lb. ai./acre or MSMA at 2 lb. ai./acre plus metribuzin at 0.25 to 0.50 lb. ai./acre or metribuzin alone at 0.5 to 0.75 lb. ai./acre are used to control mature goosegrass in golf course fairways only.

The properties of metribuzin and simazine have been discussed above. MSMA is of low mammalian toxicity (LD 50 1,800 mg./kg.). It is also of low toxicity to fish and wildlife. It is a foliar applied herbicide, but is very soluble in water and may wash from leaves to soil easily. It is inactivated in soil very rapidly. The arsenic contained in MSMA is tightly adsorbed by Hawaiian soils and does not move appreciably.

MSMA is used for weed control on greens, tees, and fairways. Control of grassy weeds and sedges with MSMA requires 2 to 3 separate applications at 2 lb. ai./acre spaced 5 to 7 days apart. No more than two sets of 2 to 3 applications are made per year. For goosegrass control the MSMA-metribuzin or MSMA-simazine mixture is applied once, sometimes followed by a second application of MSMA at 2 lb. ai./acre alone. Metribuzin alone is applied only once. Goosegrass control herbicides are applied no more than twice per year.

SUMMARY ANALYSIS

The potential for environmental hazards from application of fertilizers and pesticides to the golf course is small. As pointed out in the hydrology study (page 8, Environmental Setting Report), The golf course project overlies artesian ground water. Movement of water is upward (or perhaps laterally) in the soil. There is likely no hazard of downward percolation of fertilizers and/or pesticides to ground water. Surface flow and sub-surface interflow to streams and subsequently to Loko Waimaluhi reservoir would be of greatest concern.

The total area in tees, greens and fairways (thus the area to which fertilizers and pesticides would be applied) is estimated to be no more than 80 to 100 acres. According to the hydrology study, there are more than 500 acres in the drainage area immediately near the project. The area of the entire watershed draining into Loko Waimaluhi reservoir is not given in this report, but it is estimated to be several square miles. Considering the area of the entire watershed which feeds the reservoir, dilution of any pesticide or fertilizer element in water from the golf course would be expected to render concentrations insignificant.

The largest potential for environmental impact would be in instances where just sufficient rainfall is received to cause slight runoff. This would result in the greatest concentration of fertilizers and/or pesticides in runoff water. In such cases,

negative environmental impact would be more serious to fish, aquatic invertebrates, and wildlife in the streams flowing through or immediately below the golf course. There would likely be sufficient dilution from the entire watershed to prevent dangerous concentrations from entering the reservoir.

SUMMARY OF RECOMMENDATIONS

1. Retention and settling basins incorporated as water hazards into the design of the golf course would greatly reduce the risk of environmental hazards to streams and the reservoir in instances when slight runoff occured soon after application of fertilizers or pesticides. This possibility is discussed in the Use Application and Environmental Assessment, page 59, paragraph 2. We recommend that retention basins for drainage areas which directly contribute drainage waters to streams leading to the reservoir be large enough to temporarily retain a significant portion of runoff from streams during periods of low volume flow.

2. Use of slow release nitrogen fertilizers and the nitrogen portion of complete fertilizers is recommended. The nitrogen release from these fertilizers is similar to the nitrogen uptake rate of turfgrasses. This will minimize the hazard of nitrates entering streams and the reservoir. If soluble nitrogen sources are used, they should be applied at low rates and during favorable weather when chance of rain immediately after application is minimal.

3. Pesticides which provide the most effective control of turf pests under Hawaiian conditions with least potential for environmental hazard are recommended in this report. The pesticides which appear to present the greatest hazard to fish and wildlife are the insecticides and fungicides. These materials are usually applied only to high-maintenance turfgrass areas, such as tees and greens. There may be occasional outbreaks of insects which require treatment of fairway areas, but these are generally not widespread throughout a golf course. It is unlikely that large acreages would be treated with insecticides and /or fungicides. The greatest danger to fish and wildlife is when these materials are applied directly to water. In the event of slight runoff immediately after application of pesticides, retention basins would greatly reduce hazards to fish, invertebrates, and wildlife in streams and the reservoir. Storms of greater intensity would produce sufficient volume of water to dilute transported pesticides to very low concentrations.

APPENDIX G

Traffic Impact Analysis Report
for the
Nitto Kogyo Golf Course

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE

NITTO KOGYO GOLF COURSE

JULY 1986

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TRAFFIC IMPACT ANALYSIS REPORT

for the

NITTO KOGYO GOLF COURSE

This report documents the results of a study to evaluate the traffic impacts of a proposed country club in Windward Oahu. The study included the examination of existing traffic conditions, forecast of future traffic conditions, and analysis of traffic impacts on the local street system.

PROJECT DESCRIPTION

A world class country club is proposed on approximately 200 acres of property presently owned by Iolani School in Mahinui, Oahu, with a projected opening in 1989. The project will include a championship 18 hole golf course with clubhouse and banquet facilities capable of accomodating 500 guests. Use of the facilities will be limited to private members and their guests.

The proposed project site is situated between the Pali Golf Course and the foot of the Nuuanu Pali, as shown on Figure 1. Access will be via Kamehameha Highway and Kionaole Road. The intersection of Kionaole Road with Kamehameha Highway was analyzed for traffic impacts resulting from the proposed project.

EXISTING CONDITIONS

An inventory of existing conditions was conducted to evaluate the traffic impact of the proposed project. The review included the transportation facilities in the area and traffic volumes.

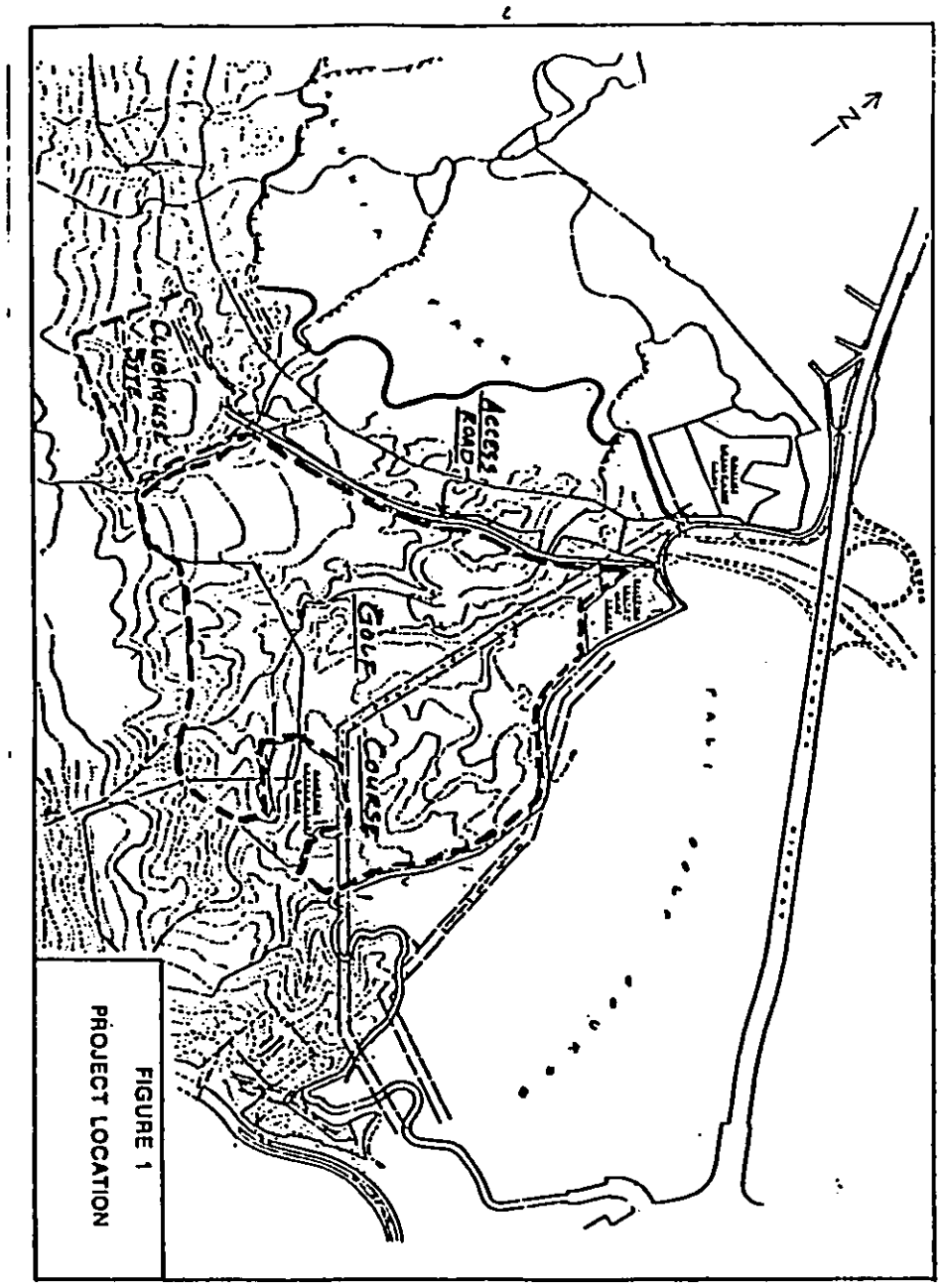

FIGURE 1
PROJECT LOCATION

Transportation Facilities

Kamehameha Highway will serve as the major access route to the proposed project site, with local access via Kionaole Road, as shown on Figure 1. Kamehameha Highway is a four-lane divided highway and is a major roadway in Windward Oahu. It intersects with Pali Highway/Kalanianaole Highway at its eastern terminus and Likelike Highway/Kaneohe Bay Drive in the west. It serves as a major route between the Windward Oahu communities of Kaneohe and Kailua and between Windward Oahu and Honolulu.

Kionaole Road is a two lane rural roadway now serving a limited number of agricultural users in the area. It intersects with Kamehameha Highway west of the Pali Golf Course, and with the Pali Highway just south of the Kamehameha Highway intersection. The portion of roadway between the project site and Kamehameha Highway is expected to become the major access route when the project is opened. For the purposes of this study, it was assumed that all project generated trips would use this route. In actuality, a small portion of the users will use the alternate route to the Pali Highway. The proposed project is expected to dominate current land uses served on Kionaole Road. Hence, only project generated trips were considered in this analysis.

The Kamehameha Highway-Kionaole Road intersection was relocated in early 1986 as part of the H-3 construction project. The new intersection is an unsignalized T with one inbound and one outbound lane on Kionaole Road. In addition to the two eastbound and westbound lanes on Kamehameha Highway, the westbound approach also has a left turn lane for vehicles turning into Kionaole Road. The median between the two roadways of Kamehameha is sufficiently wide that a vehicle making a left turn from Kionaole Road can safely stop in the median while waiting for a gap in the westbound traffic. Hence, these vehicles do not have to wait for acceptable gaps to occur in both directions of travel, but can wait for separate gaps in the two approaches.

Traffic Volumes

Traffic data was obtained from the State Department of Transportation and by manual counts. The most recently available weekday traffic counts for Kamehameha Highway was taken in 1984 by the State. The hourly meter counts taken on May 2, 1984, on Kamehameha Highway at a point 0.2 miles NW of the Pali Highway, is graphically shown on Figure 2. The graphs show that Pali-bound traffic peaks before 8 in the morning, and that Kaneohe-bound traffic peaks after 4 in the afternoon. The proposed golf course is expected to have its peak traffic generation between 10AM and 3PM, when traffic on Kamehameha Highway is not at its peak. For this reason, the weekday traffic impact was analyzed for expected conditions between 3-4PM.

A Saturday morning manual traffic count was taken on Kamehameha Highway at the Pali Golf Course entrance, on April 5, 1986. These points are summarized on Figure 2. Saturday traffic patterns differ from weekday patterns in that the former peaks at midday rather than the early morning/late afternoon peaks of the latter. The proposed country club is expected to have constant peak flow of traffic from mid-morning to mid-afternoon. Therefore, the Saturday traffic impact analysis was made for 11AM-12 noon conditions.

PROJECTED TRAFFIC CONDITIONS

The impact of a new highway facility on ambient traffic was forecast, and the traffic which would be generated by the proposed project was added to the ambient traffic volumes.

New Transportation Facility Impact

The portion of H-3 between Kamehameha Highway and Mokapu Saddle Road is scheduled to open in 1987 and will intersect Kamehameha Highway at-grade east of the Kionaole Road intersection. This new facility will cause traffic diversions which will add to traffic volumes on Kamehameha Highway at the Kionaole Road intersection. An analysis of

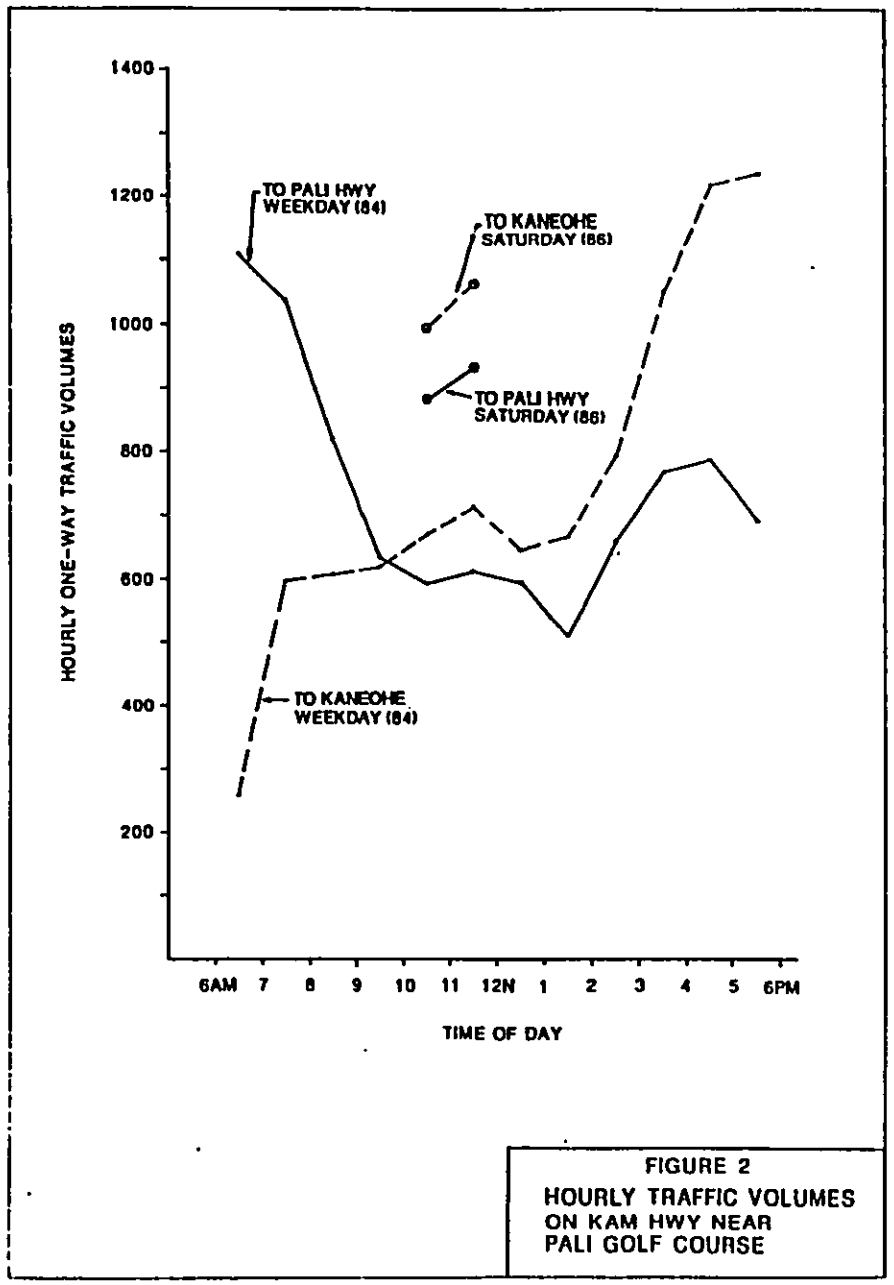

FIGURE 2
HOURLY TRAFFIC VOLUMES
ON KAM HWY NEAR
PALI GOLF COURSE

off-peak conditions indicated that the new facility would result in no travel time savings and a 1.5 mile longer trip length for travel between the Mokapu Saddle Road intersection and the Likelike Highway-Kamehameha Highway intersection. Using these results in a highway assignment diversion curve developed by the California Division of Highways, it was estimated that about 30 percent of the trips between the two points would be diverted to H-3.

Forecast of Ambient Traffic

The existing hourly traffic volumes for Kamehameha Highway shown on Figure 2 were projected to 1989 conditions using a 1.5 percent annual traffic growth rate. This growth rate was averaged from several growth rates shown in the Hall 2000 Alternatives Analysis Study (1984):

- Windward Oahu population would increase at about 0.7 percent a year.
- Daily person trips generated in Windward Oahu would increase at about 1.1 percent a year.
- Windward corridor peak hour volumes would increase at 2 percent a year.

Hence, the Weekday 1984 volumes were increased by 7.5 percent and the Saturday 1986 volumes were increased by 4.5 percent as summarized below:

Weekday, (3-4PM)
- to Kaneohe (westbound) 1050vph to 1130vph
- to Pali Highway (eastbound) 770vph to 830vph

Martin, Memmot, Bone, "Principles and Techniques of Predicting Future Demand for Urban Area Transportation." Cambridge, (1961), page 163.

Saturday (11AM-12noon)

- to Kaneohe (westbound) 1070vph to 1120vph
- to Pali Highway (eastbound) 960vph to 1000vph

When the impact of highway diversion was accounted for, State Department of Transportation traffic counts showed 880vph southbound and 820vph northbound on Kaneohe Bay Drive at Kokokahi between 3-4PM. These volumes were increased by 7.5 percent, and it was assumed that 80 percent of the traffic was through traffic, with 30 percent of the through traffic being be diverted to H-3. This resulted in 230vph southbound and 210vph northbound being diverted to H-3 and adding to the westbound and eastbound volumes of Kam Highway respectively. This would increase the westbound hourly volume on Kamehameha Highway to 1360vph, and the eastbound volume to 1040vph. These figures represent 20 and 25 percent increases in ambient traffic, respectively.

Saturday traffic volumes on Kaneohe Bay drive were not available so that traffic diversion could not be calculated. Therefore, it was assumed that traffic diversion would cause a 20 percent increase in the Saturday forecast ambient traffic on Kamehameha Highway. Westbound traffic volumes would increase from 1120 to 1340vph and eastbound traffic volumes would increase from 1000 to 1200vph.

Project Traffic Volumes

Trip generation and distribution procedures were used to estimate the hourly volume of trips which would be generated by the proposed project and the distributional split of these trips.

Standard trip generation rates from ITE's Trip Generation Report (third edition, 1982) were utilized to determine the hourly volume of trips generated during a weekday and a Saturday midday. The Report gives weekday AM peak and PM peak rates, with the former showing an 0.2 trips/acres inbound rate and the latter an 0.2 trips/acre outbound rate. These rates were assumed for the "steady-state" midday conditions when inbound and outbound traffic are relatively constant, and resulted in 40vph inbound and 40vph outbound for the 200 acre site.

A higher hourly rate of 0.64 trips/acre is given for Saturdays. It was assumed that inbound and outbound trips would be equal, or 65vph in each direction.

The manual counts taken at the Pali Golf Course showed that 60 percent of the trips were to/from the Pali Highway, and 40 percent to/from the direction of Kaneohe. The application of these distribution factors to the trip generation factors are summarized in the table below.

TRIP GENERATION AND DISTRIBUTION SUMMARY

Day	Direction	Hourly T.G. rate/acre	Hourly volume of trips	Directional Split to Pali (eastbound)	Directional Split to Kaneohe (westbound)
Weekday	INBOUND	0.2	40	25	15
	OUTBOUND	0.2	40	25	15
Saturday	INBOUND	0.32	65	40	25
	OUTBOUND	0.32	65	40	25

Combining the generated trips with the forecasted ambient traffic volumes yields the traffic volumes shown on Figure 3. As previously discussed, all generated trips were assumed to use this intersection although an alternate route is available. Also, existing turning movements at the intersection were not included since existing land use traffic would be insignificant when compared with the proposed country club.

TRAFFIC IMPACT

The forecast traffic volumes shown on Figure 3 were evaluated to determine the traffic impact of the proposed project on the highway network. The methodology for evaluating unsignalized intersections described in the Highway Capacity Manual, TRB Special Report 209 (1985), was used to estimate the levels of service for three turning movements:

- Right turns from Kionaole Road
- Left turns from Kionaole Road

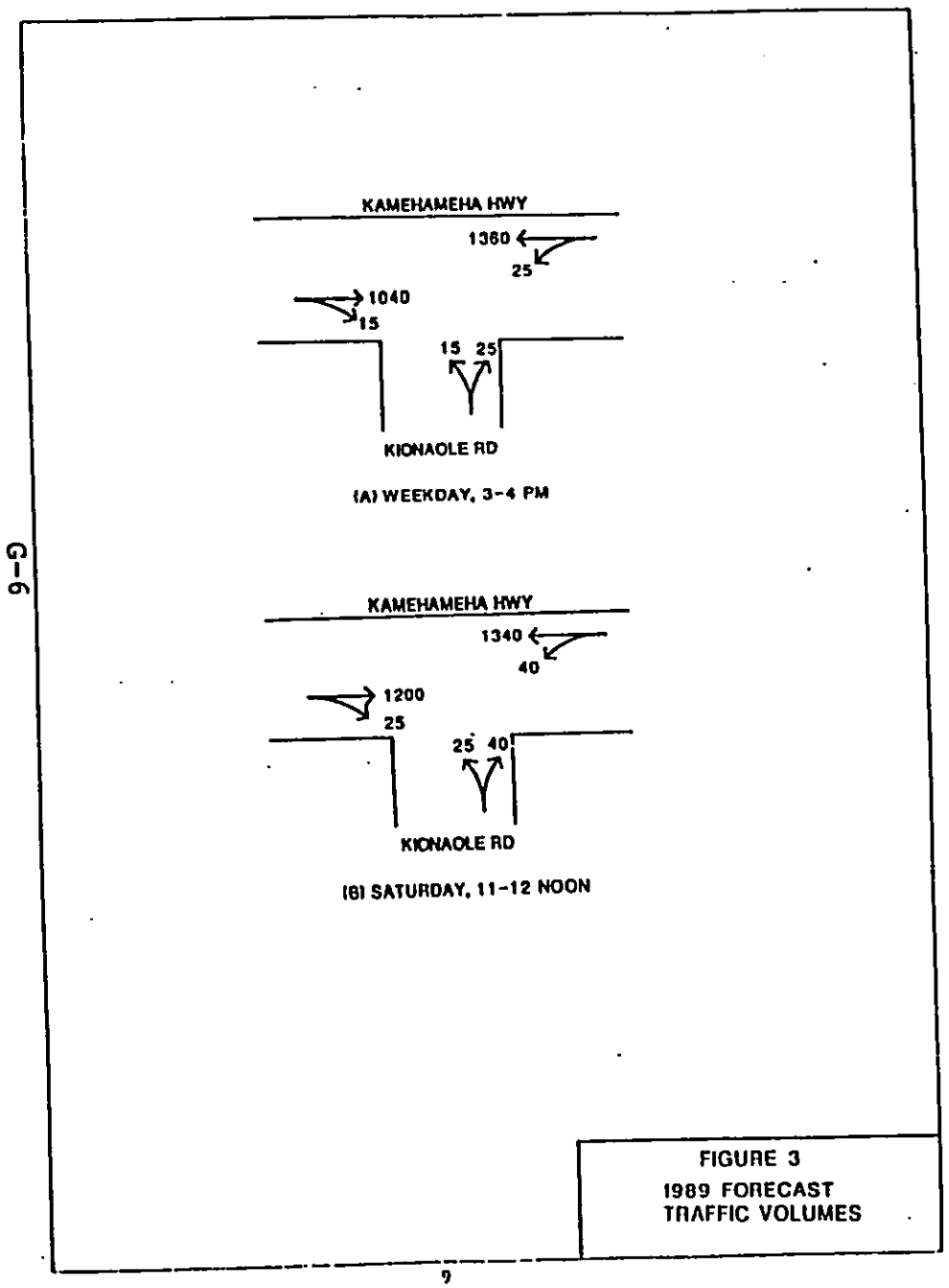

FIGURE 3
1989 FORECAST
TRAFFIC VOLUMES

*Left turns from the westbound approach of Kamehameha Highway into Kionaole Road

Through traffic movements on Kamehameha Highway are not evaluated with this procedure. The turning movements from Kionaole Road were evaluated for the two outbound turning movements being made from the same lane, and for turning movements being made from separate lanes which would imply a widening of the Kionaole Road approach. In a deviation from the described procedure, the outbound left turns from Kionaole Road were assumed to conflict with eastbound traffic and left turns into Kionaole Road only but not with westbound traffic on Kamehameha Highway. As previously discussed, the left turn vehicles need only to wait for acceptable gaps in the eastbound traffic and left turns to cross to the median, and then wait for an acceptable gap in the westbound traffic. The TRB methodology assumes that the left turning vehicle must wait for acceptable gaps in both directions of travel on the main roadway due to no median being available.

The evaluation procedure yields level of service values from A to F. These values represent expected delays ranging from "little or no delay" to "very long traffic delays" but are not directly comparable to level of service values associated with signalization intersection analysis. Hence, thresholds of acceptable and unacceptable unsignalized intersection performance have not been established.

The manual traffic counts taken on April 5, 1986 at the Pali Golf Course were analyzed to correlate existing levels of service with observed traffic performance. The outbound left turn movement from the golf course access road was estimated at level of service D, and delays up to about a minute were observed. The other turning movements were estimated at level of service C, and delays of about half a minute were observed. Based on this observation, level of service D may not be unacceptable for a golf course access road intersecting Kamehameha Highway. Also, these levels of service may worsen in the future as traffic volumes on Kamehameha Highway increase due to natural growth and due to traffic being diverted to H-3.

The level of service results for the Kionaole Highway intersection are summarized below:

MOVEMENT	WEEKDAY PM LEVEL OF SERVICE	SATURDAY AM LEVEL OF SERVICE
Left turn into Kionaole Road	C	D
Both turns from same lane of Kionaole Road	D	E
Left turn from Kionaole Road	D	E
Right turn from Kionaole Road	C	D

The levels of service C and D obtained for the weekday conditions imply "average traffic delays" and "long traffic delays", respectively. The level of service E for the Saturday condition implies "very long traffic delays" for certain movements. The left turn movement from Kionaole Road has the worst level of service, and would also affect the right turn movements if a separate right turn lane were not provided. As a mitigating action, the Kionaole Road approach should be widened to provide two turning lanes.

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The forecast levels of service for the Kionaole Road intersection should be very similar to corresponding movements at the Pali Golf Course access road intersection. Both access roads are expected to have similar volumes, and traffic volumes on Kamehameha Highway should be similar at the two locations. For this reason, the relative impact of the proposed development should not be considered as adverse.

The traffic impacts for Saturday conditions are worse than the weekday conditions for several reasons. First, more trips are generated by the country club on the average Saturday then on the average weekday. Also, the Saturday peak hour volumes are equal to or exceed the weekday off peak hour traffic volumes. However, this condition should occur for only a few hours on weekends, and other hours should have better traffic performance. Similarly, most weekday hours should have better traffic performance than the high off-peak hour conditions which were assumed.

The use of traffic signals as a mitigating action should not be considered at this time. The projected volume of trips which would be generated by the proposed country club are not sufficient to meet the warrants for traffic signals.

CONCLUSION

The proposed country club on the Iolani School Properties site is not expected to have an adverse traffic impact relative to the Pali Golf Course. Both projects are expected to have similar levels of service on corresponding movements, and will experience decreasing levels of service as traffic volumes on Kamehameha Highway increase. The present Kionaole Road approach to Kamehameha Highway should be widened to provide separate turning lanes.

APPENDIX H

Air Quality Impact Analysis
Nitto Kogyo Golf Course

AIR QUALITY IMPACT ANALYSIS
NITTO KOGYO GOLF COURSE
August, 1986

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AIR QUALITY IMPACT ANALYSIS
NITTO KOGYO GOLF COURSE

1. INTRODUCTION

Nitto Kogyo, Inc. is proposing to construct an 18-hole championship golf course on a 200-acre parcel in Kaneohe, Oahu (TMK 4-5-42:1 & 6). The site is bordered in the north by the H-3 Freeway right-of-way (and Hoomaluhia Park), in the east by Kionaole Road (which borders the Pali Golf Course), and in the east by the Koolau Range. It lies within a larger 705-acre parcel which is bordered in the west by the Like Like Highway and the Koolau Range.

The development will consist of the 18-hole course, a clubhouse, a golf driving range, an access road approximately paralleling the H-3 Freeway right-of-way, and a 150-200 stall parking lot adjacent to the clubhouse [1].

The purpose of this report is to assess the air quality impact of the proposed development. The project can be considered an "indirect source" of air pollution as defined in the federal Clean Air Act [2] since it will attract mobile sources of air pollution, i.e., motor vehicles. Thus, much of the focus of this analysis is on the project's ability to generate traffic and the resultant impact on air quality. Air quality impact was evaluated for existing (1986) and future (1989) conditions.

Also, during routine operation of the golf course, various pesticides are used which may result in air pollution contributions. This potential impact has been addressed.

Finally, during construction of the various buildings and facilities air pollutant emissions will be generated due to vehicular movement, grading and general dust-generating construction activities. These impacts have also been addressed.

2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 1 [3, 4]. Note that Hawaii's standards are not divided into primary and secondary standards as are the federal standards.

Hawaii's standards are clearly more stringent than their federal counterparts and are absolute ceiling values not to be exceeded at all. The federal standards allow one violation per year. It should also be noted that the Governor recently signed amendments to Chapter 59 (Ambient Air Quality Standards) making the state's standards for particulate matter and sulfur dioxide the same as national standards including allowance for one exceedance per year.

Primary standards are intended to protect public health with an adequate margin of safety while secondary standards are intended to protect public welfare through the prevention of damage to

soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values [5].

In the case of the automotive pollutants [carbon monoxide (CO), oxides of nitrogen (NOx), and photochemical oxidants (Ox), there are only primary standards. Until 1983, there was also a hydrocarbons standard which was based on the precursor role hydrocarbons play in the formation of photochemical oxidants rather than any unique toxicological effect they had at ambient levels. The hydrocarbons standard was formally eliminated in January, 1983 [6].

The U.S. Environmental Protection Agency (EPA) is mandated by Congress to periodically review and re-evaluate the federal standards in light of new research findings [7]. The last review resulted in the relaxation of the oxidant standard from 160 to 240 micrograms/cubic meter (ug/m^3) [8]. The carbon monoxide (CO), particulate matter, sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) standards are currently under review, but final action has not been taken yet [9].

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [10]. There simply can be no visible emissions from fugitive dust sources.

3. EXISTING AIR QUALITY

3.1 General. The State Department of Health maintains a network

of air monitoring stations around the state to gather data on the following regulated pollutants:

- o total suspended particulates (TSP)
- o sulfur dioxide (SO2)
- o carbon monoxide (CO)
- o ozone (O3)
- o lead (Pb)

In the case of TSP and SO2, measurements are made on a 24-hour basis to correspond with the averaging period specified in the standards. Samples are collected once every six days in accordance with U.S. Environmental Protection Agency (EPA) guidelines. Carbon monoxide and ozone, however, are measured on a continuous basis due to their short-term (1-hour) standards. Lead concentrations are determined from the TSP samples which are sent to an EPA laboratory for analysis. Note that the lead standard is a quarterly average.

While there are no continuous air monitoring stations in the project area, it seems safe to assume that present air quality is good most of the time since there are no large stationary sources in the vicinity, and the immediate area is not highly urbanized. The air quality is probably no longer pristine, however, due to the presence of three heavily used highways within a mile or less of the site (Pali Highway, Like Like Highway, and Kamehameha Highway). The nearest active State Department of Health air monitoring stations are located at Waimanalo and downtown

Honolulu.

3.2 Department of Health and Waimanalo Sites. Recent data from the Department of Health and Waimanalo stations are summarized in Tables 2 - 4. The data indicate that total suspended particulate and sulfur dioxide standards are being met. In fact, sulfur dioxide concentrations are below the detectable limit of the measurement method being employed.

3.3 Sand Island Site. The Department of Health also maintains a continuous monitor for photochemical oxidants on Sand Island. Photochemical oxidants (measured as ozone) are secondary pollutants formed in the atmosphere largely as a result of anthropogenic emissions of hydrocarbons and oxides of nitrogen.

Recent monitoring data from that station are summarized in Table 5. The results indicate that the state's 1-hour standard is being met over 99% of the time.

3.4 Lead Sampling. The State also has been having particulate samples analyzed for lead content, and Table 6 summarizes ambient lead levels in recent years. Generally, airborne lead levels have declined as expected due to the federal program for gradual phaseout of leaded gasoline. Particulate lead accumulated over the years in roadside soils and plants, however, will remain indefinitely in the area and provide inhalation exposure whenever dust is re-entrained in the air as a result of scouring winds or mechanical disturbance due to vehicular motion.

3.5 Other Carbon Monoxide Data. In 1977, the Department of Health conducted a special carbon monoxide study on Oahu and collected data at a number of sites around the island [11]. One of those sites was Castle Hospital which is only a few miles from the project site. A graphical summary of those data are presented in Figure 1. The results indicate that at that time (1977) 1-hour CO levels could exceed the State standard during the a.m. peak traffic period but were below the standard during the p.m. peak period.

4. CLIMATE & METEOROLOGY

4.1 Temperature & Rainfall. The National Climatic Data Center in its 1982 annual summary for Honolulu notes that:

> "Hawaii's equable temperatures are associated with the small seasonal variation in the amount of energy received from the sun and the tempering effect of the surrounding ocean. The range of temperature averages only 7 degrees between the warmest months (August and September) and the coolest months (January and February) and about 12 degrees between day and night. Daily maximums run from the high 70's in winter to the mid-80's in summer, and daily minimums from the mid-60's to the low 70's. However, the Honolulu Airport area has recorded as high as 93 degrees and as low as 53" [12].

Rainfall in the project area averages about 85 inches per year [1]. In accordance with Thornwaite's scheme for climatic classification, the area is considered humid forest [13].

4.2 Surface Winds. Meteorological records from the Kaneohe Marine Corps Air Station (KMCAS) were reviewed. As is quite evident in Figure 2, northeast tradewinds appear to predominate on an annual

basis. A closer examination of the data, however, reveals seasonal and diurnal differences both in direction and velocity. Figures 3 and 4 depict directional wind roses for the 3:00 - 5:00 p.m. period during the months of January and August. The predominance of northeast tradewinds during the summer in contrast to the more variable nature of the winter months is quite clear.

The winter months also are characterized by generally lower wind velocities as evidenced again by the January-August comparison, this time presented in tabular form (Tables 7 and 8). Light, variable winds are much more prevalent during January than in August, and not surprisingly, it is during the winter months that most of the high carbon monoxide levels are recorded by the Department of Health.

5. HIGHWAYS AND TRAFFIC

The principal roadways serving the project site are Kionaole Road and Kamehameha Highway. Kionaole Road is a 2-lane rural highway with 12-foot lanes which joins the eastbound lanes of Kamehameha Highway at a T-intersection. Kamehameha Highway has four 12-foot lanes and a variable width medial strip. A left-turn lane of approximately 90-foot length allows access to Kionaole Road from the westbound lanes of Kamehameha Highway.

Existing and projected peak-hour traffic data used in this analysis were provided by Engineering Concepts, Inc. [14], and are based on historical data, recent traffic counts and traffic

generation factors for the proposed golf course.

6. MOBILE SOURCE IMPACT

6.1 Emission Factors. Automotive emission factors for carbon monoxide (CO) were generated for calendar years 1986 and 1989 using the Mobile Source Emissions Model (MOBILE-2) [15]. To localize emission factors as much as possible, the August, 1983 age distribution for the City & County of Honolulu [16] was input in lieu of the national statistics normally used.

6.2 Microscale Analysis. Analyses such as this generally involve estimation of concentrations of non-reactive pollutants. This is due to the complexity of modeling pollutants which undergo chemical reactions in the atmosphere and are subject to the effects of numerous physical and chemical factors which affect reaction rates and products. For projects involving motor vehicles as the principal air air pollution source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere (about 1 month) [17], and it comprises the largest fraction of automotive emissions.

In this instance, a microscale screening analysis was performed for the Kionaole Road intersection with Kamehameha Highway. The EPA computer model HIWAY2 [18] was employed with an array of receptors paralleling the south edge of Kionaole Road at a 10-meter distance. Since the traffic report identified the weekday p.m. peak traffic hours and midday on Saturday as the times of maximum project contribution to traffic, worst case

meteorological conditions were selected accordingly. A wind speed of 1 meter per second, an acute wind/road angle, and neutral stability (Pasquill-Gifford Class "D") [19], were all selected to maximize concentration estimates in the vicinity of the intersections.

Maximum one-hour carbon monoxide (CO) concentrations were computed for the weekday p.m. peak traffic hours and for the Saturday midday peak traffic hour (11 a.m. - 12 noon). The analyses were performed for existing conditions (1986) and future conditions (1989) both with and without the proposed golf course. The results are summarized in Tables 9 and 10.

7. OTHER IMPACTS

The use of pesticides is routinely required at golf courses in order to maintain fairways and greens. Typical pesticide use at an 18-hole golf course is shown in Table 11 [21].

The herbicides MSMA, glyphosate, metribuzin, and pendimethalin all have relatively low mammalian toxicities with LD_{50} values on the order of hundreds or thousands of milligrams active agent per kilogram body weight (mg/kg) [22, 23]. They do, however, have WARNING and CAUTION labels because of their irritative effects on the eyes and skin. The OSHA 8-hour time-weighted average standard for metribuzin in the air is 5 mg/m3 [22].

The insecticide Sevin is a relatively low toxicity carbamate which can affect the normal functioning of mammalian nervous

systems through its inhibition of the enzyme cholinesterase. It also has a relatively high LD_{50} value of about 500 - 850 mg/kg and therefore only has a CAUTION label on its containers. The OSHA standard for airborne concentrations of carbaryl (the active ingredient in Sevin) is 5 mg/m3 as an 8-hour average [22].

The fungicides Dithane M45, Kocide 101, and Subdue are also low toxicity chemical mixtures with LD_{50} values in the hundreds and thousands of mg/kg [22, 23]. Subdue has a WARNING label because of its potential for eye injury.

If properly used in accordance with label instructions, all of the aforementioned chemicals should present no hazard to the properties or owners of properties adjoining the proposed golf course. In fact, the greatest risk in using such chemicals is generally to the users themselves if they do not strictly follow label instructions. This is because the user may come in contact with the concentrated product while nearby properties and people may only be exposed to the greatly diluted and dispersed application solution.

The potential for significant airborne concentrations of these chemicals is relatively slight when one considers the dilution factor in application solutions plus the coarse spray that is normally used to assure adequate coverage in the desired area and avoidance of drift. Should a user improperly apply these chemicals under wind conditions which would contribute to drift, then there would be an increased possibility of downwind exposure

of property and people. In order to assess the possible impact of such an event on people, a worst case dispersion modeling analysis was performed for each of the chemicals. The results of this modeling are summarized in Table 12.

8. CONSTRUCTION IMPACT

The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along Kionaole Road and Kamehameha Highway as well as in the vicinity of the project site itself. During off-peak hours, the additional construction vehicle traffic should not exceed road capacities although the presence of large trucks can reduce a roadway's capacity as well as lower average travel speeds thereby contributing to additional air pollution emissions.

The site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and a precipitation/evaporation (P/E) index of 50 [20].

Although the onsite soil, a silty clay, in all probability has a silt content greater than the 30% cited above, fugitive dust is not likely to be a serious concern due to the high rainfall in

the area and a P/E Index = 121.

9. DISCUSSION AND CONCLUSIONS

9.1 Microscale Analysis. The 1-hour concentration estimates at the Kionaole Road - Kamehameha Highway intersection (Tables 9 and 10) indicated compliance with federal and state 1-hour standards under both current and projected traffic conditions. The contribution of the proposed golf course traffic to near roadway carbon monoxide levels ranged from 1.6 to 7.7%. The relative contribution was greater during the midday Saturday scenario than the weekday p.m. peak hour scenario.

Compliance with the federal and state 8-hour standards can easily be inferred from these 1-hour concentration estimates by the fact that all the 1-hour estimates were less than the 8-hour standards. Statistically, the maximum 8-hour average will be lower than the maximum 1-hour average; therefore, the fact that all the 1-hour concentrations were less than the 8-hour standard implies that the 8-hour concentration would also be less than that standard.

9.2 Other Impacts. The results in Table 12 indicate the low level of human exposure possible under worst case conditions of user error, wind speed, and proximity to the source. Even under the assumption that all these worst case factors will occur simultaneously, the downwind pesticide concentrations are low and of short duration. This clearly indicates that under proper use conditions, there will be no significant pesticide impact on air

quality. It should be noted, however, that in the case of the herbicides improper use resulting in drift may cause some degree of injury to plants downwind.

9.3 Short-Term Impact. Since as noted in Section 8, there is only a slight potential for fugitive dust due to the silty clay soil but humid climate, adequate dust control measures should not be difficult to employ during the construction period.

Should dry periods occur, dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. Dust barriers near existing dwellings might be considered if problems arise from wind-driven dust. The soonest possible landscaping of completed areas will also help.

9.4 Conclusions. Based on the foregoing analysis, the following conclusions may be drawn:

- o Traffic generated by the proposed project will have a very small impact on local air quality, and both state and federal air quality standards will continue to be met in the project area.

- o Pesticide use associated with the project will be minimal and will not significantly affect air quality provided that label instructions are strictly adhered to.

- o Construction activities will have a small impact on local air quality due to the additional construction vehicle activity. Fugitive dust from construction activities should be negligible due to the high rainfall in the area.

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22. Farm Chemicals Handbook, Meister Publishing Company, 1977.

23. National Institutes of Occupational Safety and Health, Registery of Toxic Effects of Chemical Substances (RTECS), April 1984.

TABLES

TABLE 1

SUMMARY OF STATE OF HAWAII AND FEDERAL
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS PRIMARY	SECONDARY	STATE STANDARDS
1. Total Suspended Particulate Matter (TSP)	Annual Geometric Mean	75	60	60
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	260	150	150
2. Sulfur Dioxide (SO2)	Annual Arithmetic Mean	80	—	80
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	365	—	365
	Maximum Average			
3. Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	100		70
(micrograms per cubic meter)				
4. Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10		5
(milligrams per cubic meter)	Maximum Average in Any 1 Hour	40		10
5. Photochemical Oxidants (as O3)	Maximum Average in Any 1 Hour	240		100
(micrograms per cubic meter)				
6. Lead (Pb)	Maximum Average in Any Calendar Quarter	1.5		1.5
(micrograms per cubic meter)				

SOURCES: State of Hawaii, Title 11, Chapter 59, Air Quality Standards
Title 40, Code of Federal Regulations, Part 50

TABLE 2

AIR MONITORING DATA
DEPARTMENT OF HEALTH BUILDING
1985

	Total Suspended Particulates (TSP) 24-Hour Concentrations (ug/m3)				Sulfur Dioxide (SO2) 24-Hour Concentrations (ug/m3)			
MONTH	SAMPLES	MIN.	MAX.	MEAN	SAMPLES	MIN.	MAX.	MEAN
Jan 85	6	21	40	32	6	<5	<5	<5
Feb 85	4	15	40	26	4	<5	<5	<5
Mar 85	5	28	48	36	5	<5	<5	5<
Apr 85	4	21	27	23	5	<5	<5	<5
May 85	6	20	34	25	4	<5	<5	<5
Jun 85	5	15	26	20	4	<5	<5	<5
Jul 85	5	14	24	19	5	<5	<5	<5
Aug 85	5	10	22	16	5	<5	<5	<5
Sep 85	4	15	32	21	5	<5	<5	<5
Oct 85	5	17	32	22	5	<5	<5	<5
Nov 85	5	13	39	27	5	<5	<5	<5
Dec 85	5	17	30	22	5	<5	<5	<5
ANNUAL	59	10	48	24	58	<5	<5	<5

SOURCE: Department of Health

TABLE 3

CARBON MONOXIDE MONITORING DATA
DEPARTMENT OF HEALTH BUILDING
1984

Carbon Monoxide
Concentrations (mg/m3)

MONTH	No. of Samples	1-Hr Min	1-Hr Max	8-Hr Max	Mean
Jan 84	687	0.0	10.9	4.8	1.0
Feb 84	612	0.2	7.9	3.0	0.9
Mar 84	704	0.0	11.0	3.7	0.8
Apr 84	653	0.1	6.0	2.5	0.6
May 84	675	0.0	4.5	2.0	0.6
Jun 84	660	0.0	2.0	1.0	0.4
Jul 84	705	0.0	3.2	1.8	0.5
Aug 84	638	0.0	4.3	1.5	0.5
Sep 84	685	0.0	4.6	1.8	0.8
Oct 84	700	0.0	9.2	2.6	0.9
Nov 84	685	0.0	9.3	4.6	0.6
Dec 84	699	0.0	7.6	3.8	1.0
ANNUAL	8,059	0.0	11.0	4.8	0.7

SOURCE: Department of Health

TABLE 4

AIR MONITORING DATA
WAIMANALO, OAHU
1985

Total Suspended Particulates (TSP)

24-Hour Concentration (ug/m3)

MONTH	SAMPLES	MINIMUM	MAXIMUM	MEAN
Jan 85	6	13	33	24
Feb 85	3	19	35	25
Mar 85	3	37	52	43
Apr 85	5	24	36	29
May 85	5	23	35	29
Jun 85	5	14	30	24
Jul 85	5	19	33	24
Aug 85	4	14	22	18
Sep 85	4	15	24	19
Oct 85	4	15	36	24
Nov 85	4	14	28	19
Dec 85	5	25	51	39
ANNUAL	54	13	52	26

SOURCE: Department of Health

TABLE 5

AIR MONITORING DATA
SAND ISLAND
1983

Photochemical Oxidants
1-Hour Concentrations (ug/m3)

Month	No. of Samples	Min	Max	Mean
Jan	700	0	123	24
Feb	509	0	92	23
Mar	701	0	92	32
Apr	629	0	88	41
May	703	0	78	35
Jun	681	0	61	23
Jul	704	0	47	14
Aug	705	0	55	15
Sep	687	0	47	18
Oct	672	0	71	24
Nov	683	0	74	19
Dec	663	0	96	22
Annual	8,037	0	123	23

SOURCE: Department of Health

TABLE 6

LEAD MONITORING DATA
HONOLULU, OAHU
1970-85

AVERAGE CONCENTRATION (micrograms/cubic meter)

YEAR	1st QUARTER	2nd QUARTER	3rd QUARTER	4th QUARTER
1970	0.78	0.81	0.65	0.92
1971	1.65	0.63	0.65	1.05
1972	--	0.75	0.65	0.48
1973	0.52	0.52	0.72	0.55
1974	0.84	0.61	0.70	0.92
1975	0.65	0.81	0.59	1.05
1976	0.91	0.65	0.99	1.00
1977	0.89	0.59	0.48	0.80
1978	--	--	--	0.72
1979	0.39	0.25	0.26	0.42
1980	0.41	0.23	0.21	0.20
1981	0.25	--	--	--
1982	0.21	0.16	0.09	0.21
1983	n/a	n/a	n/a	n/a
1984	0.3	0.2	0.2	0.3
1985	0.1	0.03	0.02	0.1

Source: State of Hawaii
Department of Health

TABLE 7

KANEOHE MARINE CORPS AIR STATION
JANUARY (3:00 - 5:00 P.M.)
WIND ROSE

Frequency of Occurrence (%)

Direction	Wind Speed (knots) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	0.5	1.9	3.4	1.5	0.3		7.5
NNE	0.3	2.6	3.5	2.2	0.7	0.1	9.4
NE	0.4	2.4	3.2	5.1	1.0	0.5	12.6
ENE	0.3	1.2	4.9	7.0	1.1	0.1	14.6
E	0.5	1.1	5.0	5.1	1.3		13.1
ESE	0.5	2.1	4.3	3.8	0.3		11.0
SE	0.1	0.7	1.5	0.5	0.1		3.0
SSE	0.1	0.4	0.8	0.7		0.2	2.2
S	0.3	1.1	2.3	0.9	0.1	0.2	4.9
SSW	0.1	0.7	2.1	3.0	0.8	0.6	7.3
SW	0.3	0.6	1.5	1.6	0.5	0.4	4.9
WSW	0.3	0.4	0.5	0.6	0.1	0.1	2.0
W		0.2	0.1	0.1			0.3
WNW	0.2	0.4	0.3	0.3			1.1
NW	0.1	0.3	0.3	0.2			0.9
NNW	0.1	0.8	1.2	0.7	0.5	0.1	3.4
Calm							2.0
Total:	4.1	16.8	34.7	33.3	6.8	2.3	100.0

TABLE 8

KANEOHE MARINE CORPS AIR STATION
AUGUST (3:00 - 5:00 P.M.)
WIND ROSE

Frequency of Occurrence (%)

Direction	Wind Speed (knots) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N		0.3	0.5				0.8
NNE		1.1	4.5	1.9	0.1		7.5
NE		0.9	7.9	15.1	1.0		24.9
ENE		0.8	9.4	33.3	4.0	0.1	47.7
E		0.2	2.6	8.8	1.8	0.1	13.5
ESE		0.1	0.5	3.5	0.5	0.1	4.6
SE	0.1			0.1			0.1
SSE					0.1	0.1	0.1
S		0.1		0.2			0.3
SSW							0.0
SW			0.1				0.1
WSW							0.0
W		0.1	0.1				0.2
WNW		0.1					0.1
NW							0.0
NNW			0.1				0.1
Calm							0.1
Total:	0.1	3.5	25.6	62.9	7.5	0.4	100.0

TABLE 9

ESTIMATED MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS
AT THE KAMEHAMEHA HIGHWAY- KIONAOLE ROAD INTERSECTION
WEEKDAY (3 - 4 P.M.)

Receptor	1986 (mg/m3)	1989 Without Project (mg/m3)	Increase ($)	1989 With Project (mg/m3)	Increase ($)	Increase Due to Project ($)
R1	1.26	1.41	12.3	1.43	13.9	1.6
R2	1.29	1.45	12.5	1.49	15.0	2.6
R3	1.33	1.50	12.7	1.55	16.4	3.8
R4	1.36	1.54	12.8	1.60	17.6	4.8
R5	1.41	1.59	13.0	1.66	17.8	4.8
R6	1.38	1.55	12.8	1.61	17.0	4.2
R7	1.32	1.48	12.4	1.53	16.6	4.2
R8	1.21	1.35	11.7	1.40	15.7	4.0
R9	1.11	1.23	10.8	1.27	14.6	3.8
R10	0.97	1.06	9.4	1.09	12.9	3.5
R11	0.79	0.84	7.1	0.87	9.8	2.7
R12	1.43	1.61	13.3	1.66	16.5	3.2
R13	1.88	2.17	15.5	2.22	17.7	2.2
Mean:			12.0%		15.5%	3.5%

Notes:
1. See Figure 5 for receptor locations.
2. mg/m3= milligrams/cubic meter
3. Background CO level = 0.5 mg/m3
4. Meteorological conditions:
   Wind speed = 1 m/sec
   Stability = neutral
   Wind-road angle = 45 deg

TABLE 10

ESTIMATED MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS
AT THE KAMEHAMEHA HIGHWAY- KIONAOLE ROAD INTERSECTION
SATURDAY (11 A.M. - 12 NOON)

Receptor	1986 (mg/m3)	1989 Without Project (mg/m3)	Increase ($)	1989 With Project (mg/m3)	Increase ($)	Increase Due to Project ($)
R1	1.35	1.47	8.8	1.50	11.3	2.4
R2	1.39	1.51	8.9	1.57	12.9	4.0
R3	1.43	1.56	9.1	1.65	15.0	5.9
R4	1.47	1.61	9.1	1.72	16.6	7.5
R5	1.53	1.67	9.1	1.78	16.8	7.7
R6	1.49	1.62	8.9	1.72	15.6	6.8
R7	1.43	1.55	8.4	1.65	15.3	6.9
R8	1.31	1.42	7.8	1.50	14.4	6.6
R9	1.21	1.29	7.1	1.37	13.4	6.2
R10	1.05	1.12	6.1	1.18	11.8	5.7
R11	0.85	0.89	4.5	0.92	9.0	4.5
R12	1.54	1.69	9.5	1.76	14.5	5.1
R13	2.06	2.29	11.0	2.36	14.4	3.3
Mean:			8.3%		13.9%	5.6%

Notes:
1. See Figure 5 for receptor locations.
2. mg/m3= milligrams/cubic meter
3. Background CO level = 0.5 mg/m3
4. Meteorological conditions:
   Wind speed = 1 m/sec
   Stability = neutral
   Wind-road angle = 45 deg

TABLE 11

TYPICAL PESTICIDE USE AT AN 18-HOLE GOLF COURSE

PRODUCT	AREA (acres)	QUANTITY	FREQUENCY	ANNUAL REQUIREMENT
Herbicides (fairways & rough)				
MSMA	100	33 gal	4/yr	132 gal
Glyphosate				25 gal
Metribuzin	100	25 lb	2/yr	50 lb
Pendimethalin	100	400 lb	2/yr	800 lb
Insecticides (greens & teal				
Sevin	10	21 gal	12/yr	252 gal
Fungicides (greens & teal				
Dithane M-45	10	109 lb	25/yr	2,725 lb
Kocide 101	10	217 lb	12/yr	2,604 lb
Subdue	10	6.7 gal	3/yr	20 gal

TABLE 12

ESTIMATES OF WORST CASE DOWNWIND PESTICIDE CONCENTRATIONS

Product	Active Agent Emission Rate (g/sec)	Active Agent Concentration (mg/m3)
MSMA	.076	.2348
Glyphosate	.069	.2132
Metribuzin	.007	.0216
Pendimethalin	.083	.2564
Sevin	.292	.9020
Dithane M-45	.303	.9360
Kocide 101	.377	1.1646
Subdue	.047	.1452

Conditions:

Windspeed:	7 m/sec
Stability category:	D (neutral)
Downwind distance:	100 m
Exposure duration:	5 minutes
Treated area:	1,000 ft2
Application height:	1 m
Active agent drift:	25 %

FIGURE 1.
1-HOUR CO LEVEL VERSUS TIME OF DAY
PALI HIGHWAY AT CASTLE HOSPITAL
(JUNE - NOVEMBER 1977)

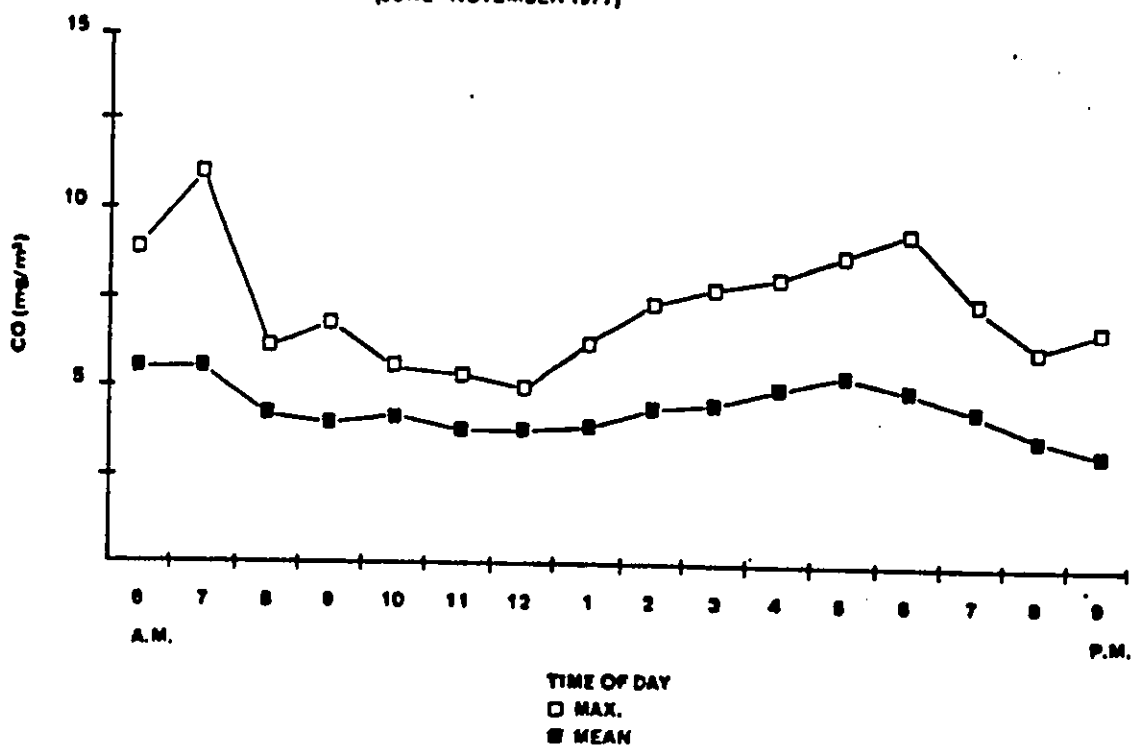
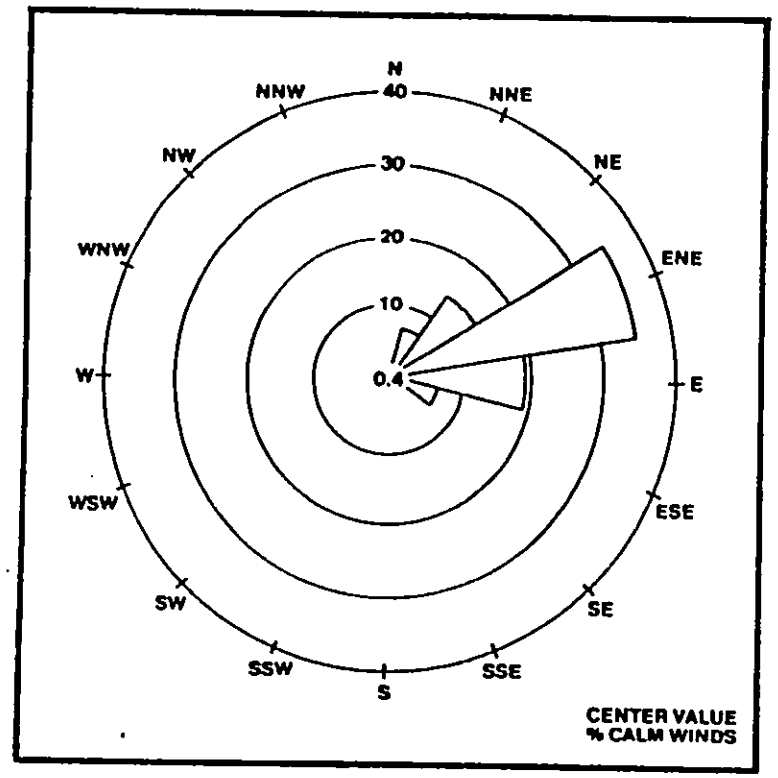


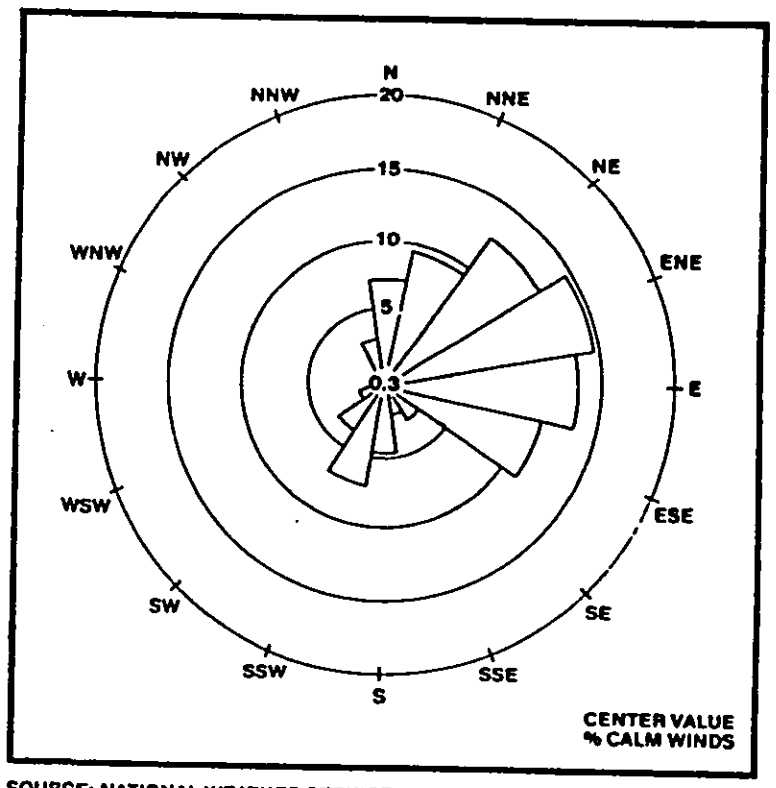
FIGURE 1

FIGURE 2.
FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KANEOHE MARINE CORPS AIR STATION
1945 - 1965



SOURCE: NATIONAL WEATHER SERVICE

FIGURE 3.
FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KANEOHE MARINE CORPS AIR STATION
JANUARY (3:00-5:00 P.M.)



SOURCE: NATIONAL WEATHER SERVICE

FIGURE 5.
KIONAOLE ROAD—KAMEHAMEHA HIGHWAY
INTERSECTION
AND MODEL RECEPTOR ARRAY

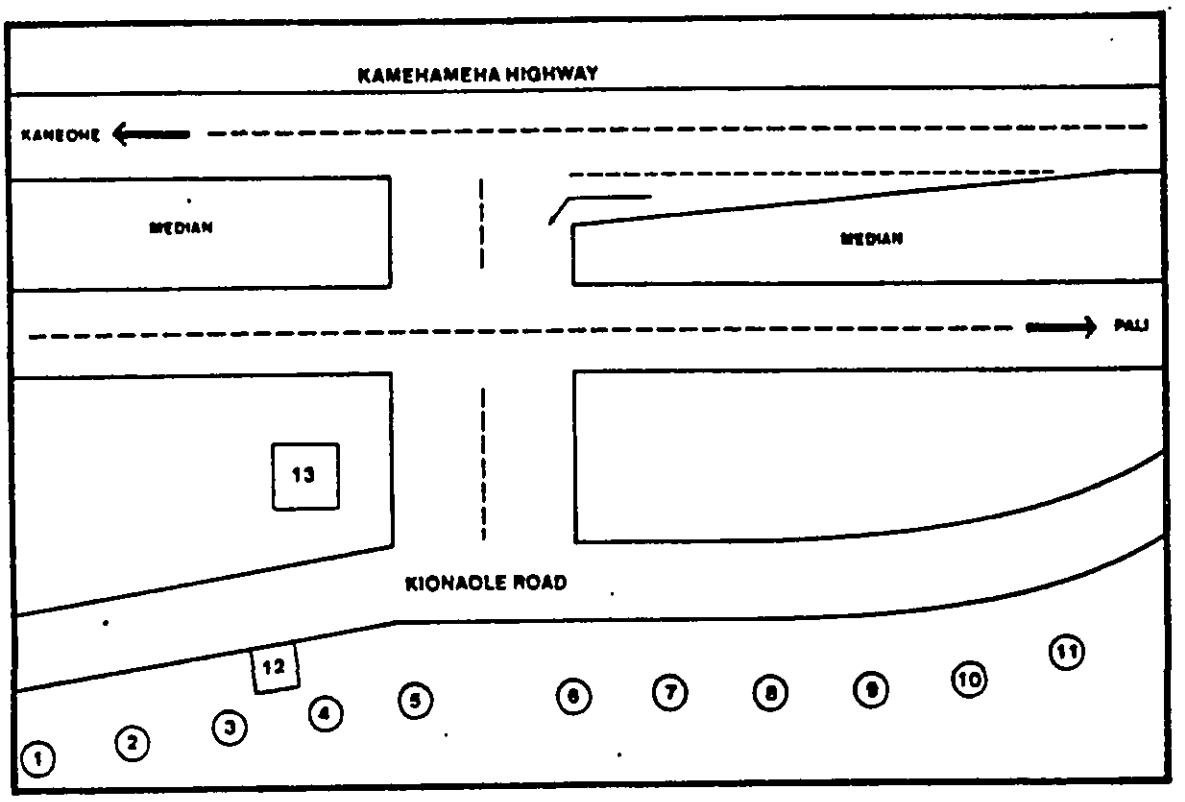
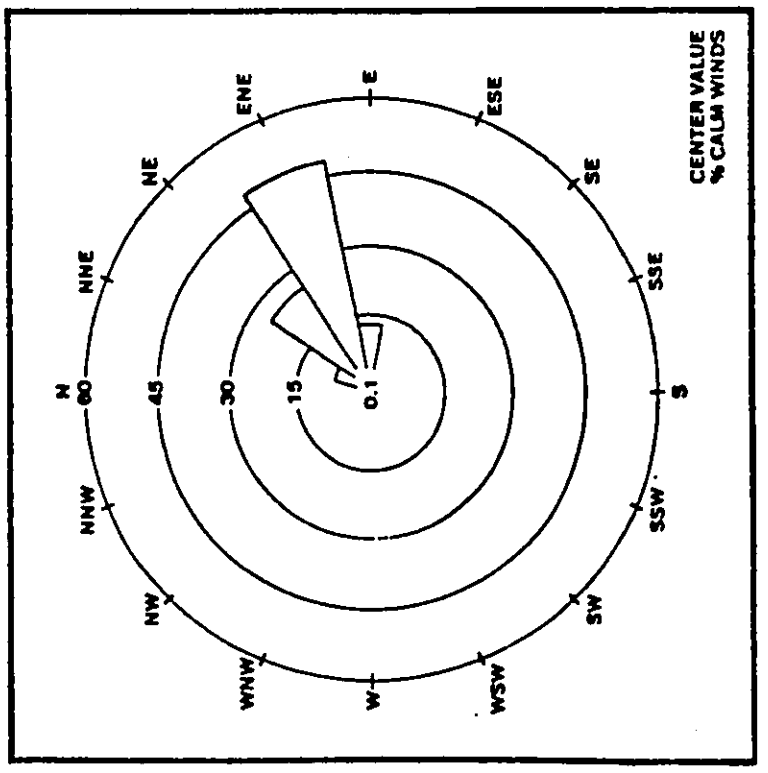


FIGURE 4.
FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KANEOHE MARINE CORPS AIR STATION
AUGUST (3:00-5:00 P.M.)



SOURCE: NATIONAL WEATHER SERVICE

APPENDIX I

Traffic Noise Study
for the
Proposed Nitto Kogyo Golf Course

TRAFFIC NOISE STUDY
FOR THE PROPOSED
NITTO KOGYO GOLF COURSE

PREPARED FOR
ENGINEERING CONCEPTS, INC.

BY
Y. EBISU & ASSOCIATES

AUGUST, 1986

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I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Nitto Kogyo Golf Course were evaluated for their potential impact on present and future residences. The increases in future traffic noise levels are anticipated to be manageable, and the proposed project should be capable of meeting the most stringent federal noise standards for residences and scenic parks.

Due to the relatively low volume of anticipated project traffic, risks of adverse noise impacts from traffic noise are considered to be low, and special noise mitigation measures are not required.

Risks of adverse noise impacts from Clubhouse activities are also low due to the use of air conditioning, and due to the large buffer distances to park lands and residences. For these reasons, special noise mitigation measures are not required for the Clubhouse.

II. PURPOSE AND METHODOLOGY

The purpose of this noise study was to predict and evaluate the motor vehicle traffic noise increases associated with the proposed Nitto Kogyo Golf Course. The scope of the noise study was limited to existing residences within the project environs and to the adjacent Hoomaluhia Park, which may be exposed to increased traffic noise as result of the proposed golf course.

Traffic noise predictions for the existing conditions and for the Year 1989 following completion of the proposed golf course were performed using traffic data from Reference 1 and the Federal Highway Administration (FHWA) Noise Prediction Model (Reference 2). Traffic data entered into the noise prediction model were: peak hour volumes; average vehicle speeds; and estimates of traffic mix.

Residential areas possibly affected by predicted increases in future traffic noise levels were isolated by comparing future traffic noise levels with FHA/HUD noise standards (Reference 3). Park areas possibly affected were isolated by comparing future traffic noise levels with FHWA noise standards (Reference 4) and the recommendations of Reference 5. The relative contributions of non-project and project related traffic to the total noise levels were also indicated, and an evaluation of possible traffic noise impacts was made.

III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

Two noise descriptors currently used to relate traffic noise levels to land use compatibility, and to assess environmental noise in general, are the Equivalent Noise Level (Leq) and the Day-Night Average Sound Level (Ldn). Both of these descriptors are averages of instantaneous A-Weighted sound levels as read on a standard Sound Level Meter. In traffic noise evaluations, the averaging period for the Leq descriptor is usually an hour, and more specifically, the peak hour of traffic. In all evaluations, the minimum averaging period for the Ldn descriptor is 24 hours (by definition). Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the Ldn descriptor.

TABLE 1, extracted from Reference 6, presents current federal standards and acceptability criteria for residential land uses exposed to various levels of environmental noise. As a general rule, noise levels of 55 Ldn or less occur in rural areas or urbanized areas which are shielded from high volume streets. Noise levels typical of communities on Oahu are shown in FIGURE 1. In urbanized areas, Ldn levels generally range from 55 to 65 Ldn, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 Ldn, and as high as 72 Ldn when the roadway is a high speed freeway. Due to noise shielding effects from intervening structures, residences which are located within interior lots are exposed to lower exterior noise levels of 60 Ldn or less.

For the purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 Ldn or lower is considered acceptable. This standard is applied nationally (see Reference 3), including Hawaii. Because of our open living conditions, the predominant use of naturally ventilated dwellings, and the relatively low

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION
(RESIDENTIAL LAND USE)

Noise Exposure Class	Day-Night Sound Level	Equivalent Sound Level	Federal (1) Standard
Minimal Exposure	Not Exceeding 55 Ldn	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 Ldn But Not Above 65 Ldn	Above 55 Leq But Not Above 65 Leq	(2) Acceptable
Significant Exposure	Above 65 Ldn But Not Above 75 Ldn	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 Ldn	Above 75 Leq	Unacceptable

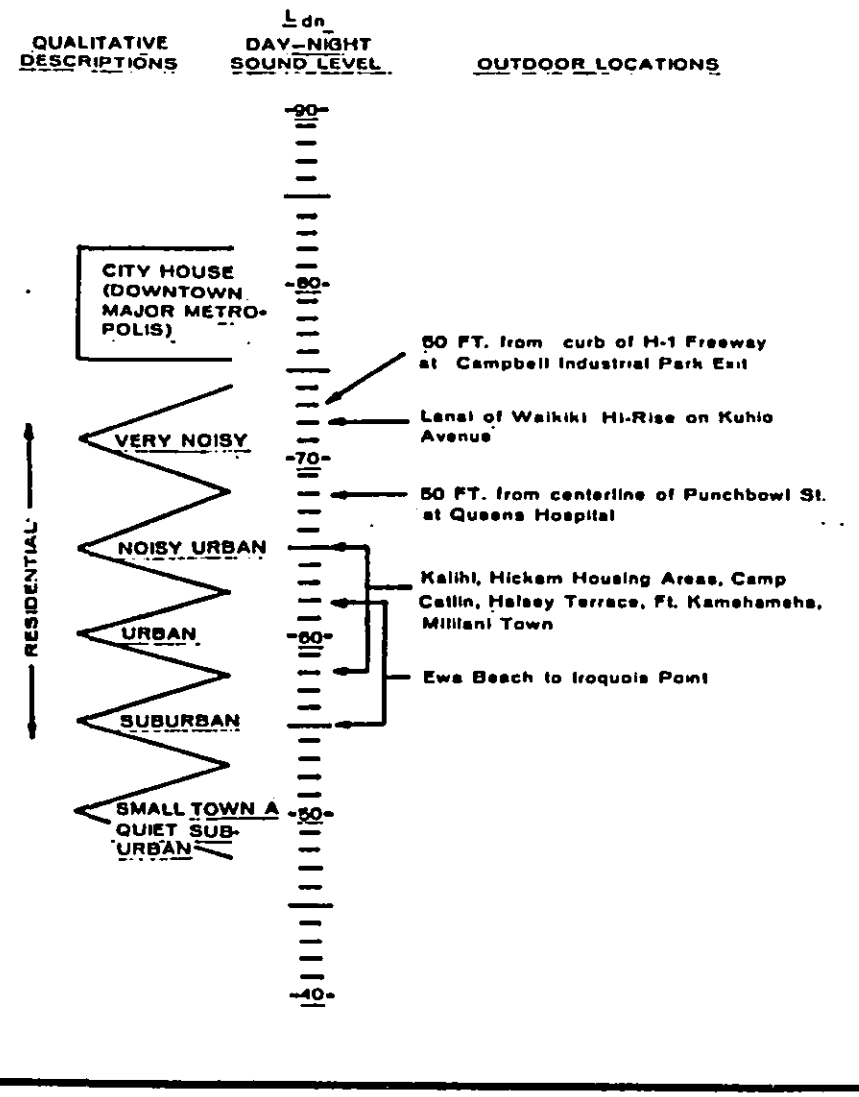
Note: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours.

I-4

FIGURE 1

RANGE OF EXTERIOR BACKGROUND AMBIENT NOISE LEVELS



exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 Ldn does not eliminate all risks of adverse noise impacts. For these reasons, and as recommended in Reference 7, a lower level of 55 Ldn is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 Ldn, government agencies such as FHA/HUD and VA have selected 65 Ldn as a more appropriate regulatory standard.

FHWA noise abatement criteria are summarized in TABLE 2. A value of 67 Leq(h) is listed as exterior noise criteria level for parks, with a lower level of 57 Leq(h) listed for "lands on which serenity and quiet are of extraordinary significance,.....". For the purposes of this acoustical study, the more stringent 57 Leq(h) criteria was used for the assessment of possible noise impacts on the Hoomaluhia Park.

TABLE 2

NOISE ABATEMENT CRITERIA
[Hourly A-Weighted Sound Level—Decibels (dBA)]

Activity Category	Leq(h)	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	——	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

(Extracted from Reference 4.)

IV. EXISTING TRAFFIC NOISE ENVIRONMENT

The existing traffic noise levels along Kamehameha Highway (the major roadway which would service this project) are high, and in the "Significant Exposure, Normally Unacceptable" category at approximately 65 to 70 Ldn along the Right-of-Way. This condition is typical along highways and major roadways of Oahu (see FIGURE 1). Traffic noise levels along the first row of homes fronting a major roadway generally represent the worst case (or highest) levels for homes of a subdivision. Traffic noise levels at interior lots (second row of homes from the roadway, for example) are generally in the "Minimal Exposure, Unconditionally Acceptable" to "Moderate Exposure, Acceptable" categories, with 5 to 10 Ldn lower noise levels resulting from shielding and distance effects. An exception occurs for mid and high-rise structures which are not shielded from the roadway by intervening low-rise units.

The existing traffic noise levels along the former Kalaniana'ole Highway (Kionaole Road) are low, and in the "Minimal Exposure, Unconditionally Acceptable" category at less than 55 Ldn at 50 FT distance from the roadway's centerline. Existing background ambient noise levels along the road are controlled by the sound of birds, wind, and distant traffic, and ranges from 40 to 45 Leq(h). Instantaneous background ambient noise levels (as read on a Sound Level Meter) range between 36 and 60 dB.

Results of calculations of existing traffic noise levels along Kamehameha Highway and Kionaole Road are shown in TABLE 3. The weekday and Saturday traffic volumes used for the Kamehameha Highway sections were obtained from Reference 1. The existing Saturday traffic volume on Kionaole Road was estimated at less than 20 VPH from spot counts. The traffic noise levels shown in the tables only apply when unobstructed line-of-sight conditions exist to the roadways. These conditions would generally occur at the first row of homes fronting the roadway, within any open space or parking lot, and at the upper levels of a mid or high-rise

TABLE 3

COMPARISONS OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS IN PROJECT ENVIRONS

LOCATION	SPEED (MPH)	VPH	*** HOURLY LEQ(H) IN DB @ 50' *** AUTO	MT	HT	ALL VEH	DB INCREASE
EXISTING PEAK HR. TRAFFIC:							
Kam. Hwy. Toward Pali*	45	770	61.4	56.7	61.5	65.1	-
Kam. Hwy. Toward Kaneohe*	40	1,050	60.8	56.4	61.6	64.9	-
Kam. Hwy. Toward Pali**	45	960	62.5	53.7	58.5	64.3	-
Kam. Hwy. Toward Kaneohe**	40	1,070	60.9	55.5	57.7	63.4	-
Kionaole Road**	25	20	35.9	31.3	35.4	39.4	-
FUTURE PEAK HR.TRAFFIC:							
Kam. Hwy. Toward Pali*	45	880	61.9	57.3	62.1	65.7	0.6
Kam. Hwy. Toward Kaneohe*	40	1,160	61.2	56.8	62.1	65.3	0.4
Kam. Hwy. Toward Pali**	45	1,080	63.0	54.2	59.0	64.8	0.5
Kam. Hwy. Toward Kaneohe**	40	1,170	61.3	55.9	58.1	63.8	0.4
Kionaole Road**	25	150	44.7	40.0	44.2	48.2	8.8

Notes:

* Weekday Peak Hour (3:00 to 4:00 PM).

** Saturday Peak Hour (11:00 AM to 12:00 Noon).

Assumed traffic mix of 95% Autos, 2.5% Medium Trucks, and 2.5% Heavy Vehicles on Kamehameha Highway, and 98% Autos, 1% Medium Trucks, and 1% Heavy Vehicles on Kionaole Road.

structure.

The existing background ambient noise levels within the Hoomaluhia Park are approximately 40 to 45 Leq(h). These background ambient levels are typical of undeveloped lands on Oahu which are removed from major highways or urbanized areas. Existing background ambient noise levels are approximately 12 to 17 dB quieter than the most stringent FHWA criteria level for parks, or 57 Leq(h).

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V. FUTURE TRAFFIC NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 1. The future projections of project and non-project traffic on the roadways which would service the project are shown in TABLE 4 for the weekday and weekend (Saturday) peak hours of traffic. The results of the Year 1989 noise predictions developed from the TABLE 4 traffic volumes are summarized in TABLE 3. TABLE 5 summarizes the predicted traffic noise increases along the roadways servicing the project, and also indicates the increases associated with project traffic.

From TABLES 3 and 5, minimal project plus non-project traffic noise increases of 0.4 to 0.6 dB are predicted to occur between the current period and 1989 along the two sections of Kamehameha Highway servicing the project. The large increase of 8.8 dB is associated with the relatively low volume Kionaole Road (former Kalaniana'ole Highway) in the immediate vicinity of the proposed project. Essentially all of the predicted traffic noise increase on this low volume roadway is associated with project related traffic. For the higher volume Kamehameha Highway, total traffic noise increases attributable to the project are predicted to be insignificant, and to range from 0.1 to 0.3 dB.

Along the entrance road to the proposed golf course, a maximum of 130 in and out trips are projected during the weekend (Saturday) peak hour (see TABLE 4). During weekdays, peak hour traffic associated with the golf course will be less at 80 trips. Based on the maximum of 200 parking stalls planned for the clubhouse facility, an anticipated maximum of 200 vehicle trips is predicted during the period immediately following a social function at the Clubhouse. Projected volumes of traffic associated with golfing and Clubhouse activities are relatively low, and traffic noise levels along the entrance road are predicted to be approximately 55 Leq(h) along the Right-of-Way, and approximately 42 Leq(h) at Hoomaluhia Park. This predicted level of project

TABLE 4

FUTURE PROJECT AND NON-PROJECT TRAFFIC VOLUMES
FOR PEAK HOUR (IN VPH)

STREET SECTION	NON-PROJECT VOLUME (VPH)	PROJECT VOLUME (VPH)
Kam. Hwy. Toward Pali*	830	50
Kam. Hwy. Toward Kaneohe*	1,130	30
Kam. Hwy. Toward Pali**	1,000	80
Kam. Hwy. Toward Kaneohe**	1,120	50
Kionaole Road**	20	130

Notes:

* Weekday Peak Hour (3:00 to 4:00 PM).

** Saturday Peak Hour (11:00 AM to 12:00 Noon).

TABLE 5

PROJECT AND NON-PROJECT TRAFFIC NOISE INCREASES

LOCATION	EXISTING LDN	FUTURE LDN	PROJECT INCREASE
Kam. Hwy. Toward Pali*	66.1	66.7	0.3
Kam. Hwy. Toward Kaneohe*	65.9	66.3	0.1
Kam. Hwy. Toward Pali**	66.3	66.8	0.3
Kam. Hwy. Toward Kaneohe**	65.4	65.8	0.2
Kionaole Road**	41.4	50.2	8.8

Notes:

Ldn values calculated at 50 FT from roadways' centerlines.

* Weekday Peak Hour (3:00 to 4:00 PM).

** Saturday Peak Hour (11:00 AM to 12:00 Noon).

traffic noise at the park is approximately 15 Leq(h) below the most stringent FHWA noise abatement criteria for parks.

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VI. DISCUSSION OF PROJECT RELATED TRAFFIC NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

From TABLE 5, the increases in traffic noise levels attributable to the project are less than 0.3 dB along Kamehameha Highway, and 8.8 dB in the immediate vicinity of the project along Kionaole Road. An increase in traffic noise of less than 0.5 dB should not be perceivable and is not considered to be significant. Increases in traffic noise of 8 to 9 dB are considered to be significant, but these larger increases are predicted to occur along the currently quiet Kionaole Road in the immediate vicinity of the project.

In absolute terms, Year 1989 traffic noise levels along the Kionaole Road should not exceed 51 Ldn at 50 FT setback distance from the roadway centerline. This level of project related traffic noise is very low when compared to current traffic noise levels of 65 to 70 Ldn at the intersection of Kionaole Road and Kamehameha Highway. The location of the golf course entrance road approximately 300+ FT west of the existing farm lot residence is more than adequate to minimize traffic noise impacts on the existing farm lot at the northeast corner of the proposed golf course.

Due to the relatively low volume of anticipated project traffic, risks of adverse noise impacts from traffic noise are considered to be low, and special noise mitigation measures are not required.

VII. OTHER NON-TRAFFIC NOISE CONSIDERATIONS

Adverse noise impacts from the Clubhouse activities are not anticipated due to the total enclosure and air conditioning of the facility's dining and social function areas. This, plus the large buffer (300+ FT) between the Clubhouse site and the Hoomaluhia Park, should be adequate to minimize risks of adverse noise impacts from the Clubhouse activities.

APPENDIX A. REFERENCES

(1) "Traffic Impact Analysis Report for the Nitto Kogyo Golf Course;" July, 1986.

(2) Barry, T. and J. Reagan; "FHWA Highway Traffic Noise Prediction Model;" FHWA-RD-77-108, Federal Highway Administration; Washington, D.C., December 1978.

(3) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B," U.S. Department of Housing and Urban Development, July 12, 1979.

(4) "Procedures for Abatement of Highway Traffic Noise," 23 CFR Part 772, Federal Highway Administration, July 8, 1982.

(5) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use," ANSI S3.23-1980, Acoustical Society of America.

(6) "Guidelines for Considering Noise in Land Use Planning and Control," Federal Interagency Committee on Urban Noise, June 1980.

(7) "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," Environmental Protection Agency, EPA 550/9-74-004), March 1974.