DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
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HONOLULU, HAWAII 96813

FILE COPY

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KK/DGP 87/CO-2A

March 31, 1987

Dr. John C. Lewin, Director
Office of Environmental Quality Control
State of Hawaii
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Lewin:

Final Environmental Impact Statement (FEIS)
Gentry 515 Development - The Gentry Companies
Tax Map Keys 9-6-04: por. 1 and 4; 9-4-06: por. 10

We are notifying you of our acceptance of the above as an adequate fulfillment of Chapter 343, HRS, and the EIS Rules.

An unresolved issue which will require approval prior to a recommendation on the applicant's development plan amendment request is a proposed General Plan amendment which would resolve inconsistency between the applicant's proposal and population distribution policies for Central Oahu in the present General Plan.

Other unresolved issues to be addressed prior to development of the site are:

1. Approval of a State Land Use District Boundary Amendment to redesignate the project site from the existing Agricultural District to an Urban District.

2. Approval of a development plan amendment to redesignate the site from Agriculture to assorted urban uses and various zoning district changes from the Honolulu City Council.

3. Approval of a new water source system from the State Department of Health, increased water allocation within the Pearl Harbor Groundwater Control Area from the Board of Land and Natural Resources and Board of Water Supply approval of a water master plan.

4. Completion of a study to determine the potential for contamination of the recharge area for the Waiawa Shaft as a result of urbanization.

5. Approval of a mitigation plan to minimize impact on the groundwater recharge quality and quantity from the Department of Land Utilization through consultation with the Department of Health.

6. Highway improvement plans and programs as required by the City Department of Transportation Services and the State Department of Transportation.

7. A sewer master plan for on- and off-site system improvements approved by the Department of Public Works.

8. A drainage plan approved by the Department of Public Works.

9. A park and recreation plan approved by the Department of Parks and Recreation.

These issues are discussed in the attached Acceptance Report. If there are any questions, please contact Keith Kurahashi of my staff at 527-6051.

Sincerely,

Donald Clegg

DONALD A. CLEGG
Chief Planning Officer

Attach.

cc: Mr. Fred Rodriguez, Environmental Communications, Inc.
Mr. Tosh Hosoda, The Gentry Companies
Department of Land Utilization

DEPARTMENT OF GENERAL PLANNING (DGP)
87/CO-2A

ACCEPTANCE REPORT: CHAPTER 343, HRS
ENVIRONMENTAL IMPACT STATEMENT (EIS)
GENTRY 515 DEVELOPMENT PLAN AMENDMENT
THE GENTRY COMPANIES
WAIAWA, OAHU, HAWAII
TAX MAP KEY 9-6-04: POR. 1;
9-4-06: POR. 10

A. Background

The proposed Gentry 515 Development is the second increment of the total master planned Waiawa community. This second increment is the subject of a City and County of Honolulu Development Plan Amendment Review and consists of 515 acres. The project site is presently designated Agriculture on the Central Oahu Development Plan Land Use Map. The total Waiawa Master Plan community will consist of approximately 2,500 acres.

The project site was used for agricultural purposes since the turn of the century. Since 1983, however, the site has been fallowed by the Oahu Sugar Company.

The development includes single-family detached residential units, low density and medium density apartments, commercial/industrial areas, and preservation areas. The acreages for these uses are as follows:

Residential	168 acres
Apartment-Low Density	156 acres
Apartment-Medium Density	26 acres
Commercial/Industrial	83 acres
Open Space	71 acres
Major Roadways	11 acres

The proposed development would result in the creation of 4,990 single family and apartment units of which approximately 3,900 would be planned for a retirement community.

The proposed project will include roadway, drainage, sewer system, water system, and underground electrical and telephone improvements.

The proposed project will access the highway system at the Waipio Interchange, Kamehameha Highway at Ka Uka Boulevard, Kamehameha Highway at Waipahu Street, and Kamehameha Highway at Waihona Street. Traffic improvements are planned at the Waipio Interchange, the Waipahu Street/Kamehameha Highway intersection, and the Ka Uka Boulevard/Kamehameha Highway intersection.

At full development, the estimated demand for potable water will be approximately 2.4 MGD per day. This development will connect to the Waiawa Development which proposes to construct an on-site water source, storage reservoirs and transmission and distribution mains which would be designed and constructed to meet City standards. The system will be turned over to the Board of Water Supply for operation and maintenance upon completion.

The proposed Gentry 515 development is expected to generate an average daily sewage flow of approximately 1.63 MGD when fully developed. This development will connect to the Waiawa Development which proposes a new 1.5 mile off-site trunk sewer to connect their system to the Pearl City Wastewater Pump Station. Wastewater will then be pumped to the regional sewage treatment plant at Honouliuli for treatment.

B. Procedures

1. An EIS Preparation Notice, prepared by the applicant's consultant appeared in the "Environmental Quality Commission (EQC) Bulletin" on December 23, 1986.

2. Comments from consulted parties were received until January 30, 1987. Twenty-two (22) parties submitted written comments during this period, which were responded to in writing by the applicant except for three (3) in which no response was deemed necessary.

3. The Draft EIS was received and distributed by the OEQC on February 6, 1987. The deadline for public review was then set for March 10, 1987.

4. Twenty-seven (27) parties made replies to the Draft EIS. Three (3) of these twenty-seven (27) replies were dated and received after the deadline for public review. The applicant made point-by-point responses to all substantive comments on the twenty-seven (27) replies received.

C. Content

The Final EIS for the proposed Gentry 515 Development adequately addresses the content requirements specified in Sections 11-200-17 and 11-200-18 of the EIS Rules.

D. RESPONSES TO COMMENTS

The applicant provided adequate point-by-point responses to all comments received within the 30-day response period established for the Draft EIS.

E. UNRESOLVED ISSUES

We concur with the listing of unresolved issues found on page X-1 of the Final EIS: State Land Use Boundary, Site Acquisition, and Agricultural versus Urban use.

In addition, several issues discussed by the applicant remain unresolved.

An issue that shall be resolved prior to approval of the applicant's development plan amendment request is its inconsistency with the population distribution policies in the General Plan. An amendment to the General Plan is currently in process.

The following issues require approvals prior to development of the site:

1. As mentioned by the applicant, a State Land Use District Amendment is required to redesignate the project site from the existing Agricultural District to an Urban District.

2. Approval of a development plan amendment to redesignate the site from Agriculture to assorted urban uses and various zoning district changes from the Honolulu City Council.

3. The project will require new water source system approval from the State Department of Health, increased water allocations within the Pearl Harbor Groundwater Control Area from the Board of Land and Natural Resources and Board of Water Supply approval of a water master plan.

4. A study that the developer indicated is underway at the request of the U.S. Navy to determine the potential for contamination of the recharge area for the Waiawa Shaft as a result of urbanization. This study, being conducted by the Water Resources Center at the University of Hawaii with the cooperation of the Board of Water Supply, may provide pertinent information to be considered in the decision making of the agencies which will have to approve water sources.

5. Approval of a mitigation plan to minimize impact on the groundwater recharge quality and quantity from the Department of Land Utilization through consultation with the Department of Health. Again the study mentioned in Item 4 above may be helpful in the decision making process.

6. Highway improvement plans and programs as required by the City Department of Transportation Services and the State Department of Transportation.

7. A sewer master plan for on- and off-site sewer system improvements approved by the Department of Public Works.

8. A drainage plan approved by the Department of Public Works which includes mitigation of downstream flood concerns.

9. A park and recreation plan approved by the Department of Parks and Recreation.

F. DETERMINATION

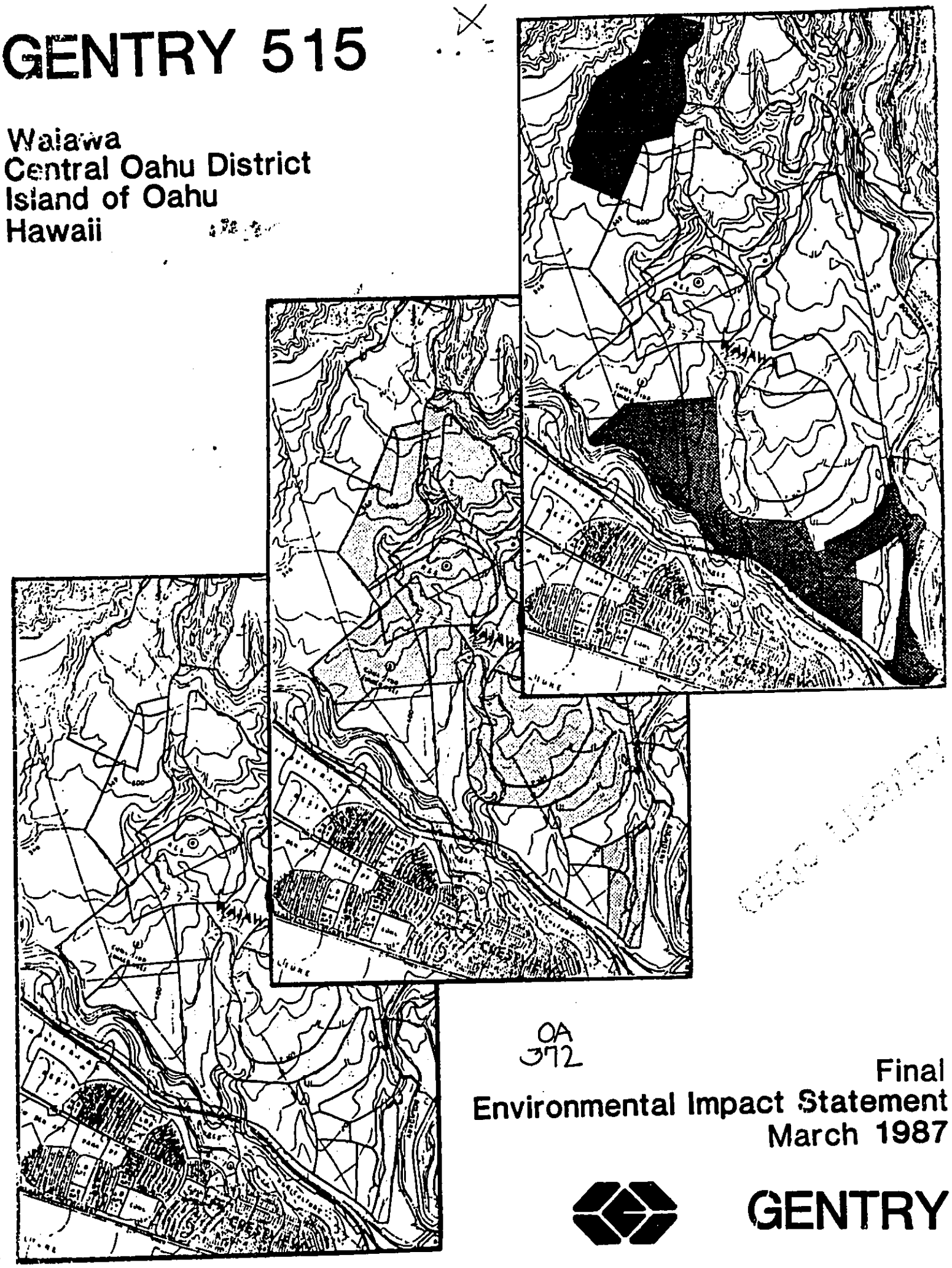
The Final EIS is determined to be acceptable under the procedures and requirements established in Chapter 343, HRS, and the State "EIS Rules." This determination in no way implies a favorable recommendation on the applicant's request for any approvals required by the Department of General Planning.

Donald Clegg

DONALD A. CLEGG
Chief Planning Officer

GENTRY 515

Waiawa
Central Oahu District
Island of Oahu
Hawaii



Final
Environmental Impact Statement
March 1987

GENTRY

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

DATE DUE

3-22-99
4-5-99
4-12-99
JAN 3 2005
Feb 17-2005

FINAL
ENVIRONMENTAL IMPACT STATEMENT
For the Proposed
GENTRY 515 DEVELOPMENT

Waiawa, Central Oahu, Hawaii
March 1987

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

F. J. Rodriguez, President
Environmental Communications, Inc.
Environmental Consultants for
The Gentry Companies

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I. SUMMARY

CHAPTER 343, HRS
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Action:	Applicant
Project Name:	Gentry 515
Project Description:	The proposed project consist of the development of 515 acres for residential, commercial, industrial, and open space in the Waiawa area of Central Oahu, Hawaii. A total of 4,990 residential units will be developed along with 83 acres of commercial/industrial space and all appurtenant service facilities and infrastructure.
Project Location:	The proposed project will be developed adjacent to the proposed Waiawa Development in Waiawa, County of Honolulu, Oahu, Hawaii. More specifically, the site is located mauka of Interstate Route H-2 between the Seaview and Crestview subdivisions and Waiawa Stream. All lands to be reclassified are vacant.
Tax Map Key:	9-4-06: Por. 10 9-6-04: Por. 1 and 4
Area:	515 Acres
Present Use:	Vacant and Grazing
Development Plan Designation:	Agriculture

Zoning:	Agriculture
State Land Use District:	Agriculture
Proposing Applicant:	The Gentry Companies P.O. Box 295 Honolulu, Hawaii 96809
Landowner:	Bernice P. Bishop Estate
Environmental Consultants:	Environmental Communications, Inc. P.O. Box 536 Honolulu, Hawaii 96809
Accepting Authority:	Department of General Planning 650 South King Street Honolulu, Hawaii 96813

Summary: The proposed Gentry 515 project consists of the development of 515 acres of fallowed agricultural land in Waiawa, Oahu, Hawaii. Uses proposed for the site include; residential, low density apartment, medium density apartment, commercial/industrial, and open space uses.

The project would provide a wide range of housing types which would be a valuable addition to the State's housing inventory. Of the 4,990 housing units proposed, 3,900 units would be dedicated to a "leisure" retirement community which would offer unique opportunities to Hawaii's mature residents. The inclusion of

commercial and light industrial use will also provide significant employment centers for the project and the region.

Significant adverse environmental impacts are not expected, however, vehicular traffic generation is an area of concern. The loss of agricultural land is also a significant land use policy issue.

Mitigation measures for the major traffic issue have been proposed and should be reviewed by the appropriate government agencies. No other major mitigation measures are expected to be necessary.

Project alternatives considered include a no action alternative and an active agricultural use alternative. The no use alternative was rejected since no benefits would be gained by the landowner or the general public. The active agricultural use alternative was dismissed since the permanent removal of the project lands would not have any significant impact on the State agricultural lands inventory.

The proposed project is an attempt at a conceptual/early planning process for a 10 to 10 year plan to follow development of the adjacent Waiawa Development. For this reason, unresolved issues for this project are not yet clearly defined.

II. PURPOSE

This Environmental Impact Statement is prepared pursuant to Chapter 343 Hawaii Revised Statutes and in accordance with the City and County of Honolulu's Department of General Planning Development Plan regulations.

The initial action required for this project involves a Development Plan amendment of Agriculture lands to Urban usage. The document will be reviewed by the City and County Department of General Planning.

This document is primarily intended for long range planning use and should not be construed as an action which will commence upon EIS acceptance. The plan presented represents a possible development alternative which could take place 10 to 20 years after commencement of the adjacent Waiawa Development.

III. PROJECT DESCRIPTION AND STATEMENT OF OBJECTIVES

A. Location of the Proposed Project

The proposed project consist of two separate parcels which are both adjacent to the proposed Waiawa Development located in Waiawa, County of Honolulu, Hawaii. More specifically, the project areas are identified as TMK: 9-4-06: Por. 10 and 9-6-04: Por. 1 and 4 which are owned in fee by the Estate of Bernice Pauahi Bishop (Figure 1).

The lands to be reclassified are vacant with minor cattle grazing as a result of previous sugar cane fallow-out implemented by Oahu Sugar Company. Several existing residential communities are located near the project site, including Seaview, Crestview, and Waipio-Gentry. The proposed Waiawa Development would be adjacent to both of the proposed project sites and would provide access between these sites as well as provide regional access to the H-2 Freeway and Kamehameha Highway. Fallowed cane lands lie to the north of both sites.

The Waiawa Correctional Facility (WCF) operates a 200 bed minimum security prison adjacent to the upper or northern boundary of Gentry 515. Located on TMK 9-6-5:11, the access road for this facility will traverse through the proposed residential areas of Gentry 515 and Gentry Waiawa. Routing will be on major collector streets that would provide direct and expeditious means to the Waiawa Correctional Facility and avoiding the lower traffic residential streets.

B. Project Description

The Gentry 515 project presented is developed as a planning concept which is separate from, but contingent upon the implementation of the proposed Waiawa Development (See Figures 2 and 3). This project will consist of residential, commercial retail, light industrial,

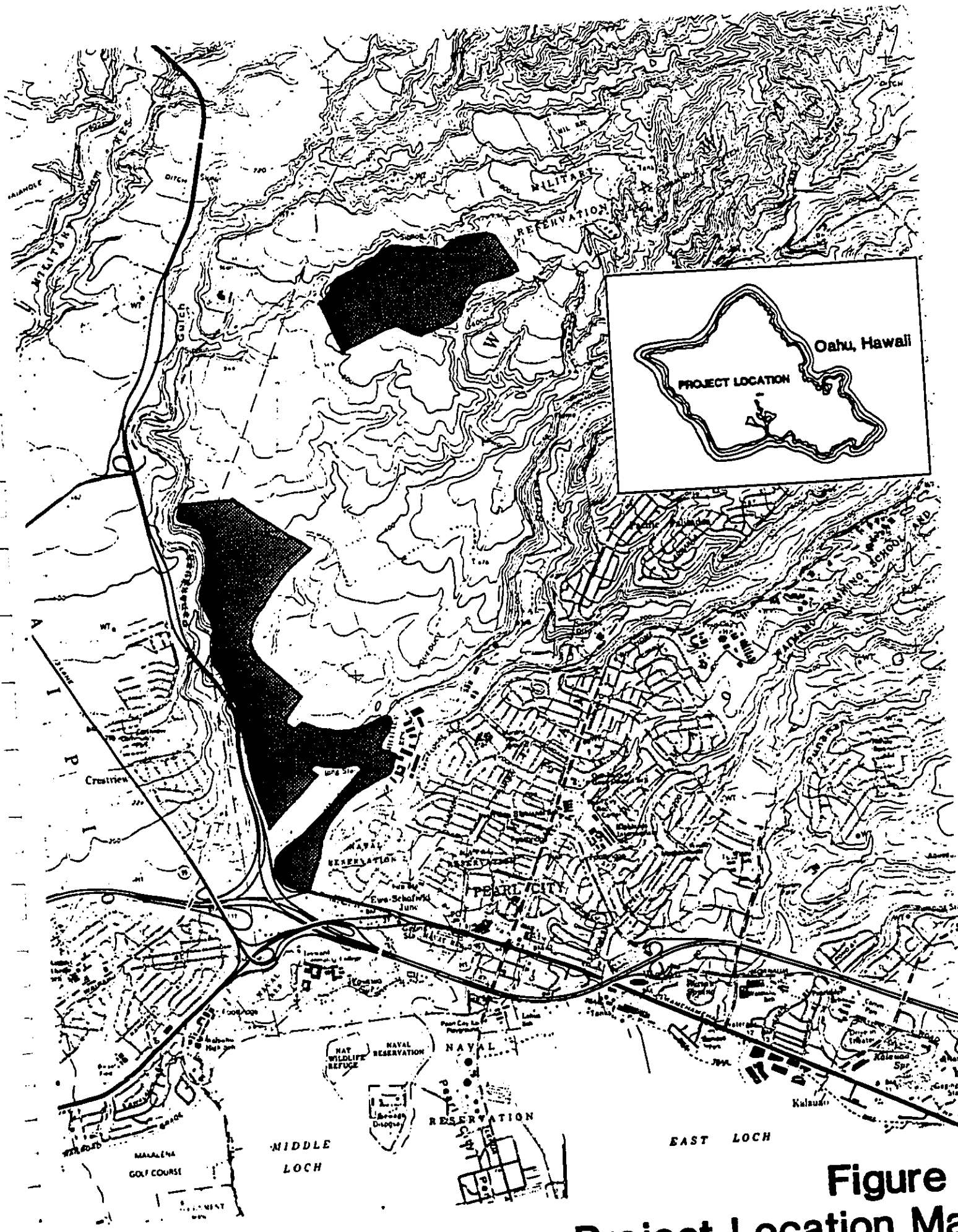
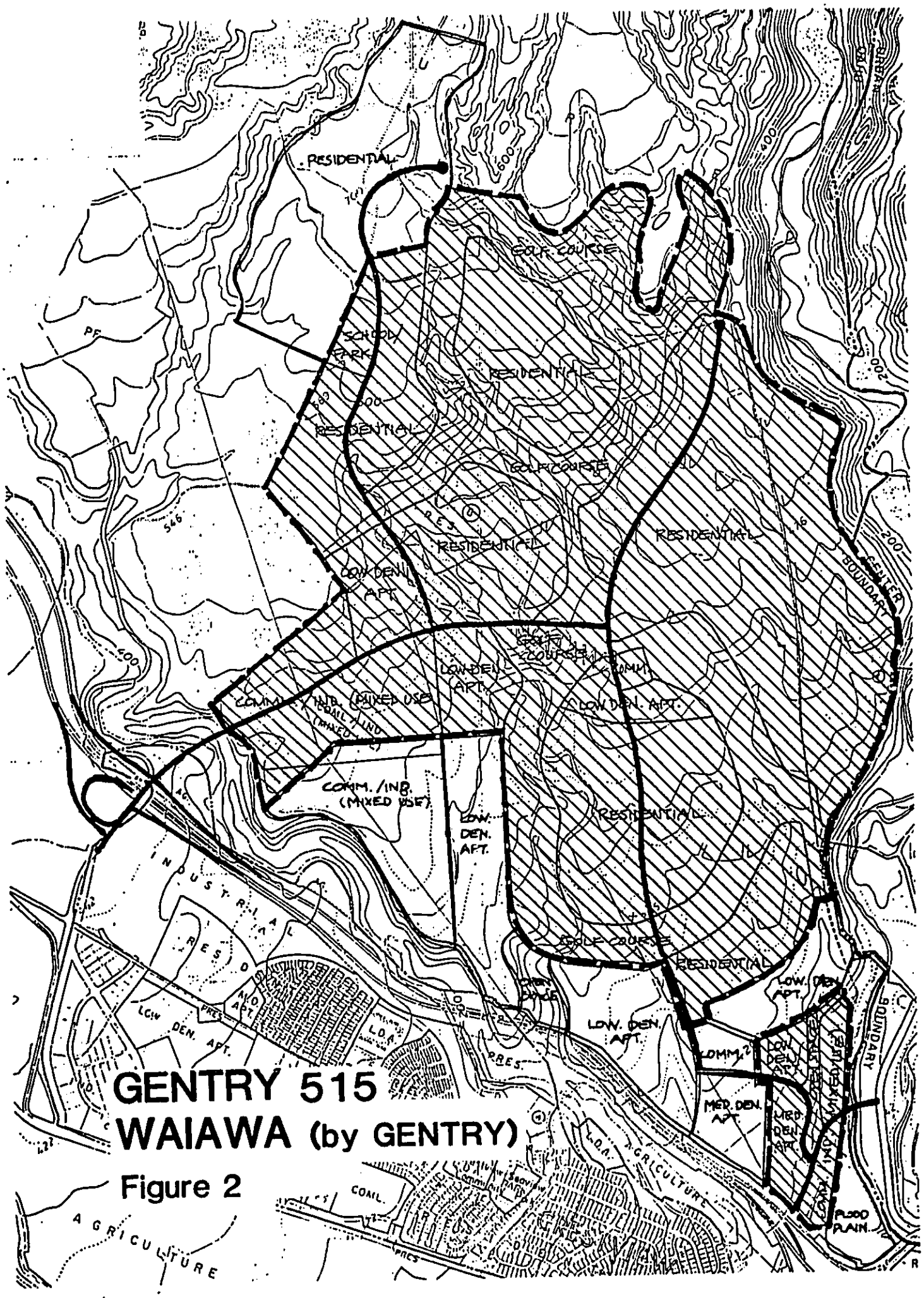


Figure 1
Project Location Map



GENTRY 515
WAIAWA (by GENTRY)

Figure 2

and open space uses. The mix of residential dwelling types will include conventional single family detached, low density apartment, medium density apartment, and "active" retirement housing in a leisure village setting which would be similar to those proposed in the Waiawa Development. The residential properties are to be sold in fee, primarily to owner-occupants.

The project will be physically separated from adjacent existing developments by the Waiawa gulch and the H-2 Interstate. The project areas however, will primarily serve as urban infill to the proposed Waiawa Development. Access to the sites would be through a proposed interchange on the H-2 connecting the proposed Waiawa Development to the State Highway system.

Urban usages of the Gentry 515 sites would be comprised of the following acreages:

Land Use	Gentry 515 Acres	Gentry 515 No. of Units	Waiawa Acres	Waiawa No. of Units	Total Acres	Total No. of Units
Residential, Single Family						
Conventional	168	1,090	402	3,216	570	4,306
Leisure Village			325	2,600	325	2,600
Low-Density Apartment						
Conventional			27	540	27	540
Leisure	156	3,120	55	1,100	211	4,220
Medium-Density Apartment						
Leisure	26	780	15	450	41	1,230
Commercial/ Industrial	73		115		188	115
Commercial	10				10	
Golf Courses/Open Space/School/Parks	13		393		406	
Major Roadways	11		63		74	
Flood Plain	58				58	
Total	515	4,990	1,395	7,906	1,795	13,011

1910

C. Statement of Objectives

The proposed project is developed as a long-range planning tool which was conceptually designed for future planning of the Waiawa area by the applicant. This conceptual design is based upon the assumption that the fully implemented Waiawa Development is in place and would be capable of supporting the proposed Gentry 515 project. All Gentry 515 design concepts are also premised on the assumption that the proposed project could not be developed without the Waiawa Development.

The project if developed, will offer living, employment, education, recreation, and shopping facilities all within a planned community. The project is sited on a highly desirable area with good views and an overall atmosphere of spaciousness.

A unique feature of the project will be the planned "retirement community" located on project. This community within a community will offer a variety of activities and will be geared towards "empty nesters" and retirees who seek a desirable and active environment typically not found within Hawaii.

D. Phasing

The proposed project, which is contingent upon completion of the proposed Waiawa Development, is developed as a long-range planning guide, therefore, no specific development or phasing plans are currently available. Residential and Commercial/Industrial properties would be developed as warranted by absorption rates; however, all infrastructure and support facilities development would be dictated by the presence and availability of Waiawa Development linkages.

E. Funding

No construction costs for structures and direct site improvements are currently available since the subject project is part of a planning study. The costs of the proposed project, when and if developed, are expected to be borne by the applicant; however, the availability of alternate financial support may be considered by the developer.

F. Historical Perspective

The project site was used for agricultural purposes since the turn of the century. Since 1983, the site has been fallowed by Oahu Sugar Company. A more detailed historical perspective is presented in the accompanying archaeological study.

IV. ALTERNATIVES CONSIDERED

A. No Action

This alternative would result in no action being implemented. The impact of this alternative would be that the project site would remain as is. Eventually, weeds and grasses would cover the vacant portions of the site while grazing uses might continue. However, this use would generally be inconsistent with the surrounding residential developments.

This alternative was not found to be viable because its non-use would render the properties useless to the landowner and the tremendous waste of valuable land adjacent to highly urbanized areas would not provide any benefit to the surrounding communities or the State at large. In addition, No-Action would represent a blow to rational long-term land planning. City and State governments would also suffer from opportunity costs associated with losses of potential employment, tax revenues, and housing supply. Conversely, development of the site would constitute an irretrievable use of land and would preclude any other uses for the site.

B. Active Agricultural Use

The subject lands have the agronomic potential to be productive agricultural lands. However, due to market parameters, the declining importance of the sugar industry, and the availability of similar lands on Oahu, placing the subject lands in an urban use will not have a significant impact on the agricultural sector of Honolulu County or the State. Lands of similar quality and economic potential are currently lying fallow and there are sufficient lands available to meet current and projected future agricultural needs. If

these lands were to remain in agriculture, their most likely use would be for grazing and grazing is an activity that returns very little per acre. An agricultural impact study for the project site is included in the document appendicies.

V. THE AFFECTED ENVIRONMENT

A. Geographical Characteristics

1. Topography

The land surface over the northern parcel of the project site is relatively flat with a gentle gradient of approximately 5 percent flowing from north to south. The eastern end of the project site is delineated by the Waiawa Gulch and stream. Slopes bordering the gulch are relatively steep but level off along the bottom areas.

2. Geology

The proposed project area is located on the southern slope of the Schofied Plateau. This plateau was built up by many successive lava flows originating from the Koolau shield volcano. This rock unit is made up of firm to very hard volcanic rocks which form bedrock in the proposed project area and vicinity. The soils in this area are typically residual, derived from the weathering of basic igneous rock.

3. Soils

There are four major soil associations found on the project site including the watershed area. These are the Lualualei-Fill Land-Ewa association near Pearl Harbor; the Helemano-Wahiawa association, the rough mountainous land-Kapaa association; and finally, the Rockland-stony steep association at the crest of the Koolau Mountain range.

The project site contains portions of at least the first three associations and is defined as:

a. Lualualei-Fill land-Ewa association: consists of deep, nearly level to moderately sloping, well-drained soils that have a fine textured or moderately fine textured subsoil and is primarily located on the coastal plains.

b. Helemano-Wahiawa association consists of deep, nearly level to moderately sloping, well-drained soils that have a fine-textured subsoil is mainly situated in the upland sectors.

c. Rough mountainous land-Kapaa association is characterized by very steep land comprised of gulches and narrow ridges that form numerous deep drainageways which are made up of well-drained soils that have a fine textured or moderately textured subsoil.

4. Climate

The mean rainfall at Waiawa is approximately 30 to 40 inches per year. The months of May through October are normally dry.

Temperature ranges on the project are consistent with similar areas of medium to higher elevations and are subject to the cooling effects of the North-northeast trade winds. Estimated annual temperature ranges of 66-84 degrees are considered typical for this site.

B. Hydrological Characteristics

1. Groundwater

The major geological features of the Waiawa Ridge area are the extensive permeable lavas and the coastal sedimentary caprock. Together, these two features provide southern Oahu

as well as Waiawa Ridge with a good source of basalt water that is high in quality.

2. Flood Insurance Study Designation

According to the Flood Insurance Study for the City and County of Honolulu prepared by the Federal Insurance Administration (FIA) in September 1980. Most of the Waiawa Development will occur in zone designations C and D. These are areas of minimal flooding and areas of undetermined, but possible, flood hazards, respectively.

The portion of the project site along Waiawa Stream has been designated as Zone A, and area of 100-year flooding with base flood elevations and flood hazard factors not determined.

3. Drainage

The project is situated in the 26.4 sq. mi. Waiawa watershed, which extends from the Middle Loch of Pearl Harbor to the crest of the Koolau Mountain Range. This watershed is one of the largest on Oahu and is the major portion of the nearly 90 sq. mi. area that drains into Pearl Harbor. Several streams drain the watershed, however, they all converge at several points into Waiawa Stream before it flows under Kamehameha Highway and into the Middle Loch of Pearl Harbor.

A USGS stream gaging station (#16216000) located on Waiawa Stream near the intersection of Farrington and Kamehameha Highways has been in operation since June 1952. Waiawa Stream follows a course slightly to the east of the proposed project.

The natural drainage patterns around and within the project's area have been changed somewhat by various irrigation facilities; however, the majority of these were abandoned when sugarcane cultivation in the area ceased in 1983.

4. Coastal Zone

The project site lies outside the designated shoreline and tsunami inundation zone. No direct coastal impacts are expected from the project and no Hawaii Coastal Zone Management Program permits are expected to be required.

5. Wetlands

No wetlands are found on the project site and no Corps of Engineers Wetland permit are expected to be required.

C. Biological Characteristics

1. Flora

The majority of the project area is covered by abandoned canefields. These former cane lands have more or less gentle slopes. Around the canefields is exotic perimeter vegetation composed largely of grass and shrub species. The gulches which dissect the fields support large blocks of forestry plantings and dense shrubbery growth. The vegetation types in the area are dominated by introduced or exotic species. No rare or endangered species were encountered on the project site. A complete flora inventory is available in the appended flora study.

2. Fauna

Due to the existing agricultural use of the project site insects, avifauna, and mammals populating the site are largely exotic in nature, and not considered rare or endangered species.

None of the birds or mammals found on the site are considered rare, threatened or endangered species. A list of fauna observed onsite is available in the appended terrestrial vertebrate study.

D. Historical and Archaeological Characteristics

An archaeological survey of the project area was conducted for evidence of past utilizaton. Because of the extensive ground distance associated with sugarcane cultivation, the primary efforts of the survey were directed on the gulches and the floodplains of Waiawa Stream.

1. Previous Research

Published information on the area is scarce. McAllister (1933: 105) mentions only one site in the vicinity, and that was in Waiawa Gulch outside the project area approximately one-half mile to the northeast:

> "Site 121. Puoiki heiau, at the juncture of Manana and Waiawa gulches.
>
> "The heiau crowned the top of a small oval knoll which is about 50 feet high by 100 feet wide and 200 feet long. The sides of the knoll are perpendicular except for a steep and narrow neck on the mountain side. During the ceremonies the people are said to have been at the foot of the knoll and surrounding the heiau. There are no remains."

Handy (1940:81) refers briefly to taro cultivation in Manana gulch:

> "This narrow Gahupua'aH was called Manana-iki in its lower portion and Manana-nui in the mountains where it broadens and includes Manana Stream, which flows into Waiawa. There were a few terraces seaward, irrigated by Waiawa Stream."

A reconnaissance survey of the larger project area was conducted in February, 1986. Exposures of partially-buried terrace retaining walls were found in the bottoms of three gulches, and a basalt adze was found on the surface of one of the adjacent slopes. During a subsequent intensive survey of two proposed golf courses, four sites were recorded. These included boulder alignments, a historic trash dump, the former location of a cannery and the former location of plantation housing (Barrera 1986).

E. Existing Population and Growth Characteristics

The Waiawa-Waipio area has undergone substantial changes during the past twenty years. Growth in the area was primarily accounted for by the advent of the Seaview and Crestview subdivisions located south of the project site and Mililani to the north. Between 1970 and 1980, the Waiawa-Waipio census area experienced 177% population growth. From 1980 to 1984 an additional 95% population growth was recorded. These changes indicate the growth potential for the area. Over the next decade substantial urbanized growth should be expected, especially in view of general plan policies which will allow substantial growth in the area.

F. Existing Traffic Conditions

The following traffic summary was compiled from the "Traffic Impact Assessment Report, Waiawa Development," prepared by Parsons Brinckerhoff Quade & Douglas, Inc., December, 1986.

The H-2 Freeway, along the west boundary of the project area, provides a direct link between Pearl City/Waipahu and Wahiawa.

Analysis using Highway Capacity Manual methods indicates that existing highway levels of service are at Level of Service B, a condition of stable flow with a slight reduction in speed, during both the AM and PM peak hours.

Ka Uka Boulevard intersects Kamehameha Highway in a T-intersection. Westbound traffic on Ka Uka Boulevard is controlled by stop signs; separate lanes are provided for left and right turn traffic. A separate left turn lane is provided for southbound traffic on Kamehameha Highway desiring to turn onto Ka Uka Boulevard. Level of Service E, volumes of near or at capacity, is experienced by Ka Uka Boulevard left turn traffic in both peak hours.

Waipahu Street, a collector route through Waipahu town, forms a T-intersection at its junction with Kamehameha Highway, north of Waiawa Interchange. In the vicinity of the Waipahu Street intersection, Kamehameha Highway is a four-lane divided highway and separate turn lanes are provided at the intersection. Analysis of the intersection using a State Highways Division estimate of existing traffic and the Critical Movement Analysis (Planning Application) for signalized intersections show under capacity conditions during the peak hours.

Waihona Street is the major collector road serving the Pearl City Industrial Park. Waihona Street meets Kamehameha Highway in a T-intersection. Two-way traffic is permitted along Kamehameha Highway between the Farrington Highway junction near Pearl City and the vicinity of Waihona Street. However, west of Waihona Street, Kamehameha Highway becomes one-way in the westbound direction and functions as on-ramps to the H-1 and H-2 freeways.

G. Ambient Air Quality

A summary of air pollutant measurements from State of Hawaii long term monitoring stations located nearest to the project is presented

in Appendix I. Data from several different sampling stations are included in the tabulation.

The sampling station for particulates and sulfur dioxide is located in Pearl City, about two miles east southeast of the project area. The monitoring of sulfur dioxide in Pearl City was discontinued in 1984 and 1985 measurements are from the Barbers Point station located about six miles southwest of the project.

Until September 1979, and after June 1983, carbon monoxide monitoring was conducted at the Department of Health building at Punchbowl and Beretania Streets in urban Honolulu. This site is about 12 miles southeast of the project. During 1981 carbon monoxide was measured at Fort DeRussy in Waikiki (13 miles southeast of the project), and in 1982 carbon monoxide was monitored at Leahi Hospital in Kaimuki, about 15 miles southeast of the project.

Ozone levels were also measured at the Department of Health building in urban Honolulu until December 1980, when the monitor was relocated to Sand Island (about 10 miles southeast of the project site). During 1981 nitrogen dioxide was also monitored at the Sand Island location, but all nitrogen dioxide monitoring has since been discontinued. Lead measurements are from Liliha Street in Kalihi, about 11 miles southeast of the project site.

From the data evaluated, it appears that State of Hawaii ambient air quality standards for particulates, sulfur dioxide, nitrogen dioxide, and lead are currently being met at nearest monitoring stations to the project area.

On the other hand, carbon monoxide and ozone readings from urban Honolulu indicate that allowable State of Hawaii standards for these vehicle-related air pollutants are being violated at a rate of about once or twice a year. Ozone is an indicator of the formation of photochemical pollutants in the air, a condition which tends to

develop if the air mass over the islands has been fairly stable with little wind flow for a period stretching over several days.

Concentrations of carbon monoxide are more directly related to vehicular emissions and tend to be highest during periods of rush hour traffic. Carbon monoxide would thus be the pollutant most likely to cause difficulty in meeting allowable State of Hawaii AQS as a result of new residential development on Oahu.

There are power plants and other potential sources of industrial pollutants along the central portion of the leeward coast in the vicinity of the project site, but the generally low readings of particulates and sulfur dioxide at the Pearl City monitoring station just to the east of the project indicate that these sources are not likely to cause any air pollution problems at Waiawa. Likewise sugar cane cultivation to the north and west could generate some particulates and carbon monoxide when fields are burned at harvest (about once every two years for any given fields), but the consistently low readings of particulates at Pearl City indicate that this source is not likely to present any significant air pollution problems either.

Finally, natural air pollutant producers which could affect air quality in the Waiawa project area include the ocean (sea spray), plants (aero-allergens), dust, and perhaps a distant volcanic eruption on the island of Hawaii. Concentrations of air pollutants from these kinds of sources should be fairly uniform for most Oahu locations.

H. Ambient Traffic Noise Conditions

The following traffic noise summary was compiled from the "Updated Traffic Noise study for the proposed Gentry 515 Project (Year 2002)" of January, 1987 by Y. Ebisu & Associates.

The existing traffic noise environment along the H-2 Freeway Right-of-Way in the area of the project is in the "Significant Exposure, Normally Unacceptable" category, with traffic noise at 70 Ldn along the Right-of-Way. However, existing noise sensitive developments on the west side of the freeway are either at large setback distances from the freeway or shielded from the freeway is the location of the proposed Waiawa Development, and the area is currently undeveloped. Traffic noise from H-2 Freeway is below 60 Ldn at residential communities west of the freeway, and generally below 55 Ldn. Existing traffic noise levels along the freeway are in the "Acceptable, Moderate Exposure" and "Unconditionally Acceptable, Minimal Exposure" categories.

I. Infrastructure and Utilities

The entire project site is currently undeveloped with the exception of abandoned Oahu Sugar wells, therefore, no infrastructure or utilities currently service the site. Existing utilities and infrastructure connections are available outside of the site and will be utilized wherever possible. Hawaiian Electric Company easements near the project site are shown in Figure 3. The easements are for the 138 kv circuits that parallel the Gentry 515 project boundary.

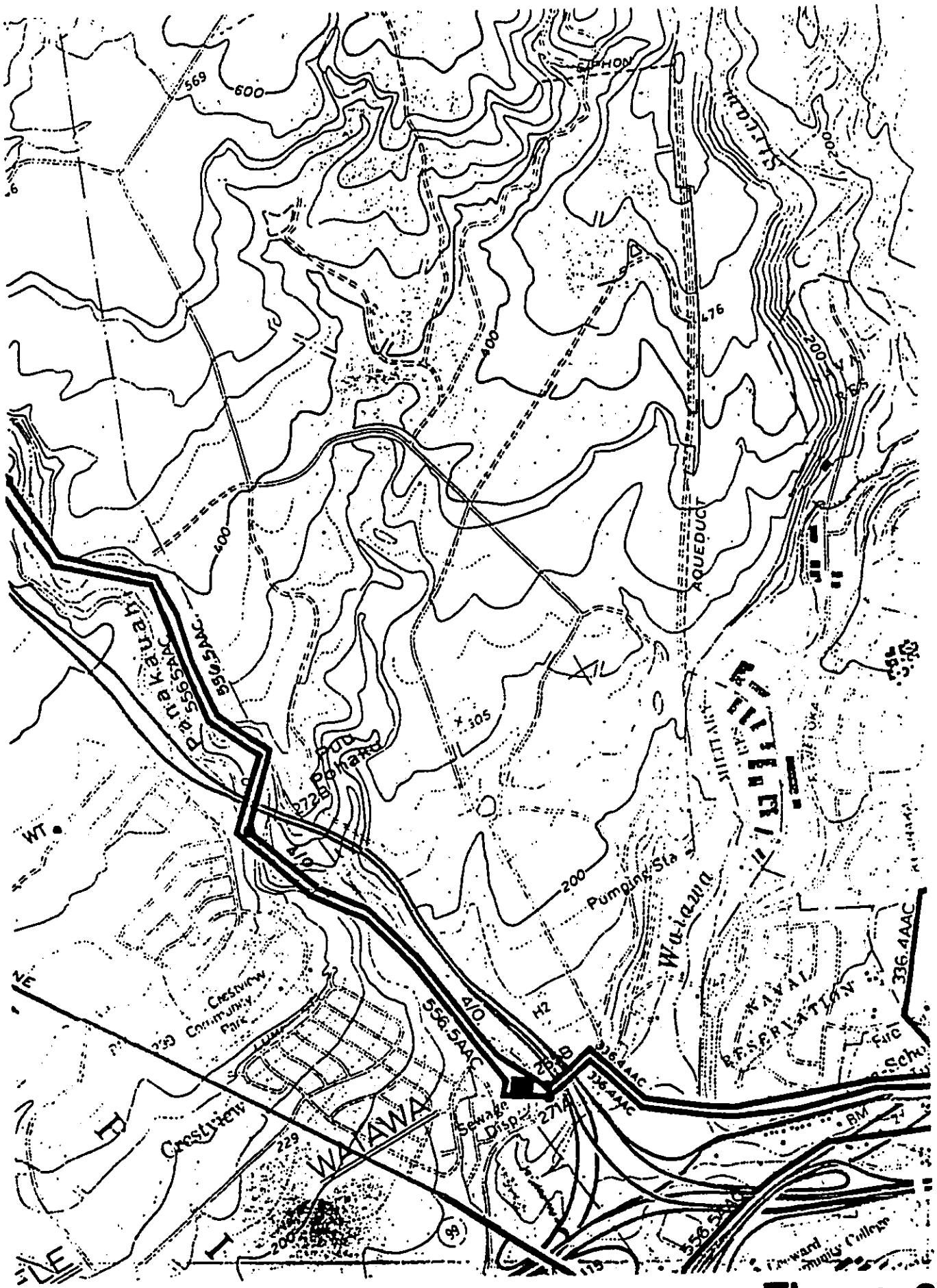


Figure 3

Waiawa HECO Easement Map

VI. RELATIONSHIP TO PLANS, POLICIES, AND CONTROLS

A. Federal

No Federal plans or programs directly affect development of the proposed residential project.

B. State

1. Hawaii State Plan

The Hawaii State Plan consists of a series of broad goals objectives and policies which act as guidelines for the growth and development of the State. In general, the proposed project is consistent with the overall intent of the State Plan. The overall theme of the Hawaii State Plan is:

- Individual and family self-sufficiency
- Social and economic mobility
- Community or social well-being

Specifically, the Hawaii State Plan details objectives and policies in the various areas such as population, the economy, physical environment, facility systems, socio-cultural advancement and fiscal management. The Gentry 515 project is consistent with many of the goals and policies of the Hawaii State Plan and has been designed to facilitate its objectives.

SEC. 226-7 Objectives and policies for the economy-agriculture.

The Gentry 515 project is situated on important agricultural land, however, the viability of profitable sugar cultivation is

limited. It was for this reason that Oahu Sugar Company has allowed the site to go fallow. Other agricultural uses also have limited potential and urban usages, such as the proposed project, will provide for other offsetting economic and social needs.

SEC. 226-11 Objectives and policies for the physical environment - land-based, shoreline, and marine resources.

The project site currently consists of fallowed agricultural land. The proposed project will provide a productive use of the project site and this use is felt to be consistent with the surrounding developments. Impacts on other resources are expected to be negligible.

SEC. 226-13 Objectives and policies for the physical environment-land, air, and water quality.

Air quality will be impacted from the additional vehicular traffic generated by the project. This impact, as reported in the air quality study, was generally not found to be significant. Water quality impacts will be minimal since a planned drainage system will be implemented to address project needs. Sedimentation basins will be utilized to mitigate project related runoff.

SEC. 226-14 Objective and policies for facility systems in general.

The proposed project will rely upon infrastructure connections to the adjacent proposed Waiawa Development. Facilities for the Waiawa Development have been reviewed by the appropriate agencies and are expected to be adequate to accommodate the Gentry 515 development. It is unlikely that the subject project will proceed without connections to the Waiawa Development.

SEC. 226-15 Objectives and policies for facility systems-solid and liquid wastes.

A wastewater plan has been developed which would utilize the regional Honouliuli treatment plant for processing and disposal. No wastes will be injected into the ground. Solid wastes will be collected and disposed of by the City and County of Honolulu and private refuse collection services.

These measures are expected to meet the objectives and policies of this section.

SEC. 226-16 Objectives and policies for facility systems-water.

There are no municipal water facilities in the project area. The water plan for the proposed project calls for connection to the proposed Waiawa Development water system which would utilize onsite storage reservoirs and transmission and distribution mains.

SEC. 226-17 Objectives and policies for facilities systems-transportation.

The proposed project will produce additional vehicular traffic which will impact the current traffic patterns. Mitigation measures which may alleviate some of these impacts are discussed in Section VII. Traffic is a major concern of the project; however, the other positive benefits of the project are felt to offset this impact.

SEC. 226-18 Objectives and policies for facilities systems-energy /telecommunications.

Energy conservation will be practiced in the development of the project through the use of solar heating and the use of

air conditioning only where necessary. Energy self-sufficiency will be practiced whenever possible.

SEC. 226-19 Objectives and policies for socio-cultural advancement-housing.

The proposed project will be consistent with the objectives and policies of this section through its' creation of a variety of housing types and costs to suit the needs of a large portion of the housing market. Additionally, the integral planning for a retirement village and an overall community integration concept lend a cohesive and desirable environment which would offer significant opportunity to Hawaii's housing market. The project is well suited for residential development within a clean and scenic area. The project would serve as urban infill yet remain separately identifiable by its topographic boundaries.

SEC. 226-20 Objectives and policies for socio-cultural advancement-health.

The proposed project will be well serviced in addressing individual health needs. The leisure village will feature excellent access to planned health service facilities which should serve the entire community. Special attention will also be paid in designing residential units which will address special needs that might be required. The abundance of recreational facilities will further promote "wellness" through physical and mental health.

The project will provide safe and healthy resources as required by all governmental laws and regulations.

SEC. 226-23 Objective and policies for socio-cultural advancement-leisure.

A wide range of activities and recreational facilities will be available to project residents through the adjacent Waiawa Development. These facilities will include golfcourses, tennis, swimming, parks, open spaces, library and community centers.

SEC. 226-24 Objective and policies for socio-cultural advancement-individual rights and personal well-being.

The Gentry 515 development will feature one very significant opportunity markedly absent from Hawaii; an active, full scale retirement community. This community would feature an active, leisure type environment which would cater specifically to the needs of a mature population. This feature is unique and will provide opportunities previously unavailable to a large segment of the State's population.

SEC. 226-25 Objectives and policies for socio-cultural advancement-culture.

The diversity of residential types and costs along with the recreational, business, commercial and employment centers within the community should foster an open sense of cohesiveness with diversity.

The area was not found to contain any significant archaeological remains nor was it found to be particularly significant historically.

SEC. 226-104 Population growth and land resources priority guidelines. Priority guidelines for regional growth distribution and land resource utilization.

The Gentry 515 development presents offsetting goals with the scope of this guideline. Development in Ewa and Central Oahu is currently being promoted to alleviate congestion within

Eastern and Urban Honolulu, however, this redirection often occurs at the expense of important agricultural lands. The agricultural economics study conducted for this project suggested that although the project lands involved are agriculturally significant, actual productivity through agriculturally viable uses is low. Although the proposed project is not in consonance with this guideline, urban usage is considered an acceptable use when the scope, planning, and socio-economic benefits of the proposed project are considered.

The project site was not determined to be environmentally critical in the area of archaeology, flora, and fauna. Any environmental impacts occuring as a result of the development will be mitigated where possible. Development of the site will result in the permanent loss of open space as it exists, however, the project will be very open through its use of two integrated golfcourses and various park and green spaces. The project is not expected to adversely affect any critical resources in the area.

SEC. 226-106 Affordable housing. Priority guidelines for the provision of affordable housing.

The proposed project will provide a diversity of housing types within a spectrum of costs. Affordable housing is planned for the development and a commitment between the developer and the City and County of Honolulu will be negotiated in a timely manner.

Although the use of marginal or poor agricultural lands for urban use would be desirable, it should be understood that the project site is important and valuable for both agricultural and urban uses.

2. State Functional Plans

The Hawaii State Plan has been prepared for use as the primary planning tool in directing the planning process for Hawaii's long and short-term goals. By setting the overall theme and directive, functional plans were created as extensions of the State Plan. These functional plans specify objectives, policies, and implementing actions to address these concerns. These plans were reviewed to determine their relationship to the proposed project. These plans are reviewed and evaluated below.

a. State Education Plan and State Higher Education Plan

This plan relates to educational functions, respective school systems, growth and goals. Office procedure (records in a computer system), target groups, personal developments, and school sites are discussed. As related to the proposed project, demand for educational facilities will be increased; however, existing facilities are expected to accommodate the initial increase. A school site in the adjacent Waiawa Development will serve the needs of the community's residents as the need arises.

b. State Housing Plan

The project will contribute significantly to the State's housing inventory in offering a broad range of unit types at varying costs. These units will include medium and low density, single family detached, and unique retirement homes, all in a planned, integrated community. Affordable housing is planned for the development and will be negotiated with the appropriate authorities in a timely manner.

The project is designed to take into account the physical setting, including visual and aesthetic amenities. Its location provides easy access to public facilities and services.

c. State Health Plan

The primary purpose of the State Health Plan is to serve as a guide for State and County agencies and the private sector in outlining environment related and health care objectives for Hawaii.

The State Health Plan focuses primarily on public health programs under the jurisdiction of the State Health Department.

As the State Health Plan relates to the proposed project, health and medical care facilities (emergency and routine) are located within the immediate area and are expected to accommodate the additional population of the project. Additionally, a health care center planned for the Waiawa Development should serve the needs of the community at large.

Environmental concerns covered in the State Health Plan have been addressed in the air and noise quality studies and utilities sections of this document. Utility impacts such as sewerage and drainage, as it affects water quality, are expected to create only minor impacts that are normal for projects of this nature. Mitigation of these impacts are the responsibility of the developer and will be addressed as necessary. No toxic waste impacts are expected on the ground water supply.

Air and noise quality impacts, as reported in their respective studies, are also minor in nature.

d. State Conservation Lands Plan

This relates to conservation lands and does not address this project site.

e. State Agriculture Plan

The Hawaii State Plan states its two primary objectives as 1) increased viability in the sugar and pineapple industries, and 2) continued growth and development of diversified agriculture throughout the State.

The project site, which is currently fallow, will be permanently lost from the State's agricultural land inventory and is therefore, in conflict with this functional plan. However, the agronomic feasibility of maintaining these lands in active agricultural production is marginal.

f. State Historic Preservation Plan

The Historic Preservation Plan, reviews the procedures and identifies areas where archaeological salvaging or preservation are desirable. Procedures for developments include preparing an archaeological survey, preserving sites considered of value, and coordination of salvaging and preservation with the State Historic Sites Office. In this regard, the project has complied with these procedures and no significant historic sites were found on the uncultivated portions of the site. None are likely to be found on the fallowed land since it was extensively cultivated for many years.

g. State Transportation Plan

The general objectives of this plan are outlined in these two statements:

An integrated multi-modal transportation system which services statewide needs relating to the efficient, safe, and convenient movement of people and goods.

A statewide transportation system supportive of planned growth objectives throughout the state.

Although the State Transportation Plan does not single out the project for any specific highway development or improvement policies and actions, the development will increase vehicular traffic in the general area. For this reason, an extensive traffic study has been conducted and mitigative measures recommended. These measures, which include roadway modifications are presented in an effort to meet the general objectives of the Plan.

Additionally, the Department of Transportation recognizes the rapid growth in the project area and subsequently, several projects are currently being planned or implemented to accommodate the needs of the area.

h. State Recreation Plan

The State Recreation Plan reviews the demands and actions that need to be taken to fulfill existing and future recreational demands. The proposed development will be consistant in this plan with its extensive and integral open and park spaces.

i. State Energy Plan

The Hawaii State Plan defines two major energy objectives:

Dependable, efficient, and economical Statewide

energy systems capable of supporting the needs of the people; and

Increased energy self-sufficiency for Hawaii.

Specific information on projects do not relate to or address the project site. Other policies and objectives are broad and relate to energy conservation and use of energy sources other than fossil fuels.

Energy conservation methods will be investigated for use in the project pertaining to the latest energy savings devices and installations which should result in some cost reduction as well as being conservation actions.

j. State Tourism Plan

This plan relates to tourism actions and does not address or relate directly with this project.

k. State Water Resources Development Plan

The primary objectives of the State Water Resources Development Plan are:

Regulations of the development and use of water to assure supplies for the future;

Development of water resources to meet municipal, agricultural, and industrial requirements, and the reduction of flood damage; and

Preservation of water-related ecological, recreational, and aesthetic values and the quality of water resources.

This plan acknowledges that municipal water supply service is primarily a County function. To this extent, the developer has coordinated with the Board of Water Supply in addressing the project's water needs. The proposed water system development for the project is not expected to be of any significant impact.

Water quality impacts in the area are expected to be minimal and in conformance with the objectives of the Plan.

3. State Land Use

The project site is currently designated for Agriculture on the State Land Use Boundary Map. The developer of the proposed project will petition the State Land Use Commission for a boundary change which will redesignate the site for Urban use at the appropriate time after the completion of the Waiawa development.

4. H.R.S. Chapter 205-A Coastal Zone Management

The Project site is not designated as a special management area for which a permit is required pursuant to H.R.S. Chapter 205-A. However, the project site is within an area controlled by the CZMA and is, therefore, subject to H.R.S. Chapter 205-A's objectives and policies. No permits will be required.

C. City

1. City and County of Honolulu General Plan

The General Plan of Honolulu is a twofold document which: one, is a statement of the long-range social, economic, environmental, and design objectives for Oahu; and two, is a

statement of the broad policies which are necessary to meet the objectives of the Plan.

The plan lists nine areas of concern; population; economic activity; the natural environment; housing; transportation and utilities; physical development and urban design; public safety; health and education; and culture and recreation. These items are addressed in the context of this document. Population guidelines for the District are currently under review by the Department of General Planning.

2. Development Plan

The parcel is currently designated for Agriculture on the Development Plan Land Use Map. The project is currently under review for a Development Plan Amendment which would allow urban use of the site.

3. Zoning

The site is currently designated AG-1, Restricted Agriculture. Zoning for the planned urban uses of the site will be requested at the appropriate time.

VII. ANTICIPATED IMPACTS AND MITIGATIVE MEASURES

Impacts of the proposed project can be viewed in the short-and long-term. Short-term impacts, beneficial and adverse, generally result from construction-related activities. Consequently, these impacts should last no longer than the duration of the construction. Long-term impacts, beneficial and adverse result from the implementation and operation of the proposed project.

A. Impact on Geographical Characteristics

1. Topography

Impact on the physical terrain of the proposed parcels of land will result from site grading. However, this grading will be limited to typical site preparation work. Cutting and filling will be kept to a minimum.

Prior to beginning of any grading operation it will be necessary to strip all existing vegetation from areas to be developed. The material exposed after the stripping operation may be used for engineered fill. After stripping, slab and pavement, sub grades, and areas to receive engineered fill should be excavated of any and all loose soils.

To minimize the occurrence of soil erosion, temporary soil erosion and sediment control measures will be designed and implemented during the construction phase in accordance with Chapter 23, Grading, Soil Erosion, and Sediment Control, Revised Ordinances of Honolulu, 1978, as amended; the City & County of Honolulu's Grading, Grubbing, and Stockpiling Ordinance No. 3968, 1972; and the USDA Soil Conservation Services Erosion and Sediment Control Guide for Hawaii, 1981.

2. Geology

No impacts are expected on the geology of the area, therefore, no mitigative measures should be required.

3. Soils

Impact on the soil will result from introduction of soil conditioners and EPA approved fertilizers, pesticides, and herbicides. These conditioners will enhance the grassing and landscaping of the project site. The introduction of such chemicals, however, will not adversely affect the soil.

Project development will not alter soil characteristics, but soils on site will determine procedures and techniques in construction of structures, paving and utilities. No mitigative measures should be required for soils impact.

4. Climate

No impacts are expected on the climate of the area.

B. Impact on Hydrological Characteristics

1. Surface Water Runoff Quantity

The storm water runoff volume for the 1 yr, 1-hr duration storm for post (full) development conditions is about two magnitudes greater than predeveloped (1986) conditions; however, as the storm duration and recurrence interval increases, this difference reduces down to approximately 1.6 greater for the 100-yr 24-hr storm, whereas, for the composite conditions (including the Waiawa Development) the ratio difference wasn't as great. At higher rainfall intensities and durations, soil saturation increases, thus more runoff occurs. The relatively

large discrepancy between the pre-and-post storm water runoff condition is because of the soils within the project are notably "well-drained" types. The increased runoff from the project area(s) will correspondingly result in less groundwater recharge within the sites of the project; however, sedimentation basins are planned to be incorporated within the project's boundaries which should, if properly designed and maintained, enhance groundwater recharge as well as intercepting the constiuents, especially suspended solids in the runoff.

As would be generally expected, the greatest calculated incremental storm runoff volume resulted from the 100-year storm with a 24-hour duration. These values (acre-ft/event) represent a volume of water and should not be confused with peak discharge rates which represent the maximum volume of storm water runoff discharged per unit of time.

2. Surface Water Runoff Quality

Besides the changes in the volume of storm water runoff, the quality of the various constituents being transported is of equal, if not more importance.

The summation of nitrogen, phosphorus, and suspended solids loads from both present 1986 and projected (full) residential development for storms of 1- and 24-hr. duration at recurrent intervals of 1-, 5-, 10-, 25-, 50-, and 100-years were calculated in the appendix. The incremental changes per storm event for the present and projected development conditions for the various duration and recurrence interval storms indicate that from the least to the greatest amount of rainfall: nitrogen and phosphorus increases and suspended solids increases for the low intensity and duration storms and decrease at the higher intensity and duration storms.

The seemingly high nitrogen and phosphorus values have to be compared with the previous land use of the area, sugarcane which received for a two-year cycle, 300 to 500 lb. each of nitrogen and phosphorus over the first 8 months of the culture cycle. Storm runoff during or shortly after, fertilization events undoubtedly had a high concentration of both nitrogen and phosphorus.

The hydrologic and water quality aspects of the surface water runoff were only considered for the present and projected conditions. However, increases in constituent loads will undoubtedly result from construction activities, especially if a significant storm occurs during the interim period between earth moving operations and soil stabilization completion. The impact of construction activities can be minimized by adhering to strict erosion control measures.

Other water quality constituents of general concern include biocides and heavy metals. Typically, the biocides in general use tend to break down more readily in comparison to the more long lasting types of a few years ago; consequently, except for agricultural runoff, the types and concentrations are usually considered insignificant.

Heavy metals, on the other hand, do apparently increase somewhat as a result of urbanization. The possible long-term effect, if any that the apparent slightly increased heavy metals have upon the biological life the receiving waters (Waiawa Stream and the Middle Loch of Pearl Harbor) at the concentrations expected is not presently well defined. However, a biological study of Pearl Harbor, conducted by the U.S. Navy in the early 1970's concluded that the heavy metal burden in Pearl Harbor was below the level of concern (even though several heavy metal sources discharged to Pearl Harbor-since eliminated-existed at that time) and that the major detriment

to marine environment appeared to be silt (Evans et al., 1972). The suspended solids load for the heavy storm events are calculated to decrease, and the sedimentation basins being planned should significantly decrease the suspended solids (sediment) load from the lower level, although relatively infrequent storm events.

3. Storm Drainage

Storm water runoff from the project area is presently collected by the existing natural ditches and streams located in ravines and gulches. These flows eventually converge at several points into Waiawa Stream at the southern end of the site which transports the collected runoff into the Middle Loch of Pearl Harbor. The development of Waiawa will increase the quantity of surface runoff flowing into Waiawa Stream. Retention facilities will be designed and placed throughout the site to control the amount of discharge from the project area.

The concept is to retain the increase in urban storm runoff in available open space areas (golf courses) and retard the floodwater flow to Waiawa Stream. Design of a retention berm with minimum sized culverts to convey only normal low flow storms (say 10-year storms) would limit passage of runoff from higher peak storms (50- to 100-year storms) and, therefore, flood the open area mauka of the berm. However, during and after the storm, the ponded waters would continually discharge at a rate controlled by the size of the culverts.

The increase in storm runoff volume due to urbanization of the project area (excluding the open space) for a 24-hour 100-year storm is estimated to be 400-acre-feet. Therefore, if flooding depth was limited to an average of 4 feet, then, only 100 acres of the golf course area would be required for floodwater retention.

During retention, potential of ground water percolation for basin recharge would increase. Additionally, major project desilting will occur in the ponded golf course area rather than carried to Pearl Harbor.

C. Impact on Biological Characteristics

1. Flora

The vegetation on the Gentry 515 project site is dominated by introduced plant species. The few native species on the site, such as 'uhaloa (Waltheria indica var. americana) and yellow wood sorrel (Oxalis corniculata), are considered hardy, "weedy" natives and are widespread throughout the islands in similar environmental conditions.

As the proposed project will impact principally lands now occupied by fallowed cane fields, development will not have a significant impact on the native species. No plants considered rare, threatened or endangered were found on the project site. Flora surveys of adjacent or nearby areas have also reported no rare, threatened or endangered plant species. These surveys have also noted that the vegetation is composed primarily of introduced species.

The project's flora consultant expressed some concern over soil loss due to vegetation removal on sloping areas. It is therefore, recommended that such areas be grassed over as soon as possible to prevent soil loss through wind and water erosion.

2. Fauna

No rare, endangered or threatened species were found on the project site. Grading and grubbing activities will undoubtedly force certain wildlife to relocate to adjacent areas. However,

in some instances they will return to the project site for food and shelter, thereby further minimizing any adverse impacts to them.

All of the mammals, land reptiles, and amphibians that occur in the project area are introduced or alien animals. Many of them are predators on birds and several are destructive to agriculture and forest lands and/or to man and his buildings.

Because the vegetation in the project area is virtually all introduced or exotic and because all of the terrestrial vertebrate animals in the region are alien to the islands, it can be concluded that the proposed project would not have any adverse effect on any endemic Hawaiian animal or ecosystem.

D. Impact on Archaeological Characteristics

1. Survey Results

No significant archaeological or historic sites were found. This lack is primarily the result of the extensive ground disturbance caused by sugarcane cultivation and other more recent earth-moving activities, but the possibility that agricultural sites have been buried by flood deposits in Waiawa Stream is a real one, especially in light of Handy's remarks (Section V-D).

2. Recommendations

It is recommended that the developer retain an archaeologist to monitor construction and grading activities so that any sites and their associated scientific information that may have been obscured by sugar cultivation or stream flooding may be identified, assessed and protected. In the event that any archaeological finds are made during construction, contruction will be stopped and the State Historic Preservation Officer notified.

E. Waiawa Population Forecast

The Waiawa market area can be expected to capture a larger share of the County's future population and housing growth than it has historically. Several factors account for this potential growth with the primary indicators being: government initiated planning for Central Oahu; the availability of vacant lands; and the industrial inventory build-up occuring in the project area.

The 1984 Waiawa area population of 12,783 represented 95% growth over 1980. Beyond this existing population, the Gentry 515 project is expected to increase the population by approximately 9,800 new residents. These population figures was derived from the unit count and mix utilizing a derived number per household multiplier.

The adjacent planned Waiawa development is expected to support a population of approximately 18,873 residents upon completion. This would result in the combined population of approximately 28,670 for the immediate area upon full development.

F. Impact on Traffic Conditions

The proposed project will access the highway system at three locations: the Waipio Interchange, the Kamehameha Highway at Waipahu Street, and Waihona Street.

The proposed project is expected to affect traffic conditions in the region by redistributing travel demands. The State's traffic assignment, which assumed no development at the project site, was based on a rate of development in the area north and west of the Waiawa Interchange consistent with expected population growth in Leeward and Central Oahu. Inclusion of the proposed development is assumed to not affect the total expected population in the area, but to redistribute it. Adjustments made to the State's traffic assignment, therefore, kept traffic volumes east of Waiawa Interchange constant and distributed H-1 and H-2 volumes proportionally.

The State's estimates for years 1998 and 2008 were extrapolated to determine year 2010 volumes. Traffic impacts to the collection-distribution service along Kamehameha Highway were evaluated using an additive algorithm.

The analyses of freeway conditions, ramp termini levels of service, and intersection adequacy followed procedures described in the Highway Capacity Manual[3]. These calculations provide an indication of the number of lanes required to serve the projected traffic demands, but do not indicate the design of needed improvements, such as length of on-ramp or storage requirements.

1. Waipio Interchange

A two-lane loop on-ramp will be needed to serve traffic from the proposed development toward Honolulu on H-2 at the Waipio Interchange. The ramp capacity analyses indicate that the critical demand volumes in year 2010 will exceed the capacity of the interchange, even with the two-lane on-ramp. A reduction of demand from the project of 36% or approximately 900 vehicles in the AM Peak Hour would be necessary. Traffic demands from Honolulu on H-2 at Waipio Interchange will also exceed the capacity of the two-lane off-ramp; a reduction of 30% or about 650 vehicles in the PM Peak Hour will be necessary. The following section on "Mitigation Measures" discusses changes in travel characteristics which could achieve these reductions.

The single-lane ramps on the north side of Waipio Interchange will provide adequate service for the projected demand volumes.

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[3] Transportation Research Board, National Research Council, Special Report 209, Highway Capacity Manual, Washington, D.C., 1985

While the capacity analyses indicate that two-lane ramps and the six-lane H-2 Freeway will serve future traffic (assuming mitigation measures effectively reduce the project's demand), good freeway design includes certain relationships between the number of lanes at ramp termini and desirable ramp lengths and separations. While the desirable design will require additional improvements, including widening of the freeway, the traffic demand volumes projected for this location indicate that the existing rural conditions will no longer prevail, but that the segment of H-2 between Waipio and Waiawa Interchanges will become a congested, urban freeway.

2. Kamehameha Highway Intersections

The development will increase turn volumes at three intersections with Kamehameha Highway: Ka Uka Boulevard, Waipahu Street, and Waihona Street. Improvements at each intersection beyond those identified for traffic demands without the project will be necessary to accommodate project traffic. With the necessary improvements, conditions at each intersection will be similar to conditions without the development.

An additional westbound lane on Ka Uka Boulevard approaching Kamehameha Highway will be needed (this analysis assumes a "T"-intersection without development of the proposed Waiola Estates project). Variable message signs and special signalization should be provided to maximize utilization of the lanes available; the analysis indicates that the added lane should be usd as a second left turn lane into southbound Kamehameha Highway during the AM Peak Period, and as a second right turn lane to northbound Kamehameha Highway in the PM Peak Period. The intersection would operate under-capacity with or without the proposed project.

The intersection of Kamehameha Highway and Waipahu Street

would be changed from the existing "T"-intersection to a cross-intersection. New turn lanes will be needed from Kamehameha Highway. The analysis indicates that the most efficient signal operation would be six-phase, with separate phases for the westbound and eastbound approaches. The new westbound connection from the project would need to have three approach lanes: a right turn only lane, a left turn/straight option lane, and a third lane exclusively for left turns. Widening of the eastbound approach (existing Waipahu Street) would be needed, with the third (middle) approach lane serving traffic wishing to cross Kamehameha Highway to proceed into the Waiawa development. As is the case at Ka Uka Boulevard, variable message signs could allow for special use of the middle lane, as an optional right turn lane in the AM Peak Period and an optional left turn lane in the PM Peak Period, to maximize utilization of the intersection.

Signalization is needed at the Kamehameha Highway and Waihona Street intersection to provide adequate capacity for projected Waihona Street traffic in the PM Peak Hour, with or without the proposed project. With the project's traffic, two left turn lanes would be needed to maintain under-capacity conditions.

3. Waihona Street

The unsignalized intersection formed at the project's access road with Waihona Street will have adequate capacity to serve projected traffic volumes.

4. Mitigation Measures

The traffic generated by the proposed project will require multiple-lane ramps at Waipio Interchange and other improvements at the Kamehameha Highway intersections. At Waipio Interchange, however, projected demand volumes would still exceed capacities.

A program to reduce traffic by encouraging high occupancy vehicle (HOV) use during peak periods has the potential to reduce traffic demands. The project traffic demand forecast was developed using observed existing travel patterns; if a change in the pattern of use can be achieved, a reduction in traffic demand would follow. Table 1 shows what an HOV program would need to achieve to reduce the project's traffic generation to a level which can be served by the proposed roadway improvements.

5. Conclusions and Recommendations

The proposed development will affect traffic conditions in the area. Modifications to the Waipio Interchange would be needed to accommodate the traffic demands of the proposed project. Overall growth due to all projects in the area, including the Waiawa development will cause increased traffic demands on the roadways. The establishment of ridesharing programs and the provision of facilities to encourage increased use of high occupancy vehicles should be instituted to help mitigate adverse traffic impacts of this growth.

Specific recommendations from this evaluation identify improvements which should be made between years 2000 and 2010:

- Provide improved signalization and variable message signs to increase efficiency at the Kamehameha Highway intersections with Kai Uka Boulevard and Waipahu Street.

- Monitor traffic volumes at Waihona Street and provide signalization and restriping as necessary.

- Establish and continue a program to encourage the use of high occupancy vehicles as a means to reducing traffic demand.

TABLE 1

TRAFFIC DEMAND REDUCTION PROGRAM

	AM Peak Hour	PM Peak Hour
Critical Volume (vehicles/hour)	2,545	2,262
Location	SB on-ramp (loop)	NB off-ramp
Level of Service	F	F
Base vehicle occupancy (estimated)	1.2	1.2
Person trip demand	3,054	2,714
Desired modal use pattern:		
A) No change	55 %	65 %
Person trips	1,680	1,764
Vehicle occupancy	1.2	1.2
Vehicle trips	1,400	1,470
B) Shift to car pools	25 %	15 %
Person trips	764	407
Vehicle occupancy	3.5	3.5
Vehicle trips	218	116
C) Shift to Express Bus	20 %	20 %
Person trips	611	543
Vehicle occupancy	48	48
Vehicle trips	13	12
Total vehicle trips	1,631	1,598
Reduction in Critical Volume	35.9 %	29.4 %
Ramp Level of Service	E	E

G. Impact on Air Quality

Present air quality in the project area is estimated to be good since nearby long term monitoring stations have consistently been recording airborne particulate and sulfur dioxide levels that are well within allowable State of Hawaii Air Quality Standards, but particulate and carbon monoxide emissions from nearby sugar cane or pineapple fires do present some potential to degrade air quality in the project area for short periods of time and vehicular emisisons during peak period traffic conditions may be creating "hot spots" near congested downstream intersections where carbon monoxide levels could exceed allowable air quality standards under especially unfavorable meterological dispersion conditions.

Except for short term dust emissions during the construction phase of the development, no significant direct air quality impacts are expected. Adequate control measures exist to limit the scope of this impact, but special care will have to be exerted to insure that previously developed residential areas are not subjected to excessive levels of particulate pollution from construction activities.

Indirect air quality impacts are expected to result from new demands for electrical energy. This impact is most likely to occur in the vicinity of existing power plants such as the Kahe Plant on the Waianae coast where increased levels of particulates and sulfur dioxide can be expected. Maximum use of solar energy designs in project development can at least partially mitigate the magnitude of this impact. New methods of generating electrical power such as wind or ocean thermal energy conversion may eventually also play a mitigative role in this regard.

Increased traffic generated by the proposed development will increase emissions of carbon monoxide and nitrogen dioxide in the project area and along routes leading to urban Honolulu. Detailed

carbon monoxide modeling carried out as a part of this study indicates that allowable State of Hawaii standards can be met at the proposed Waipio Interchange, but that these standards are not likely to be met at other critical receptor sites in the vicinity of Waipahu Street and Kamehameha Highway and along the H-1 Freeway between the Waiawa Interchange and the Halawa Interchange.

While modeling indicates that future levels of carbon monoxide at these locations are likely to be lower than present values whether traffic from the proposed development is included or not, it is still likely that State of Hawaii standards will be exceeded at these sites unless regional measures to mitigate traffic congestion are employed.

H. Impact on Noise Environment

Future traffic noise levels in the vicinity of the proposed development for the Year 2010 planning period were reevaluated for their potential impact on present and future residences. The future traffic noise level increases on Kamehameha Highway and H-2 Freeway were calculated for the Year 2010 planning period following full development of the additional 515 acres. Increases in traffic noise ranging from 0 to 3.8 Ldn (or dB) are predicted to occur between now and the 2010 planning period as a result of project plus non-project traffic. Project related traffic noise increases on existing roadways are predicted to be in the order of 0.2 to 1.0 Ldn, which are considered minimal to moderate.

Future traffic noise impacts on residents can be minimized by the use of buffer zones of adequate depth on the Waiawa side of H-2 Freeway, and along the internal roadways of the development. In order to not preclude federal (FHA/HUD) assistance on the project, it is suggested that minimum setback distances to the future 65 Ldn noise contours be used in siting future residential and apartment units. If these setback distances are not practical, the use of other noise mitigation measures may be applied as required. Because of

possible noise impacts from H-2 Freeway, more detailed analyses of future traffic noise at parcels along the H-2 are recommended following completion of the site grading plans.

Traffic noise impacts on existing residences along Kamehameha Highway are predicted to be insignificant. Along H-2 Freeway, noise impacts are expected to be moderate. Although significant increases in traffic noise levels are predicted as a result of primarily non-project traffic, existing residences should remain in the "Acceptable, Moderate Exposure" and "Unconditionally Acceptable, Minimal Exposure" categories.

The possibility of adverse noise or operational impacts exists along the proposed common boundaries between the commercial/industrial and low density apartment lots of the proposed development. Because these lots are removed from the highway, background ambient noise levels are expected to be low, and in the order of 40 to 55 dB, and noise from commercial/industrial activities may be audible along the common boundary line with the apartment units. Commercial/industrial users will be required to not exceed State and County noise limits at the common boundary line, and this should prevent excessive noise levels at the neighboring apartment units.

It may be necessary to control the type of tenants or, as a minimum, to advise commercial/industrial subdivision tenants of the possibility of noise complaints from the neighboring apartments, and of their responsibilities for compliance with the State and County noise regulations. Along the common boundary line between the proposed apartment and commercial/industrial subdivisions, State and County noise regulations will probably be enforced if noise complaints occur. The lower noise limits for apartment/dwelling units in the State and County noise regulations will place an upper limit on the permissible noise levels along the common boundary line. As long as current noise regulations are adhered to, the possibility of noise conflicts should be minimized.

The following noise mitigation measures should be considered to minimize the possibility of conflicts along the common boundary between the commercial/industrial and low density apartment lots:

a. Locate commercial/industrial tenants with the nosiest operations toward a boundary line which is not anticipated to be noise sensitive, such as the north or southwest boundary lines.

b. Avoid locating commercial/industrial tenants or noise equipment near a noise sensitive boundary line, unless the tenant's noisy operations or equipment can be housed within a dense structure which blocks the visual line-of-sight between the tenant's operations or equipment and the noise sensitive neighbor.

c. Maximize buffer distances between the noise sensitive dwelling units and the commercial/industrial boundary line, and provide intervening structural barriers (stairways, solid walls, utility rooms, etc.) to block the visual line-of-sight between the noise sensitive units and the commercial/industrial lots.

I. Impact on Infrastructure and Utilities

1. Water System

The entire project site is currently undeveloped and, therefore, no infrastructure or utilities are available on the site. Prior to 1982, Oahu Sugar Company irrigated its canefields with basal water pumped from deepwells located on-site adjacent to Waiawa Stream. Pumpage from these wells of up to 7 mgd was discontinued just prior to discontinuance of cane cultivation on Waiawa Ridge in 1982.

For Waiawa Ridge, the developer proposes to fund and construct onsite, the required water deepwells, storage reservoirs and transmission and distribution mains. The system will be designed and constructed to the Board of Water Supply's standards. Upon completion, the system will be dedicated to the Board of Water supply for operation and maintenance.

For water source, the developer proposes to request allocation of the project's required 4.7 million gallons per day (mgd) from the Board of Water Supply. Said request would be made against present and future excess BWS water allocated by the Department of Land and Natural Resources in the Pearl Harbor Water Control District.

When fully developed, the estimated demand for potable water would be approximately 2.40 million gallons of water per average day.

The project area is located within the Pearl Harbor Ground Water Control Area (PHGWCA) as designated by the Department of Land and Natural Resources under Chapter 177, HRS, and administered through the Department's Administrative Rule, Chapter 166 of Title 13, and as such, a water use permit from DLNR will be required if the project plans for either the Gentry 515 Development or the Waiawa Development call for the development of groundwater sources or require the modification or exchange of present groundwater uses.

There are no municipal water facilities in the Gentry 515 project area. Therefore, connection to the Waiawa Developments's proposal to construct onsite water source storage reservoirs, and transmission and distributions mains is planned. The system would be designed and constructed to meet City standards. Upon completion, the system will be turned over to the Board of Water Supply for operation and maintenance.

2. Sewage Treatment and Disposal

The entire project site is currently undeveloped and, therefore, no infrastructure or utilities are available on-sie with the exception of a municipal sewage pump station at the southern boundary adjacent to Waihona Street. When constructed in 1978, the sewage pump station had a design capacity for about 400 low density apartment units for future Waiawa Development.

Adjoining Crestview, Seaview and Gentry-Waipio Subdivisions are serviced by trunk main sewers which convey the wastewater to the municipal pump station on lower Waipahu Depot Road, where it is boosted to the Honouliuli Regional Wastewater Treatment Plant.

For Waiawa Ridge, the developer proposes to fund and construct on-site underground collection pipe systems, as well as a new 1.5-mile long off-site trunk sewer to the municipal Pearl City Wastewater Pump Station. Average daily flow is expected to generate 3.1 (MGD). The alignment will follow the Gentry 515 alignment as described above.

The Gentry 515 project is expected to generate an average daily sewage flow of approximately 1.63 MGD. Connections to the Pearl City Wastewater Pump Station will be required which will involve connection to the Waiawa Development's new off-site trunk sewer. The preliminary alignment follows Waihona Street; Kamehameha Highway; and proposed easements to the pump station. Wastewater is then pumped to the regional plant at Honouliuli for treatment and discharged into the Pacific Ocean off the Ewa Coast.

The DPW notes that the existing and approved projects (under present population restraints to year 2005) will require a total capacity of 35.42 mgd at the Honouliuli WWTP whose present

capacity is 25 mgd. If so, the WWTP capacity should not be increased to 37.5 mgd but to its ultimate capacity of 51 mgd and, therefore, provide for Waiawa development and other future projects within the tributary area.

Since many of the approved and planned projects will not be implemented completely for about 20 years, another alternative is to increase the WWTP capacity to 37.5 mgd by 1993 and plan another expansion to 51 mgd in about ten years thereafter.

3. Electrical and Telephone Service

Both the Hawaiian Telephone Company and Hawaiian Electric Company can provide adequate underground services for the proposed 515 development. Existing electrical facilities on the site may require relocation.

Commitments to meet additional costs for adequate underground electrical service will be reviewed at the appropriate time after electrical engineering design work has been completed. This also applies to the relocation of existing HECO facilities currently located on perpetual easements and the need for an onsite substation.

4. Solid Waste Collection and Disposal

The development will be served by City & County of Honolulu and private refuse collection services. Refuse is disposed at the Waipahu Incinerator.

J. Public Facilities and Services

1. Police and Fire Protection

Police and fire services appear adequate to serve the development. Police facilities are located in Pearl City on Waimano

Home Road, approximately two (2) miles from the project site. The Waipahu and Pearl City Fire Stations, as well as the Navy Fire Station and the proposed City Fire Station at Gentry-Waipio, are located within the project area. The Fire Department recommends that a site for future station plans within the adjacent Waiawa project be considered.

2. Health Care Facilities

Waipahu, Pearl City, Mililani Town, and Pearl Ridge adequately and conveniently provide all the necessary health care services to meet the needs of the residents of the area. In addition, health care facilities will be incorporated into the design of the Waiawa Development retirement community.

3. Educational Facilities

Initially, until the development generates a sufficient number of K-6 students, the residents at Gentry 515 will be served by the Kanoelani and Pearl City Elementary Schools. Higher grade students will attend the Waipahu and Highlands Intermediate Schools and the Waipahu and Pearl City High Schools. Higher educational opportunities are available at Leeward Community College and West Oahu College.

An Elementary public school site is planned at the Waiawa Development.

State library services are provided at the Pearl City Regional, Mililani and Waipahu Libraries, located within a 2-mile radius of the project site. Library and other community-type services will be considered in the design of the town center site.

4. Parks, Recreation and Open Space

The Gentry 515 Plan includes over 13 acres of open space use. 58 acres of flood plain area will also serve as visual open space lending a sense of openess to the makai portion of the project site.

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

It is anticipated that the construction of the proposed project will commit the necessary construction materials and human resources (in the form of planning, designing, engineering, construction labor, landscaping, and personnel for the sales, management, services offices, and maintenance functions). Some of the construction materials could be reused if and when the structures are demolished; however, at the present time and state of our economy, it is felt that the reuse of much of these materials is not practical. Labor expended for this development is not retrievable. However, labor will be compensated during the various stages of the project by the developer, commercial businesses, and the building's management.

The appearance of the project site will be altered from its present open vacant appearance to that of a completed planned residential community. The development will be highly visible but visually integrated with the surrounding areas.

Air and noise quality will be adversely affected by this proposed project, but will remain in compliance with State standards. While ambient air and noise quality in the area is relatively good, however, the proposed development will result in greater number of vehicles going to and from the project areas, resulting in vehicular pollution emissions.

The project development will result in a commitment of land for a long-term period. Once low and medium density residential uses are established, it is unlikely that the land will be reverted to a lower usage in the long-term future. Commitment of land for these purposes will likely foreclose certain future use options of the land.

The project development will, in the short- and long-term result in residential uses which will likely benefit future homeowners, the landowner and private businesses.

IX. ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The following adverse environmental effects (both short- and long-term) cannot be avoided.

(1) Agricultural use of the land will be lost.

(2) The site-clearing and construction work will result in temporary fugitive dust, some disruption to traffic, and noise.

(3) Traffic will increase from the number of additional cars utilized by residents of the proposed development. Additional impacts associated with increased traffic include potential air and noise quality deterioration.

(4) The need for utility services will increase.

(5) The need for public services for fire and police protection, schools, and public recreational facilities will increase slightly.

(6) Solid waste and sewage generated by the project will increase the need for disposal and treatment and will increase total local waste output.

(7) The Waiawa Correctional Facility (WCF) operates currently on lands adjacent to proposed residential sectors of this project. The access road will run through the project site, and in the normal procedure of their operation, provide traffic consisting of prison officials, staff, inmates and their escorts, counselors, families and friends. To the extent possible, major collector streets would be used to provide the direct routing to the WCF, avoiding the lower traffic residential streets.

X. SUMMARY OF UNRESOLVED ISSUES

The proposed Gentry 515 development plan is a conceptual planning exercise for years 10 to 20 in the larger adjacent Waiawa Development. Viewed in this perspective, it should be noted that implementation of the Gentry 515 project is highly unlikely without the completion of the Waiawa Development which will provide major infrastructure support. Similarly, due to the conceptual nature of this project it is difficult to define the scope of the subject project in this early stage.

A. State Land Use Boundary

The project site is currently designated for Agriculture use by the State Land Use Commission. A petition for boundary amendment will be filed with the Commission to have the site designated for urban land use. Until this petition is filed and the land use change is granted, the project site will remain as an agricultural area.

B. Site Aquisition

The project site is currently owned in full by Bishop Estate. Oahu Sugar Co. has been leasing the site for sugarcane acreage. Purchase negotiations between the developer and the present landowner are currently being finalized.

C. Agricultural Use vs Urban Use

The significance of the subject lands as part of the agricultural resources of the State of Hawaii can be evaluated by examining the potential uses of the land. These uses are determined by three sets of factors: (1) the physical, agronomic and environmental characteristics of the land; (2) economic variables such as the existence and location of markets for goods that can be feasibly produced on the land, the cost of inputs required to grow the

The subject lands have the agronomic potential to be productive agricultural lands. However, due to market parameters, the declining importance of the sugar industry, and the availability of similar lands on Oahu, placing the subject lands in an urban use will not have a significant impact on the agricultural sector of Honolulu County or the State. Lands of similar quality and economic potential are currently lying fallow and there are sufficient lands available to meet current and projected future agricultural needs. If these lands were to remain in agriculture, their most likely use would be for grazing and grazing is an activity that returns very little per acre.

XI. ORGANIZATIONS AND AGENCIES CONSULTED DURING THE EIS PREPARATION NOTICE COMMENT PERIOD

ORGANIZATIONS/AGENCIES	Date of Comment	Date Comment Received	Date of Response
State			
Department of Agriculture	1/19/87	1/21/87	2/06/87
Hawaii Housing Authority	1/21/87	1/23/87	2/06/87
Department of Defense	--	--	--
Department of Planning & Economic Development	1/21/87	1/23/87	2/06/87
Department of Education	1/21/87	1/30/87	2/06/87
Department of Health	1/22/87	1/28/87	2/06/87
Department of Land & Natural Resources	--	--	--
Department of Transportation	1/23/87	1/29/87	2/06/87
OEQC	1/20/87	1/28/87	2/06/87
University of Hawaii at Manoa			
Water Resources Research Center	--	--	--
Environmental Center	--	--	--
City & County			
Board of Water Supply	1/26/87	1/27/87	2/06/87
Building Department	1/19/87	1/22/87	NRN
Department of General Planning	1/22/87	1/23/87	2/06/87
Department of Housing and Community Development	1/19/87	1/22/87	2/06/87
Department of Land Utilization	1/22/87	1/23/87	2/06/87
Department of Public Works	1/22/87	1/23/87	2/06/87
Department of Transportation Services	--	--	--
Fire Department	1/20/87	1/22/87	2/06/87
Police Department	1/20/87	1/22/87	2/06/87
Department of Parks and Recreation	1/23/87	1/29/87	2/06/87
Federal			
Department of the Army Corps of Engineers	1/23/87	1/29/87	2/06/87
U.S. Dept. of the Interior Fish and Wildlife Service	1/21/87	1/22/87	2/06/87
U.S. Dept. of the Interior Geological Survey	1/22/87	1/23/87	NRN
U.S. Navy	1/23/87	1/29/87	2/06/87
Soil Conservation Service	1/27/87	1/29/87	NRN

Organizations and Agencies Consulted

Community Organizations	Date of Comment	Date Comment Received	Date of Response
Hawaiian Electric Company, Inc.	1/27/87	1/29/87	2/06/87
Hawaii's Thousand Friends	--	--	--
American Lung Association of Hawaii	--	--	--
Waipahu Neighborhood Board #22	--	--	--

NRN: NO RESPONSE NEEDED

JOHN WAIHEE
GOVERNOR

SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

TADASHI TOJO
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

January 19, 1987

Mr. Fred J. Rodriguez
Environmental Communications, Inc.
P. O. Box 536
Honolulu, Hawaii 96809

Subject: Environmental Impact Statement Preparation Notice (EISPN) for Gentry 515 Project; The Gentry Companies
TMK: 9-4-06: por. 10, 9-6-04: por. 1 and 4
Waiawa, Oahu 515 acres

Dear Mr. Rodriguez:

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

According to the EISPN, the applicant is seeking to develop areas of mixed urban uses on the edge of the proposed Waiawa Development. Development of the subject project is adjacent to and contingent upon the implementation of the proposed Waiawa Development.

The Draft EIS should include discussion on the following issues:

- Information (including maps) should be provided on existing soil types and characteristics which may limit agricultural or urban use of the site. In addition, an analysis of the Agricultural Lands of Importance to the State of Hawaii (ALISH) system and Land Study Bureau Overall Productivity Ratings are important to determine the agricultural viability of the project site.

- An evaluation of the project area in terms of the Land Evaluation and Site Assessment (LESA) system of identifying and protecting important agricultural lands (IAL) (as mandated by the State Constitution) should be included.

- The potential of establishing viable alternative agricultural uses on the project site should be analyzed.

JAN 21 1987

- The broader economic and resource impact on the State from the irrevocable loss of prime agricultural lands should be assessed.

- How does the proposed project conform to the State Agriculture Functional Plan and its objectives and policies, particularly, Implementing Action B(5)(c)?

- How does the proposed project relate to Hawaii State Plan priority guidelines 226-104(b)(2) and 226-106(1), which direct development into marginal or non-essential agricultural land to meet housing needs and "...(maintain) agricultural lands of importance in the agricultural district"?

- What is the impact of this development on future agricultural production requirements and expansion of diversified agriculture, as identified in the Final Report of the Land Evaluation and Site Assessment (LESA) Commission (February, 1986)?

- Will groundwater recharge of the Pearl Harbor Groundwater Control Area be reduced due to urbanization of the project site, and will this have an impact on agricultural viability in the area?

Thank you for the opportunity to comment. We will provide further comment upon our receipt and review of the Draft EIS.

Sincerely,

Suzanne D. Peterson

SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: DPED
OEQC
LUC
DGP
DLU

ENVIRONMENTAL
COMMUNICATIONS
INC.

F J RODRIGUEZ
PRESIDENT

February 6, 1987

Ms. Suzanne D. Peterson
Chairperson, Board of Agriculture
Department of Agriculture
1428 South King Street
Honolulu, Hawaii 96814-2512

Dear Ms. Peterson:

We have received your department's comments dated January 19, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry 515 Project. The comments have been provided to the applicant and Evaluation Research Consultants (Peter V. Garrod, Ph.D) for their review and response.

The specific items discussed in the EISPN comments will be provided for in the Draft Environmental Impact Statement (DEIS). Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P O BOX 538 • HONOLULU HAWAII 96809 • TELEPHONE (808) 521-8351

John D. Waihee

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:

87:PLNG/324

January 21, 1987

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

Dear Mr. Clegg:

Re: Environmental Impact Preparation Notice (EISPN)
for the Proposed Gentry 515

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

The EIS should address the provision of affordable housing within the proposed development. More specifically, the number, type of dwelling, price range and location of units available to low- and moderate-income and gap group families.

Thank you for the opportunity to review the EISPN. Should you have any questions, please contact Colette Sakoda of my staff at 848-3226.

Sincerely,

RUSSELL N. FUKUMOTO
Executive Director

cc: F. J. Rodriguez

JAN 23 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

1148 FORT STREET MALL, SUITE 200 • P. O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-4591

February 6, 1987

Mr. Russell N. Fukumoto
Executive Director
Hawaii Housing Authority
Department of Social Services
and Housing
P.O. Box 17907
Honolulu, Hawaii 96817

Dear Mr. Fukumoto:

The comments received from your office dated January 21, 1987 on the Gentry 515 Project have been provided to the applicant and we respond as follows:

The HHA requirements for low and moderate income housing availability will be discussed in the Draft Environmental Impact Statement (DEIS) to the extent the data is available. As stated in the Environmental Impact Statement Preparation Notice (EISPN), the Gentry 515 project is a planning requirement EIS and reflects the long range planning in the second ten year period for the Waiawa Ridge development. The DEIS will attempt to state as best as it can, the availability of type, price range, and location of housing units that will be provided.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT
KAMAMALU BUILDING 250 SOUTH KING ST HONOLULU HAWAII
MAILING ADDRESS P.O. BOX 2359 HONOLULU HAWAII 96804 • TELEX JN 82250 HOPED

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
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DEPUTY DIRECTOR

DIVISIONS
BUSINESS AND ADVISORY 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-5778

January 21, 1987

Mr. Fred J. Rodriguez
Environmental Communications, Inc.
P.O. Box 536
Honolulu, Hawaii 96809

Dear Mr. Rodriguez:

Subject: EISPN for Gentry 515, Waiawa, Oahu

We have reviewed the subject Environmental Impact Statement Preparation Notice (EISPN) and have the following comments.

1. Throughout the EISPN, reference is made to the interdependence of the proposed project with a similar but larger project proposed for development adjacent to the subject property. Page II-1 of the EISPN states, "The Gentry 515 project presented is developed as an advanced planning concept which is separate from, but contingent upon the implementation of the proposed Waiawa Development." Page II-4 of the EISPN states, "All Gentry 515 design concepts are also premised on the assumption that the proposed project could not be developed without the Waiawa Development." The EISPN goes on to state, "all infrastructure and support facilities development would be dictated by the presence and availability of Waiawa Development linkages."

   From these and other statements in the EISPN, it appears that this "urban infill" project is actually the second phase of the proposed Waiawa Development. If this is the case, the draft EIS (DEIS) should contain a discussion on how the two projects are interrelated and what environmental impacts can be expected, both individually and cumulatively, if the two projects are physically linked by project infrastructure. Infrastructure capacities must be evaluated in terms of total development.

   The reason why this project was not included in plans for the larger Waiawa Development should be disclosed in the DEIS. The status of the EIS for Waiawa appears to be slightly further along in the review process than the proposed Gentry 515 development. When two projects are so closely interrelated, the preparation of one comprehensive EIS would seem more desirable and the reasons for not doing so in this case should be discussed.

JAN 23 1987

   Page II-4 of the EISPN refers to "alternate financial support." The DEIS should clearly define this term and clarify whether infrastructural improvements will be funded by the applicant, the proposed Waiawa Development, or governmental sources.

2. The EISPN states on page II-4, that "no development or phasing plans are currently available." The DEIS should explain how this proposal relates to the Land Use Commission Rules, Subchapter 8, 15-15-78 - Incremental Districting. Anticipated time frame or phasing of project construction relative to the proposed Waiawa Development should be addressed if the two projects are to share infrastructure.

   The DEIS should also include a list of permits required for the proposed development, an analysis of how Waiawa infrastructural design specifications will be altered if Gentry 515 comes on line, and whether the inclusion of the proposed project will require a reevaluation of the Waiawa project. It should be noted here that the Honouliuli and Waipahu sewer facilities were not designed to include this subdistrict.

   Even though existing utilities and infrastructure connections are available outside of the site, these might need to be expanded to accommodate the increased demands. This impact should be recognized in the appropriate section of the DEIS.

3. The DEIS should include a thorough analysis of downstream impacts on H-1 Freeway vehicular traffic, how the necessary funds for roadway improvements will be provided, and what mitigating alternatives can be implemented to lessen the impacts on vehicular congestion.

4. The location map and site plans for the DEIS should include more detail in regard to proposed improvements and existing physical features. These may include, but are not limited to, roads, building location, infrastructure location, topographic information, soils, and drainage.

5. Land use changes from agricultural to urban uses in Central Oahu may have an impact on the groundwater recharge potential of the Pearl Harbor Basin. The DEIS should contain information on the potable and irrigation water requirements for the proposed development, plus estimates of the cumulative impact on groundwater relative to other land use conversions within the Pearl Harbor Groundwater Control Area.

6. The DEIS should provide 1) a map to delineate the Flood Hazard Zone "A" referred to on page III-3 of the EISPN, 2) proposed development within this zone, and 3) information on mitigating construction practices to conform with Flood Hazard Zone development restrictions.

7. Drainage and runoff coefficients for residential development can be utilized to determine potential impact on coastal ecosystems downstream from the project's drainageways. The DEIS should evaluate sedimentation of coastal ecosystems and the anticipated water quality of surface drainage.

8. This project and the Waiawa Development have the potential for contaminating the groundwater drawn by the Waiawa shaft. This facility is important to Pearl Harbor Naval Base, therefore, the draft EIS should include an analysis of all potential groundwater pollution problems which may jeopardize the quality of the Central Oahu groundwater resource and groundwater drawn by the Waiawa shaft.

9. The EISPN states on page IV-5 that prior to 1982, the subject lands were utilized for sugar cane production and are considered as "Prime Agricultural Lands by the Hawaii Department of Agriculture." The draft EIS should consider alternative agricultural uses of the project site, the cumulative impact of lost agricultural production in Central Oahu resulting from agricultural land conversion, and the statewide impact of irrevocable agricultural land conversion to urban uses.

10. The EISPN indicates on page III-4 that two archaeological sites located adjacent to the subject property are referred to in the available archaeological literature. Two source documents published in 1933 and 1940 are quoted. The DEIS should contain a current and detailed site assessment of historical and archaeological characteristics to determine their significance for preservation or excavation. If significant sites are found, plans and policies should be in place to preserve their historical value before construction begins.

11. On page III-5 the EISPN states, "Over the next decade substantial urbanized growth should be expected, especially in view of local policies which target the area for major growth." If the project site is classified as agricultural by both the State and County, the DEIS should quote the local growth policies being referred to and provide a discussion identifying their relationship to the proposed project.

Page III-5 also discusses past population growth in Central Oahu of 177 percent between 1970-1980 and 95 percent between 1980-1984. The draft EIS should address the success Central Oahu has had in absorbing past growth and whether or not there is sufficient carrying capacity to receive more growth in the future in light of present policies and past experience.

12. The EISPN states on page III-5, "The existing traffic noise ... in the area of the project is in the Significant Exposure, Normally Unacceptable category, with traffic noise at 70 Ldn along the right-of-way." The DEIS should discuss mitigating measures to dampen noise impacts with consideration for cost effectiveness and energy efficiency. If this proves to be unfeasible, what alternative uses are available in areas which are noise sensitive and what are the accompanying impacts?

13. Page IV-1 of the EISPN states, "The material exposed after the stripping, slab and pavement sub-grades and areas to receive engineered fill should be excavated of any and all loose soils." The EISPN goes on to state, "No impacts are expected on the soils in the area." This appears to be an inconsistency and should be clarified in the draft EIS.

14. The proposed project will contain an area of "active" retirement housing "similar to those proposed in the Waiawa Development." The DEIS should include an analysis of the market demand for such a facility, the types of public and private services unique to a development such as this, and a discussion on alternative uses of the retirement area and accompanying impacts.

15. The DEIS should include information on the pricing of housing units and the ability of persons in the low, moderate and gap-group income levels to qualify for occupancy. Plans to meet this need in consideration of State and County policies should also be included.

16. Hawaii Coastal Zone Management (CZM) policies provide for the protection of valuable coastal ecosystems, preventing flood hazards, and promoting water quantity and quality planning and management. With respect to these CZM policies, the following concerns should be incorporated into the text of the EIS.

    Water Supply: Adequate water supply is requisite for developments like the Gentry 515 and Waiawa Developments. Therefore, the EIS should recognize that the project is within the Pearl Harbor Groundwater Control Area and that there is a limited supply based on its 225 MGD maximum sustainable yield.

Even though water demand figures are not presently available, at least a projected estimate should be provided. This estimate should be related to the amount of available yield from the 225 MGD. Any potential impact upon groundwater resources, i.e., contamination, should be disclosed along with the fact that the project site is situated over the Waiawa Shaft, the Navy's primary water source.

Flood Hazard: The Waiawa Stream flood hazard area should be shown on a map. Flood mitigating measures and compatible land use of these areas to minimize flood hazards should be proposed and discussed.

Drainage and Runoff: The Pearl Harbor estuary and the National Wildlife Refuge will directly receive surface water runoff from the project via Waiawa Stream. Potential impacts upon these resources should be addressed in the EIS.

17. The DEIS should discuss the relationship 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: Agriculture (Section 226-7, HRS), Physical Environment (Section 226-13, HRS), Facility System (Sections 226-14 thru 226-17, HRS), Socio-cultural (Sections 226-19, 226-20, 226-23 and 226-25, HRS). Among the relevant Priority Guidelines, the following should be examined: Population Growth and Land Resources (Section 226-104(b), HRS) and Affordable Housing (Section 226-106, HRS). The State Functional Plans should be reviewed to determine relevance to your project and important relationships should be discussed in the DEIS.

Thank you for the opportunity to review and comment on the subject document.

Sincerely,

Roger A. Ulveling

cc: Hon. Donald A. Clegg, Chief Planning Officer
Dept. of General Planning, C&C of Honolulu
Office of Environmental Quality Control

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

February 6, 1987

Mr. Roger A. Ulveling, Director
Department of Planning and
Economic Development
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

We are in receipt of your comments dated January 21, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry 515 Project. These comments have been provided to the applicant for his review and we respond in the following:

As stated in the EISPN, this project is requested by the Department of General Planning, City and County of Honolulu as a Planning Only EIS to determine the impacts on the total acreage on a 10-10-10 year basis. The EISPN further states and identifies clearly that without the initial project (Waiawa by Gentry), this 515 acre increment will not proceed. We are requesting DPED's indulgence in their review of the 515 project on that premise.

We will respond with adequate data and information to the best of our ability, the balance of the 16 commented items. Having gone through the rigors of a recent EIS review on the Waiawa project, we are confident that we can respond adequately to the DPED comments.

We look forward to hearing from you on this matter.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P. O. BOX 538 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-0511

6. The DEIS should provide 1) a map to delineate the Flood Hazard Zone "A" referred to on page III-3 of the EISPN, 2) proposed development within this zone, and 3) information on mitigating construction practices to conform with Flood Hazard Zone development restrictions.

7. Drainage and runoff coefficients for residential development can be utilized to determine potential impact on coastal ecosystems downstream from the project's drainageways. The DEIS should evaluate sedimentation of coastal ecosystems and the anticipated water quality of surface drainage.

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Even though water demand figures are not presently available, at least a projected estimate should be provided. This estimate should be related to the amount of available yield from the 225 MGD. Any potential impact upon groundwater resources, i.e., contamination, should be disclosed along with the fact that the project site is situated over the Waiawa Shaft, the Navy's primary water source.

Flood Hazard: The Waiawa Stream flood hazard area should be shown on a map. Flood mitigating measures and compatible land use of these areas to minimize flood hazards should be proposed and discussed.

Drainage and Runoff: The Pearl Harbor estuary and the National Wildlife Refuge will directly receive surface water runoff from the project via Waiawa Stream. Potential impacts upon these resources should be addressed in the EIS.

17. The DEIS should discuss the relationship 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: Agriculture (Section 226-7, HRS), Physical Environment (Section 226-13, HRS), Facility System (Sections 226-14 thru 226-17, HRS), Socio-cultural (Sections 226-19, 226-20, 226-23 and 226-25, HRS). Among the relevant Priority Guidelines, the following should be examined: Population Growth and Land Resources (Section 226-104(b), HRS) and Affordable Housing (Section 226-106, HRS). The State Functional Plans should be reviewed to determine relevance to your project and important relationships should be discussed in the DEIS.

Thank you for the opportunity to review and comment on the subject document.

Sincerely,

Roger A. Ulveling

cc: Hon. Donald A. Clegg, Chief Planning Officer
Dept. of General Planning, C&C of Honolulu
Office of Environmental Quality Control

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

February 6, 1987

Mr. Roger A. Ulveling, Director
Department of Planning and
Economic Development
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

We are in receipt of your comments dated January 21, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry 515 Project. These comments have been provided to the applicant for his review and we respond in the following:

As stated in the EISPN, this project is requested by the Department of General Planning, City and County of Honolulu as a Planning Only EIS to determine the impacts on the total acreage on a 10-10-10 year basis. The EISPN further states and identifies clearly that without the initial project (Waiawa by Gentry), this 515 acre increment will not proceed. We are requesting DPED's indulgence in their review of the 515 project on that premise.

We will respond with adequate data and information to the best of our ability, the balance of the 16 commented items. Having gone through the rigors of a recent EIS review on the Waiawa project, we are confident that we can respond adequately to the DPED comments.

We look forward to hearing from you on this matter.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P. O. BOX 538 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8761

John Waihee
Governor

Charles T. Toguchi
Superintendent

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

January 21, 1987

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

Dear Mr. Clegg:

SUBJECT: Gentry 515

Our review of the proposed development indicates that it may generate the following additional enrollment:

Students Projected

Schools	Grades	Approximate Enrollment
------	K-6	200-300
Highlands Intermediate	7-8	50-80
Pearl City High	9-12	90-130

Highlands Intermediate and Pearl City High are now operating at capacity and may require budgeting for the construction of additional classrooms.

Per our letter dated December 16, 1986, an elementary school site will be required within the first phase of the Waiawa development to accommodate the K-6 students. A second elementary school site may be required within the Gentry 515 phase. A close monitoring of the first phase will be made before any decision is made on the need to establish a second elementary school.

Should you have any questions, please call Mr. Richard Inouye at 737-4743.

Sincerely,

Charles T. Toguchi
Superintendent

CTT:dk (MRI)
cc Leeward District
OBS
Mr. F.J. Rodriguez

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

February 6, 1987

Mr. Charles T. Toguchi
Superintendent
Department of Education
State of Hawaii
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Mr. Toguchi:

We are in receipt of your department's comments dated January 21, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 Project. The comments have been forwarded to the applicant for his information and planning.

We will indicate in the Draft Environmental Impact Statement (DEIS) the provisions that your staff have indicated for future growth and relationship between the Waiawa by Gentry project and the Gentry 515 project.

Thank you for you comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

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JOHN WAIHEE
GOVERNOR OF HAWAII

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

John C. Lewin, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPHSD

January 22, 1987

MEMORANDUM

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

From: Director of Health

Subject: Environmental Impact Statement Preparation Notice (EISPN) for Gentry 515, Waiawa, Central Oahu, Hawaii

Thank you for the opportunity to comment on the subject project. We provide the following comments:

Drinking Water

The Department of Health has previously expressed concerns about negative impacts on Waiawa Shaft due to the adjacent Waiawa Ridge Development. The proposed Gentry 515 Project would be located in the recharge area for the Waiawa Shaft, the major source serving the United States Navy's Pearl Harbor Water System. This source has already been shown through scientific studies to be affected by irrigation recharge of the proposed ridge area by brackish waters. In addition, the source has registered low level contamination by the chemicals dibromochloropropane (DBCP) and trichloropropane (TCP) which has led to the application for listing of this source on the National Priorities List (for Superfund Clean-up). The Waiawa Shaft is clearly susceptible to contamination. This fact, coupled with the importance of this source as a source of potable water serving a major water system, require that no activity be allowed in the recharge area which may further contaminate the Shaft.

The Drinking Water Program strongly recommends that the EIS adequately address all aspects (including potential contaminating activities, contaminants involved, probability for contamination, mitigating methods to be used, liability in the event of contamination, and corrective actions) of chemicals and other sources of potential contamination from residential developments at the proposed site. In the event that such an assessment does not adequately address these potential groundwater contamination concerns, or in the event that the proposed activity would adversely impact the groundwater in a manner that cannot be adequately resolved, the Drinking Water Program would strongly recommend that the project area be maintained as a conservation watershed area.

The Draft Environmental Impact Statement should address these concerns. The potential for contamination of such a vital resource as Waiawa Shaft is too critical to be ignored. The concerns expressed by the Drinking Water Program on the possible contamination of the groundwater aquifer must be considered before this project proceeds.

Noise

The applicant must address concerns such as noise from adjacent commercial-industrial facilities and recreational activities, and develop plans to mitigate these problems. The applicant must state in the final EIS that the construction stage of the project will comply with the provisions of Title 11, Administrative Rules Chapter 43, Community Noise Control for Oahu.

Wastewater Disposal

The proposed project is not included in the Honouliuli WWTP 201 planning area. Therefore, the impact of the sewage flows from the proposed project on the capacity of the Honouliuli WWTP must be addressed.

Page IV-1, A.1. Topography

Department of Health, Administrative Rules Title 11, Chapter 26, Vector Control, Section 11-26-35, requires a developer to ascertain the presence or absence of rodents prior to any work and if rodents are present to eradicate them before clearing any lands.

Page IV-2, C.2. Fauna

Grading and grubbing activities will cause existing rodents to migrate so it is important to control them prior to any work.

JOHN C. LEWIN, M.D.

cc: Mr. F. J. Rodriguez ✓

JAN 28 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

February 6, 1987

Dr. John C. Lewin, Director
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Lewin:

We have received the comments from your department dated January 22, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 Project. The comments have been provided to the applicant and the technical consultants that will be assisting in the preparation of the appropriate sections in the Draft Environmental Impact Statement (DEIS).

1. Drinking Water

There has been extensive previous discussion on this subject in the Waiawa by Gentry DEIS. The data that has been covered will be provided again with additional volumes of potable water requirements indicated by the civil engineering firm.

2. Noise

The Noise consultant will be responding to these comments and this will be covered in the DEIS.

3. Wastewater Disposal

The capacity at the Honouliuli WWTP is under review by the Department of Public Works, City & County of Honolulu. It is understood that the current capacity is not available and that expansion will be required.

Page IV-1, A.1. Topography

This is a new subject of discussion and the required compliance with Department of Health, Administrative Rules Title 11, Chapter 26, Vector Control, Section 11-26-35, will be adhered to at the appropriate time, which will be at the time of building permit.

Page IV-2, C.2. Fauna

The control on onsite rodents will be accomplished with the appropriate DOH requirements in mind.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

FJR:ls

1148 FORT STREET MALL, SUITE 200 • P.O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8791

6104
STP 8.1808

January 23, 1987

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

Dear Mr. Clegg:

EIS Preparation Notice
Gentry 515
Waiawa, Oahu

The subject Preparation Notice was submitted to us by Environmental Communications Inc. with instructions that our comments be forwarded to your office.

From the information provided, we find the magnitude of the development will require that a Traffic Impact Analysis Report be prepared. Since traffic generation will be significant, particular attention should be directed toward the design of the access system and the possible need for improvements to the Waipio and Waiawa Interchanges to accommodate the projected increase in traffic movements. For further comments, please refer to our recent comments to you on the Waiawa Development EIS.

The developer should also be informed that we are seriously concerned about the effects of developments such as Gentry 515 on downstream sections of our highway system. Consequently, we will be considering methods to obtain developer's assistance to fund needed improvements.

We look forward to reviewing the draft EIS upon its completion and availability.

Very truly yours,

Edward Y. Hirata
Director of Transportation

DT:ko

cc: HWY, STP(dt)
F.J.Rodriguez,

JAN 29 1987

5854
STP 8.1810

January 22, 1987

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

Dear Mr. Clegg:

EIS - Waiawa by Gentry
Waiawa, Oahu

After reviewing the subject EIS, we have the following comments for your consideration:

1. We do not agree with the statement on page VII-10, "The total traffic demand into the Waiawa interchange would remain constant in year 2002 with or without the Waiawa project." It appears that this is based on the assumption that growth will come from Waiawa Ridge and traffic/growth from other areas will remain relatively constant.

2. Figure 2, Site Plan, shows an interchange located between the Waipio and Waiawa Interchanges. The Highways Division is opposed to any more new interchanges within this segment of H-2.

3. The double-lane loop ramp serving the Waiawa Ridge development to H-2 at the Waipio Interchange should be limited to only a single-lane loop ramp. A two-lane loop ramp would require widening H-2 from the Waipio Interchange through the Waiawa Interchange to maintain freeway lane balance.

4. Costs of improvements to mitigate the development's traffic impacts shall be borne by the developer. This shall include any necessary improvements at Waipio Interchange, on Kamehameha at Ka Uka Boulevard, on

JAN 29 1987

Kamehameha Highway at Waipahu Street and any other improvements required by traffic utilizing the Waihona Street access or any other access point.

5. The new proposed access connection to the existing T-Intersection at Waipahu Street and Kamehameha Highway must be re-evaluated. The existing intersection already has severe problems. Adding a 4th leg will only compound the problem. If the proposed Waikele and Waiola developments also become a reality, in addition to Waiawa by Gentry, the problems at this intersection will become even greater.

6. Other alternatives for access should be investigated.

7. Will the development create new jobs that would reduce residents' need to use our highway facilities to get to their jobs during the peak traffic period? Has this been considered in the traffic generation study?

8. The EIS mentions that an increase in the use of high-occupancy vehicles has the potential to reduce traffic demand. What kind of resources is the developer willing to commit toward achieving this change in commuter pattern?

9. The developer should be informed that we are seriously concerned about the effects of developments such as Waiawa on downstream sections of our highways system. Consequently, we will be considering methods to obtain developer's assistance to fund needed improvements.

We appreciate this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

DT:ko

cc: HWY, STP(dt)
P.J. Rodriguez

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

February 6, 1987

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

Dear Mr. Hirata:

We are in receipt of your department's comments dated January 23, 1987 on the Environmental Impact Statment Preparation Notice (EISPN) for the Gentry 515 project. The comments have been forwarded to the applicant and the retained consultants, Parsons, Brinckerhoff and Community Planning, Inc. for their use and assistance in responding to your agency comments.

The development of a Traffic Impact Analysis Report is being done by Parsons and the document will be included in its' entirety in the Draft EIS. The applicant will be reviewing the DOT concerns regarding the downstream impacts and the mitigation measures necessary to relieve these long term concerns.

We have received the comments on the Gentry/Waiawa project and have also forwarded them to all concerned on this project. Unfortunately, the deadline was missed to include them in the Final EIS. I am personally sorry that this happened since the comments were of great value. Fortunately, there is still ample time to review the total impact for the Waiawa and the 515 projects so the DOT is still able to comment.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

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John Waihee

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

DIRECTOR
TELEPHONE NO.
548-6915

F. J. RODRIGUEZ
PRESIDENT

ENVIRONMENTAL
COMMUNICATIONS
INC.

January 20, 1987

Mr. Fred J. Rodriguez
P.O. Box 536
Honolulu, Hawaii 96809

Subject: Environmental Impact Statement Preparation Notice: Gentry 515, Waiawa, Central Oahu, Hawaii

The Office of Environmental Quality Control believes that traffic, availability of water, and sewage disposal to be main impacts resulting from the proposed development. Concentrated discussion of these impacts would be greatly appreciated.

Sincerely,

John C. Lewin, M.D.
Director of Health

February 6, 1987

Dr. John C. Lewin
Director of Health
Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Lewin:

We have received the comments from the Office of Environmental Quality Control dated January 20, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 project. The subjects as noted in your comments are of major importance and will be covered in specific sections of the Draft Environmental Impact Statement.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

JAN 28 1987

1146 FORT STREET MALL, SUITE 200 • P. O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-2361

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

January 26, 1987

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: EIS PREPARATION NOTICE FOR GENTRY 515 PROJECT
TMK: 9-4-06: POR. 10, 9-6-04: POR. 1 AND 4

Thank you for the opportunity to review the environmental assessment for the proposed project.

We have the following comments on the assessment:

1. A water master plan incorporating both the water systems of the proposed Waiawa Development and Gentry 515 development should be submitted for our review and approval since both developments are proposed to share common water facilities.

2. The development will require the installation of a complete water system inclusive of source, transmission, and storage facilities.

3. The discussions of "Geographical Characteristics" and "Hydrological Characteristics" in sections, III and IV should be expanded in the Draft EIS.

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

Very truly yours,

For KAZU HAYASHIDA
Manager and Chief Engineer

cc: F. J. Rodrigues

JAN 24 1987 JAN 27 1987

F. J. RODRIGUEZ
PRESIDENT

ENVIRONMENTAL
COMMUNICATIONS
INC.

February 6, 1987

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

Dear Mr. Hayashida:

We have received the comments dated January 26, 1987 from your agency on the Gentry 515 Environmental Impact Statement Preparation Notice (EISPN). The comments have been provided to the applicant and the civil engineering consultant, Community Planning, Inc. Discussion of the three items listed in your comments will be addressed in the Draft Environmental Impact Statement (DEIS).

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1188 FORT STREET MALL, SUITE 209 • P. O. BOX 538 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-4781

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 1/87-112

January 22, 1987

Mr. Fred Rodriguez, President
Environmental Communications, Inc.
P.O. Box 536
Honolulu, Hawaii 96809

Dear Mr. Rodriguez:

This is in response to your request for comments on the Environmental Impact Statement Preparation Notice for the proposed Gentry 515 development in Waiawa.

In preparing the Draft Environmental Impact Statement the cumulative impact of the Gentry 515 proposal and the previously proposed Waiawa Ridge development should be discussed.

The following points should be addressed in the preparation of the Draft Environmental Impact Statement:

1. Vehicular Access and Traffic

   The applicant's "Traffic Impact Assessment" for Waiawa Ridge recommends various improvements and studies. The impacts of these improvements and studies should be assessed with input from the State Department of Transportation because of the projected reduced levels of service surrounding the proposed Gentry 515 and Waiawa Ridge developments.

2. Sewage Treatment and Disposal

   The availability of capacity at Honouliuli in context with other project demands should be reviewed by the City Department of Public Works as well as the alignment and adequacy of the proposed intercept.

3. Water System

   The proposed development should be reviewed by the Department of Land and Natural Resources and the Board of Water Supply with regard to its cumulative impact on the water resources when considered with the Development Plan's existing designations.

4. Drainage System

   The Gentry 515 and Waiawa Ridge developments will increase the quantity of surface runoff flowing into Waiawa Stream which has a history of flooding its banks. The drainage plan should be reviewed by the City Department of Public Works.

5. Public Schools

   The Department of Education should review the plans for the proposed development with regard to adequacy of school facilities.

6. Parks, Recreation and Open Space

   The plans for the proposed golf courses, botanical garden and neighborhood parks should be reviewed by the City Department of Parks and Recreation. The adequacy of park areas planned in the Waiawa Ridge development to serve the additional population of Gentry 515 should be discussed.

7. Other Public Facilities

   Agencies responsible for solid waste collection and disposal, electric, telephone, police, fire and health care services should be contacted to determine the ability to support Gentry 515 and Waiawa Ridge as well as other planned development in Central Oahu.

8. Social and Economic Characteristics

   A social impact study and a market analysis to justify the Commercial and Commercial/Industrial Mixed use areas should be prepared to support the proposed developments.

9. Environmental Characteristics

   A. Agriculture: The Department of Agriculture should be contacted for their input on loss of "prime" agricultural land.

   B. Environmental Quality: Air quality and noise level issues need to be discussed at greater length, including the total impact from surrounding areas.

10. Flora, Fauna, Archaeological and Historic Resources

    An intensive survey of the site will be required to protect any rare or endangered plants or animals and to preserve any archaeological or historic sites or remains.

Thank you for giving us an opportunity to comment on this matter.

Sincerely,

Donald Clegg

DONALD A. CLEGG
Chief Planning Officer

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

February 6, 1987

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:

We have received your department's comments dated January 22, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry 515 project. The comments have been provided to the applicant and all information requested will be provided in the Draft Environmental Impact Statement (DEIS) which is currently under preparation.

We will be in contact with your designated staff planner assigned to this project for further direction. Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1140 FORT STREET MALL, SUITE 200 • P. O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8361

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

January 19, 1987

MEMORANDUM

TO: Donald A. Clegg, Chief Planning Officer
Department of General Planning

FROM: Mike Moon

SUBJECT: Environmental Impact Statement Preparation Notice
Gentry 515
Waiawa, Central Oahu, Hawaii

We appreciate the opportunity to review and comment upon the Environmental Impact Statement Preparation Notice for the Gentry 515 project proposal.

The Department's primary concern relates to the provision of housing opportunities for a range of income groups. Therefore, we recommend that the Environmental Impact Statement (EIS) for the project contain, in as much detail as possible, a description of the types and price ranges of the housing units proposed for the project, and a discussion of the affordability of the units for households of various income groups, in particular, those of low and moderate income. The Department's current policy is to request that ten percent of the units in a development be targetted to households of low and moderate income or that the developer contribute in kind toward the development of such housing. However, this policy is presently under review and the developer will be notified of any changes.

We also recommend that the EIS address the feasibility and marketability of the proposed development, with special attention on the marketability of the "leisure village" units. In addition to the 3,900 units proposed for the Gentry 515 project, retirement communities of 1,400 units and 4,000 units are planned at the Mililani-Mauka and Waiawa developments, respectively. Being in proximity to one another, these communities will compete for prospective residents from essentially the same market areas. Moreover, the Hawaii market for these types of units is basically untested. The EIS should address whether or not there exists the potential for the market to absorb these 9,300 units.

Thank you for the opportunity to provide these comments.

for MIKE MOON

JAN 22 1987

cc: F. J. Rodriguez

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

February 6, 1987

Mr. Michael M.H. Moon
Director
Department of Housing and
Community Development
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Moon:

We have received the comments from your department dated January 19, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 Project. These comments have been provided to the applicant for his review and we respond as follows:

There will be specific sections on the marketing and feasibility of Leisure Village type residential units as described in this project and other projects in Waiawa and Mililani-Mauka. Further, the committment for 10% of the residential units for low and moderate income families is acknowledged and the applicant will be maintaining contact with your staff on the fulfillment of this requirement.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1148 FORT STREET MALL, SUITE 200 • P.O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8751

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

87/EC-9(BWM)

January 22, 1987

Mr. Fred J. Rodriguez
P. O. Box 536
Honolulu, Hawaii 96809

Dear Mr. Rodriguez:

Consultation Comments
Environmental Impact Statement
Preparation Notice (EISPN)
Gentry 515, Waiawa, Central Oahu
Tax Map Keys 9-4-06: Portion 10,
9-6-04: Portion 1 and 4

We have reviewed the EISPN and have the following comments and questions:

A. Response Time for Comments

A comment period of ten days is unreasonable. We suggest that you allow at least a 30-day comment period.

B. Relation to Other Development Plan Amendment Applications

How does this project relate to the Development Plan Amendment application for TMK 9-4-06: portion 10 and 9-6-04: portion 1, 86/CO-4, for 1,242 acres? This EISPN identifies only 515 acres (9-4-06: portion 10 and 9-6-04: portion 1 and 4). The EIS should include a full description and map showing the relationship between these proposals and areas.

The EIS should consider the cumulative impacts of the entire Waiawa development.

C. Traffic

1. Proposed Waiawa Interchange with H-2 Highway

Does the proposed interchange meet Federal standards for separation of interchanges along an interstate highway?

JAN 23 1987

2. Time Schedule for Highway Improvements

a. What is the time schedule for improvements of the Cemetery Road overpass for conversion to an interchange with the H-2 highway?

b. What is the time schedule for funding and construction of (1) the Cemetery Road overpass conversion to an interchange and (2) the construction of the proposed Waiawa Interchange?

3. Traffic Congestion

What will be the downstream effects on H-1 highway in terms of traffic volume, speed, density and level of service?

D. Water

How will this development affect groundwater recharge within the Pearl Harbor Ground Water Control Area (PHGWCA)? Will it be necessary to import water to the PHGWCA? Will this development affect the current export of water to Honolulu from the PHGWCA? The EIS should take into account the new report entitled "Land Use Effects on the Water Balance of a Tropical Island" by Thomas Giambelluca in National Geographic Research 2(2): 125-151 (1986).

E. Drainage

1. Surface Runoff

How will the surface runoff into Waiawa Stream be affected when greater amounts of areas with high percolation are covered with impermeable surfaces?

2. Effects on Pearl Harbor

How will the rate of sediment, nitrogen or phosphorous loading into Pearl Harbor be affected?

F. Historic and Archaeological Characteristics

An archaeological reconnaissance appears to be warranted by the literature search.

G. Noise

1. What will be the noise impacts created by H-2 traffic on the proposed low-density and medium-density apartments adjacent to the freeway?

2. What will be the noise impacts of the commercial-industrial area on the adjacent low-density apartment area?

H. Wastewater System

How will this development impact the capacity of the Waipahu WWPS and the Honouliuli WWTP? Are these facilities at or near capacity? What is the cumulative impact of this project, the Waiawa Development and other previously approved Central Oahu and Ewa development proposals on these facilities? What improvements will be necessary?

I. Funding Responsibility

What will be the developer's, the State's, and the City's responsibility for funding improvements to:

1. Water facilities,

2. Wastewater facilities, and

3. Traffic improvements, including the Cemetery Road interchange, the proposed Waiawa Interchange, and downstream improvements to the H-1 Highway?

J. Permanent Loss of Agricultural Land and Dependency on Imported Food

The essentially permanent loss of agricultural land should be discussed. While agricultural self-sufficiency may not be a goal, some discussion regarding the high dependence on imported food and the danger of a fragile transportation system should be discussed.

Thank you for the opportunity to comment. If you have any questions, please contact Bennett Mark of our staff at 527-5038.

Very truly yours,

for JOHN P. WHALEN
Director of Land Utilization

JPW:sl
06768

cc: OGP

F. J. RODRIGUEZ
PRESIDENT

ENVIRONMENTAL
COMMUNICATIONS
INC.

February 6, 1987

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Whalen:

We have received the comments from your department dated January 22, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry 515 Project. The comments have been provided to the applicant and the various consultants that will be preparing the responses to the specific comments received.

We will address to the extent practicable, those comments that are answerable at this preliminary stage.

1. Relation to other Development Plan Amendment Applications

As stated in the EISPN, this project is requested by the Department of General Planning as a Planning Only EIS to determine the impacts on the total project on a 10-10-10 year basis. The EISPN further states and identifies clearly that without the initial project, this 515 acre increment will not proceed. We would hope that the DLU can review this EIS on that basis.

We will respond to the balance of items B-J in the Draft Environmental Impact Statement (EIS) to the best of our ability and are confident that the comments made in this stage will meet your satisfaction.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P. O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8391

PRO 87-10

January 22, 1987

MEMORANDUM

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: ALFRED J. THIEDE
ACTING DIRECTOR AND CHIEF ENGINEER

SUBJECT: GENTRY 515

We have reviewed the Environmental Impact Statement Preparation Notice (EISPN) of the subject project and have the following comments to offer:

1. The drainage master plan should be submitted for our review.

2. The wastewater from the area should be directed to the Pearl City Sewage Pump Station.

3. The area will not be allowed to connect to the municipal system until the Honouliuli Wastewater Treatment Plant is expanded.

4. A sewer master plan which includes the Waipio by Gentry development should also be submitted for our review.

ALFRED J. THIEDE
Acting Director and Chief Engineer

cc: F. J. Rodriguez

JAN 23 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

February 6, 1987

Mr. Alfred J. Thiede
Acting Director and Chief Engineer
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

The comments received from your department dated Janury 22, 1987 on the Gentry 515 Project have been provided to the applicant and the civil engineering consultant, Community Planning, Inc. and we respond as follows:

1. The Drainage Master Plan will be provided to your department for review and comment upon completion.

2. Wastewater generated from this project will be directed to the Pearl City Sewage Pump Station.

3. All requirements to connect to the City's municipal system will be based on the ability of the Honouliuli Wastewater Treatment Plant to accommodate generated flows.

4. A Sewer Master Plan will be designed and submitted to your department for review and approval upon completion of the Plan.

These comments will be reflected in the Draft EIS currently under preparation. Thank you for your comments and continuing concern.

Very truly yours

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P. O. BOX 538 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8791

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

January 20, 1987

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: FRANK K. KAHOOHANOHANO, FIRE CHIEF

SUBJECT: GENTRY 515, WAIAWA, CENTRAL OAHU

We have reviewed the subject material provided and wish to reiterate our position, as expressed in various responses to requests for comments regarding Waiawa, that due to limited access to the area by fire apparatus from Pearl City, Waipahu and Waikele Fire Stations (the Gentry-Waipio Station is to be relocated), the Honolulu Fire Department will request the developer to assist the City and County by providing a fire station site of at least 25,000 square feet within the proposed development.

Although within a four mile radius of other fire stations, the topography and anticipated excessive response times (over 5 minutes) to Waiawa necessitate a fire station housing an engine company, a ladder company and a battalion chief headquarters.

We appreciate the opportunity to comment on this matter. Should you have any questions, please contact Battalion Chief Kenneth Word of our Administrative Services Bureau at 943-3838.

FRANK K. KAHOOHANOHANO
Fire Chief

FKK:KAW:lm
cc: F. J. Rodgriguez,
Environmental Communications Inc.

JAN 22 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

February 6, 1987

Chief Frank K. Kahoohanohano
Fire Department
City and County of Honolulu
1455 S. Beretania Street, Room 305
Honolulu, Hawaii 96814

Dear Chief Kahoohanohano:

We have received your department's comments dated January 20, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry 515 project. These comments have been provided to the applicant and we respond in the following:

The fire station site within the project development to meet the fire protection requirements of your department are under review for the Waiawa site; the applicant assures you that there will be discussions held with your staff to meet this requirement as the project reaches Zoning review.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P.O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8351

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU

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

FRANK F. FASI
MAYOR

DOUGLAS G. GIBB
CHIEF

WARREN FERREIRA
DEPUTY CHIEF

OUR REFERENCE SS-LK

January 20, 1987

TO: DONALD CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: ENVIRONMENTAL IMPACT PREPARATION NOTICE FOR GENTRY 515, WAIAWA, CENTRAL OAHU, HAWAII

We have reviewed the Environmental Impact Preparation Notice (EISPN) for the above referenced project and find our comments to be in line with our recent letter to you on the proposed Waiawa Development.

We restate our concerns as follows:

1. The proposed development would increase calls for police services and require additional manpower and equipment. Our ability to meet those needs would require substantial additional funding.

2. Traffic safety is also a major concern, as increased development places a higher demand on our already congested freeways. We recommend that serious consideration be given to the impact on traffic with other projects that are proposed in the Central Oahu area.

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

Douglas G. Gibb

DOUGLAS G. GIBB
Chief of Police

cc: F. J. Rodriguez

JAN 22 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

February 6, 1987

Chief Douglas G. Gibb
Police Department
City and County of Honolulu
1455 South Beretania Street
Honolulu, Hawaii 96814

Dear Chief Gibb:

We are in receipt of your department's comments dated January 20, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 project. The comments have been provided to the applicant and the traffic consultant for their review and the cumulative impacts of the traffic to be generated by this project and others under planning will be analyzed in conjunction with the State DOT. Their input as to the long range plannng measures necessary to mitigate these traffic concerns will be a major consideration on the rate of approvals that these projects will be granted.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1136 FORT STREET MALL, SUITE 205 • P. O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8781

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

FRANK F. FASI
MAYOR

DONALD A. CLEGG
DIRECTOR

January 23, 1987

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: HIRAM K. KAMAKA, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT PREPARATION NOTICE (EISPN)
GENTRY 515 - WAIAWA
TAX MAP KEY 9-4-06: POR. 10 AND 9-6-04: POR. 1 AND 4

We have determined that the Environmental Impact Preparation Notice for the Gentry 515 project is unacceptable. The EISPN report has not adequately addressed the project's recreational needs for both the planned residential and retirement community. Public or private parks have not been designated in the Gentry 515 land use map, Fig. 1, to serve a project of this magnitude.

We are presently attempting to assess the recreational needs for the Waiawa Development, Inc. I, of which Gentry 515 is a part of. However, the single-family residential areas A & B of the Gentry 515 project are located outside of the Inc. I boundary area so we will need to revise our assessment of the project. It will be necessary to discuss the applicant's conceptual and phasing plan of the total Waiawa Development in more detail.

We recommend that the applicant contact Mr. Jason Yuen of our Advance Planning Section at 527-6315 to discuss the project's recreational needs and requirements.

Hiram K. Kamaka

HIRAM K. KAMAKA, Director

HKK:ej

cc: F. J. Rodriguez, Environmental Communications, Inc.
Gentry Companies

JAN 29 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

February 6, 1987

Mr. Hiram K. Kamaka, Director
Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Kamaka:

We are in receipt of your department's comments dated January 23, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 project. The comments have been forwarded to the applicant for his review and he will be in contact with your Advance Planning Section for the conceptual and phasing planning. Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P.O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8701

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

REPLY TO ATTENTION OF:

January 23, 1987

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

Dear Mr. Clegg:

Thank you for the opportunity to review the EIS Preparation Notice for Gentry 515, Waiawa, Oahu. The following comments are offered:

a. Any construction in or placement of fill within Waiawa Stream will require a Department of the Army permit. Suggest the applicant coordinate with Operations Branch (telephone: 438-9528) as plans are developed.

b. According to the Flood Insurance Study for the City and County of Honolulu prepared by the Federal Insurance Administration, the parcel (TMK: 9-4-6:10) is not subject to flooding from the 100-year flood and is designated Zone X (previously known as Zone C), or area of minimal flooding. The parcel (TMK: 9-6-4:1 & 4) is designated Zone A, area of 100-year flooding for which base flood elevations and flood hazard factors have not been determined.

Sincerely,

ORIGINAL SIGNED

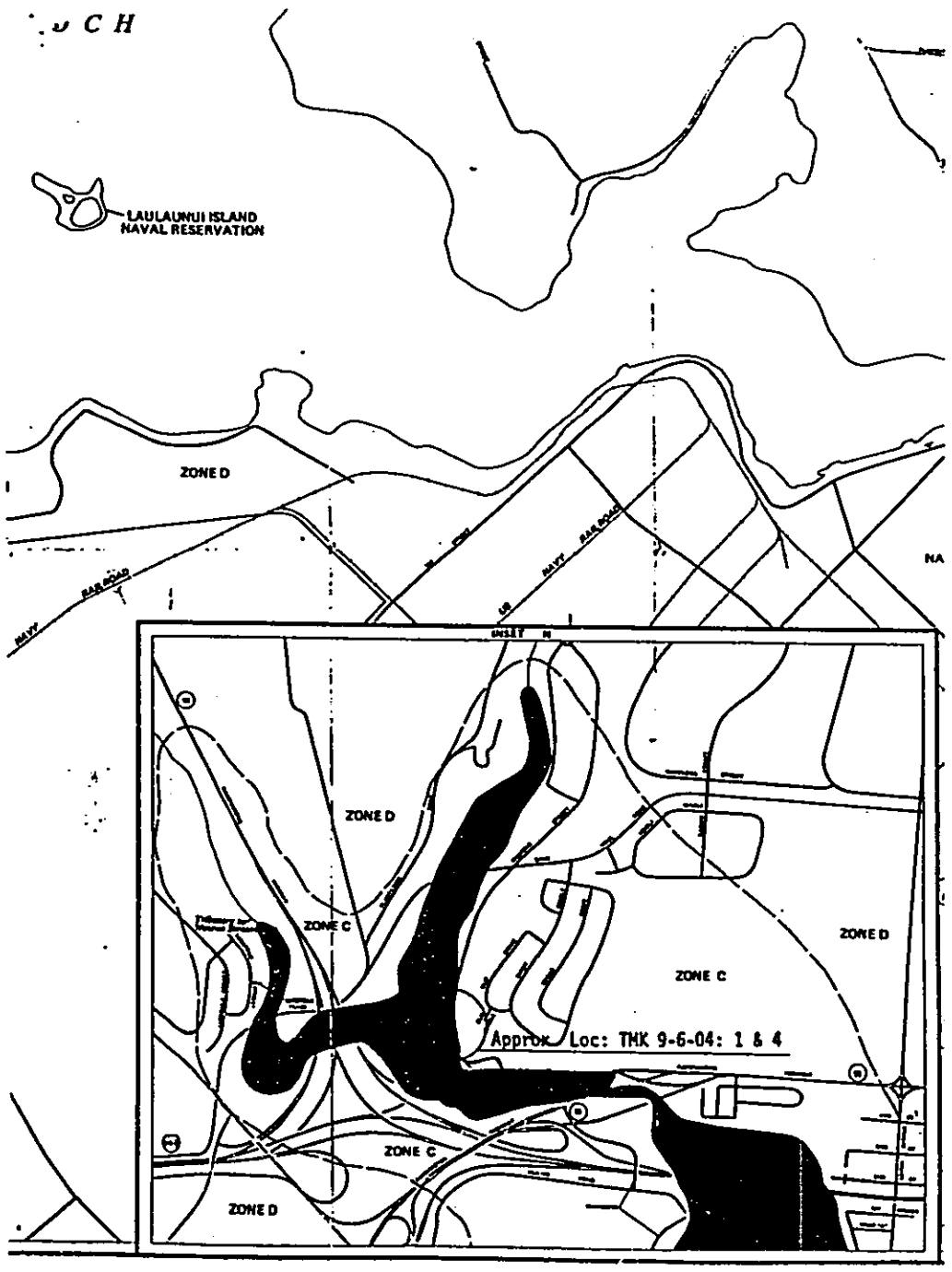
Kisuk Cheung
Chief, Engineering Division

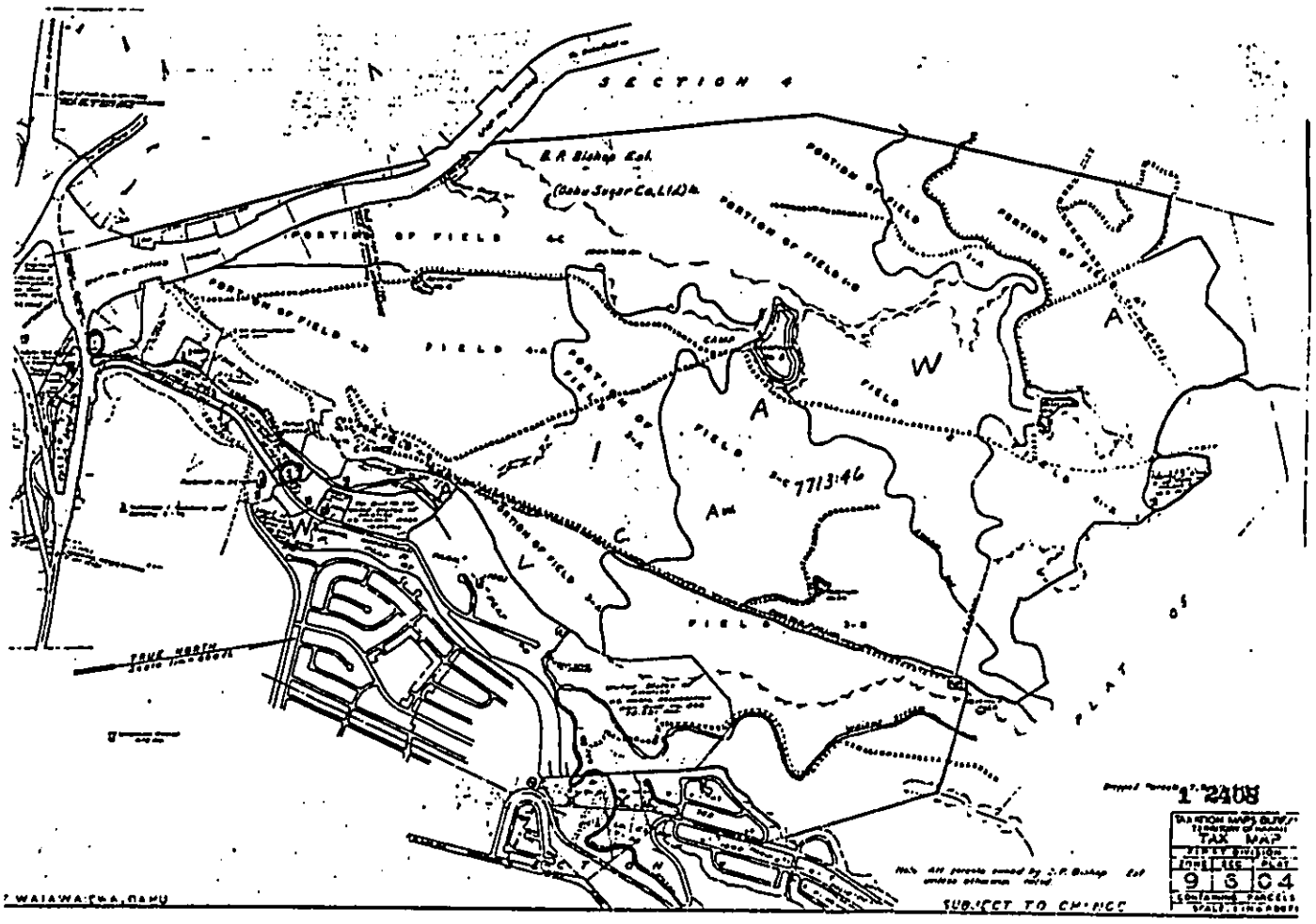
Enclosures

Copy Furnished:

F. J. Rodriguez
P. O. Box 536
Honolulu, Hawaii 96809

JAN 29 1987

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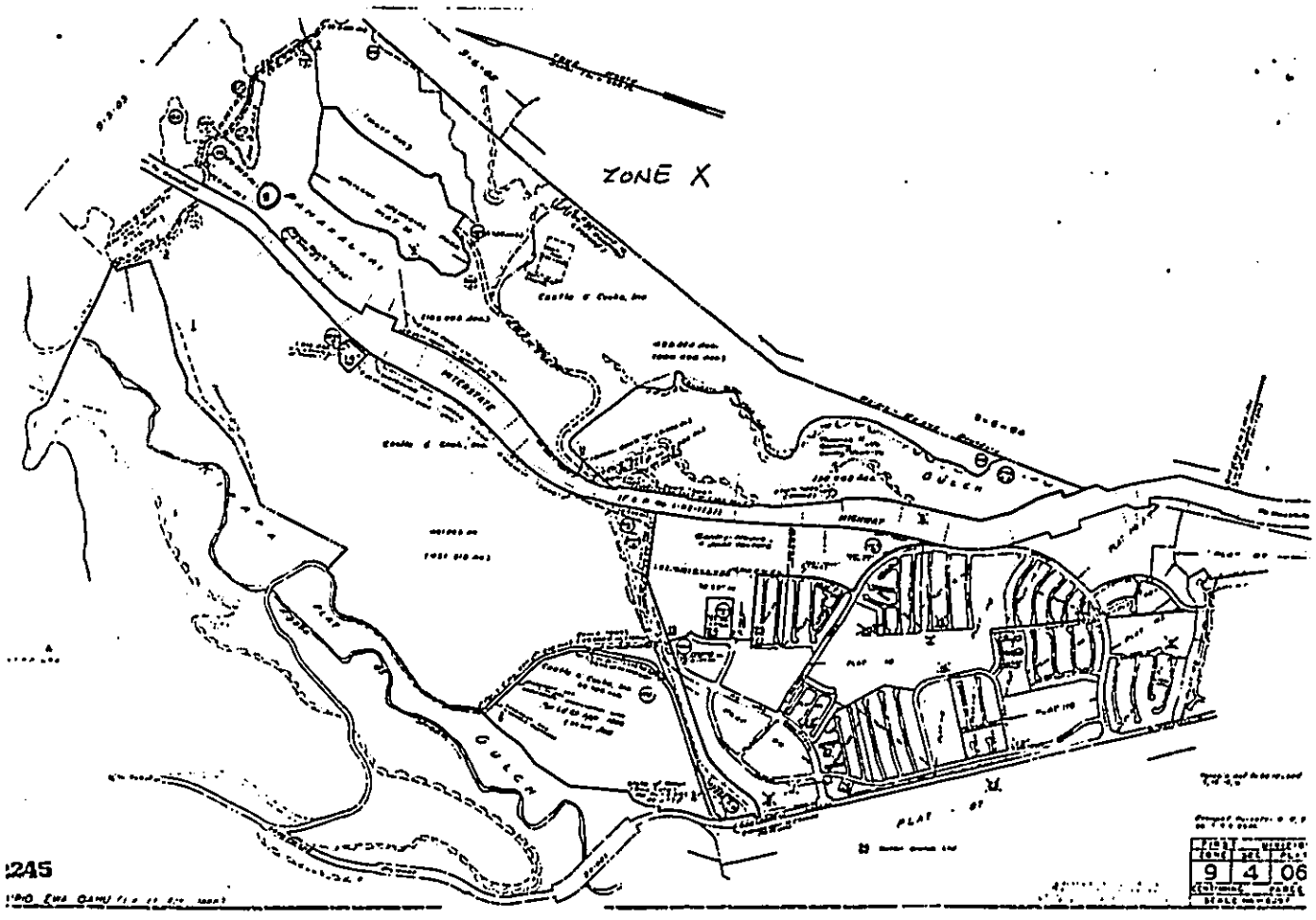
B.P. Bishop Est.
(Oahu Sugar Co., Ltd.)
PORTION OF FIELD 44
FIELD 44
FIELD 45
FIELD 46
FIELD 47
FIELD 48
FIELD 49
CAMP
TRUE NORTH
1" 2400'
TAX MAP
ZONE
SECTION
PLAT
9
3
04
WAIAWA, EWA, OAHU
SUBJECT TO CHANGE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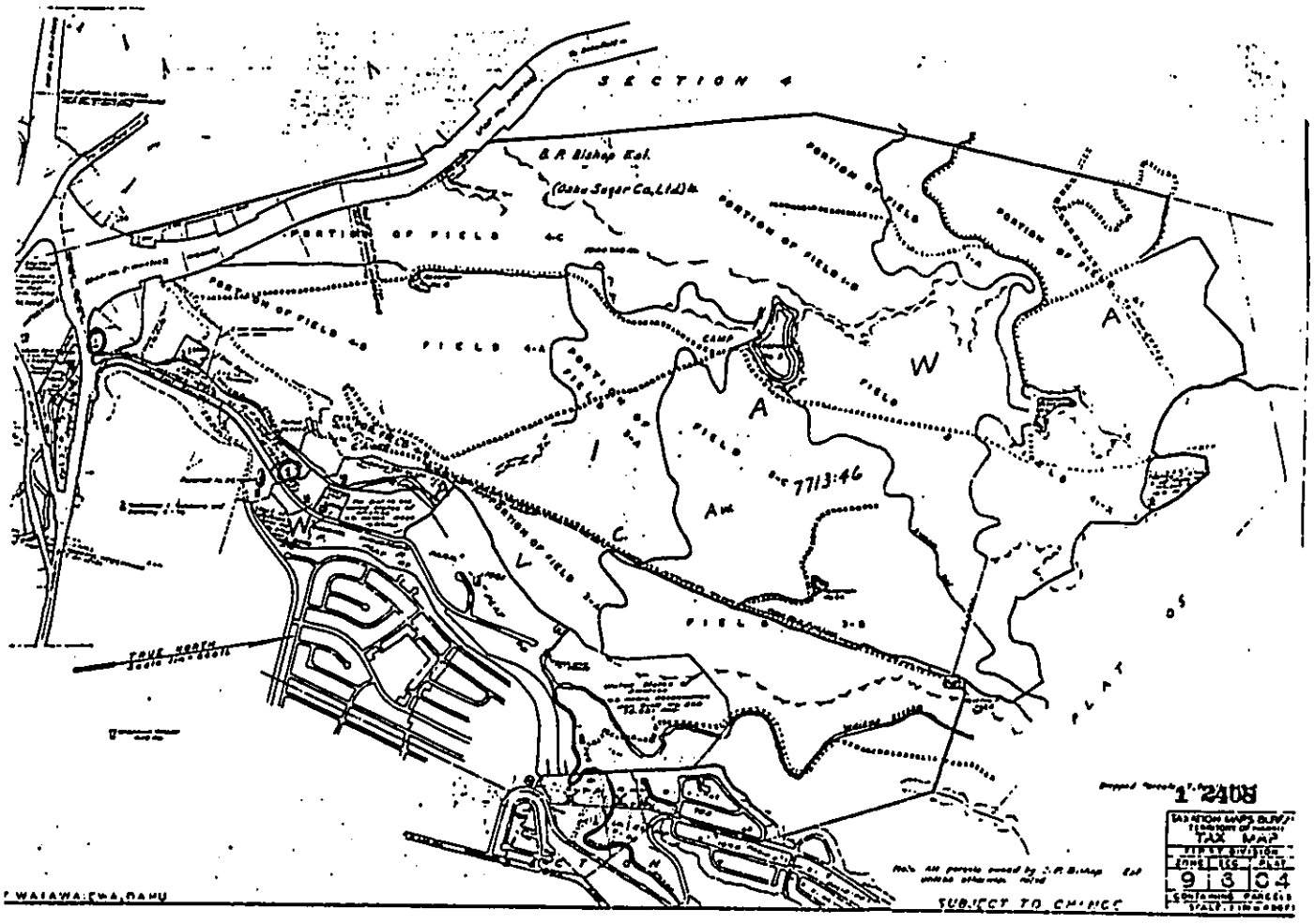
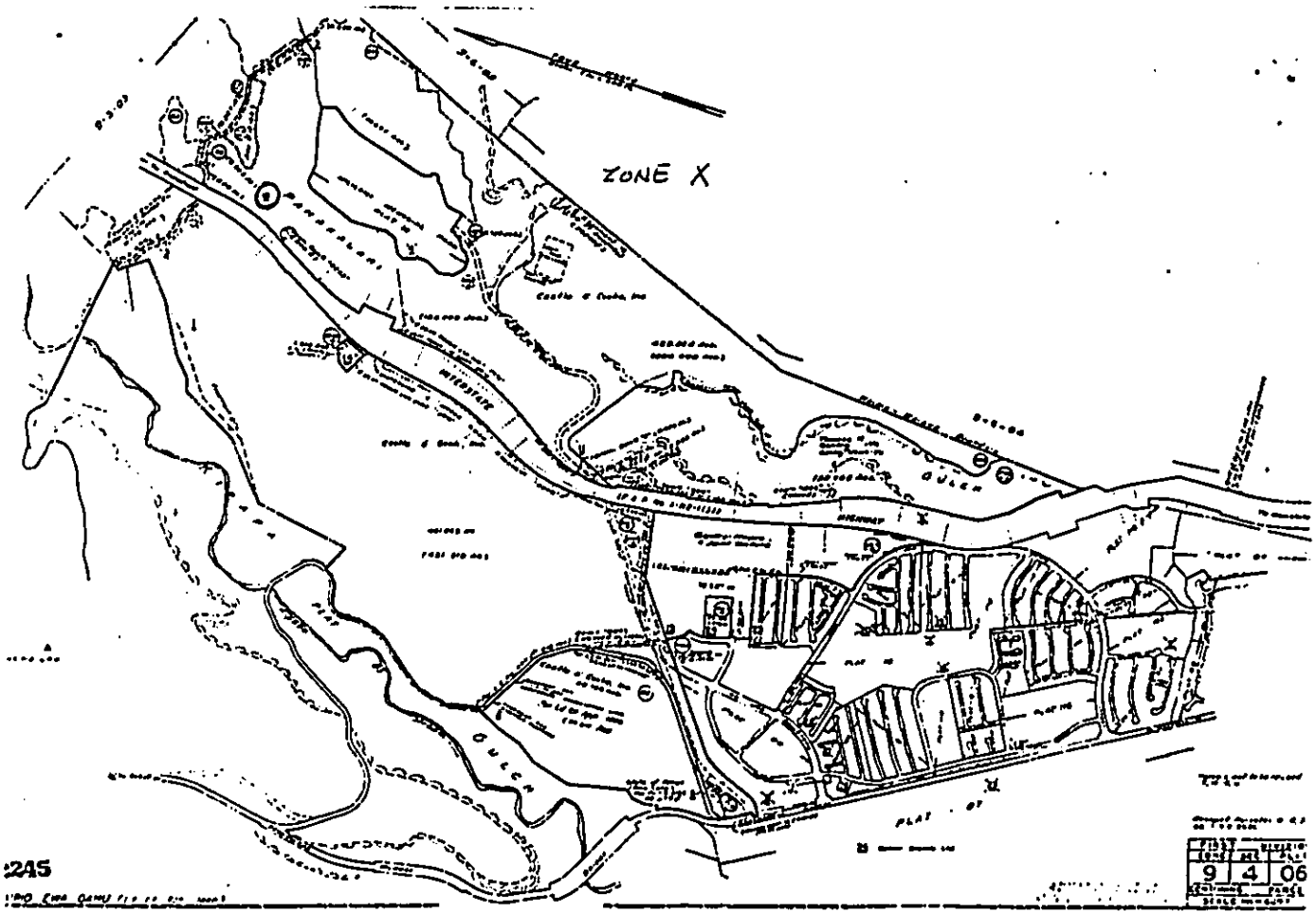
INTERSTATE
GULCH
PLAT
9
4
06


SECTION 4
B. P. Bishop Est.
(Oahu Sugar Co. Ltd.)
PORTION OF FIELD 4C
FIELD 4A
FIELD 3-B
FIELD 7713:46
TAX MAP
ZONE 9 SEC 1 PLAT 04
SUBJECT TO CHANGE


ZONE X
GULCH
ZONE 9 SEC 4 PLAT 06

ENVIRONMENTAL
COMMUNICATIONS
INC.

F J RODRIGUEZ
PRESIDENT

February 6, 1987

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

Dear Mr. Cheung:

We are in receipt of your department's comments dated January 23, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry 515 project. The comments have been forwarded to the applicant and the data will be included in the Draft Environmental Impact Statement (DEIS). In the event that there is a Waiawa Stream construction that would require a DOA permit, we will meet with the Operations Branch staff.

Thank you for your comments and continuing concern

Very truly yours,

F. J. Rodrigues

FJR:ls

1146 FORT STREET MALL, SUITE 208 • P O BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8351

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

ES
Room 6307

JAN 21 1987

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

Re: Environmental Impact Statement Preparation Notice (EISPN), Gentry 515, Waiawa, Oahu

Dear Mr. Clegg:

We have reviewed the EISPN and offer the following comments for your consideration.

According to the EISPN, the Draft and Final EIS will include a storm drainage plan for the project area. We recommend the storm water drainage design use the areas designated as open space and flood plain (Areas E, K, and L of Figure 1 of the EISPN) to capture and store storm water runoff. In addition, the Draft EIS should discuss potential adverse impacts of increased storm water runoff on aquatic fauna in Waiawa Stream and Pearl Harbor.

We appreciate the opportunity to comment.

Sincerely,

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: F.J. Rodriguez

CONSERVE AMERICA'S ENERGY

JAN 22 1987

Save Energy and You Serve America!

ENVIRONMENTAL COMMUNICATIONS INC.

F. J. RODRIGUEZ, PRESIDENT

February 6, 1987

Mr. Ernest Kosaka
Project Leader
Office of Environmental Services
U. S. Department of the Interior
Fish and Wildlife Service
P.O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

We have received the comments from your department dated January 21, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 Project. The applicant has reviewed the comments and will be providing us with the necessary information to respond to your specific comments and concerns. The design of the various holding ponds and detention basins on the golf courses will be to retain on the project site, the drainage runoff from the project site. There will not be an increase to the Waiawa Stream volume that exceeds today's flow rates.

Thank you for your comments.

Very truly yours,

F. J. Rodriguez

FJR:ls

1148 FORT STREET MALL, SUITE 200 • P O BOX 536 • HONOLULU HAWAII 96809 • TELEPHONE (808) 521 6151

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

IN REPLY REFER TO
11010
Ser 002(09P2)/148

23 JAN 1987

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

Dear Mr. Clegg:

ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN)
FOR GENTRY 515 - WAIAWA, CENTRAL OAHU, HAWAII

The subject EISPN has been provided by Environmental Communications, Inc. by transmittal of January 12, 1987 for review and comment. The U. S. Navy provides the following comments for your consideration:

a. The project location map (Figure 1) does not show relation of this project to the many other present and proposed developments in this area. In order to study the cumulative impact of this project, maps in the EIS must show the project relationship to the entire Central Oahu area.

b. On page IV-3 there is the statement, "Water demands for the proposed project are currently unavailable. However, availability of system linkage with the proposed Waiawa Development is expected." The EIS must be very specific as to water requirements and supply because of the heavy demands being made by so many developments in the Pearl Harbor basin. In the letter to you of January 7, 1987 on the EIS for Waiawa Development (December 1986) the following was provided and is included again for your reference:

> As pointed out in the Navy letter of June 20, 1986, the agricultural fields above our water tunnel comprise the major recharge area. Development (paved roads, house) will surely reduce the amount of water infiltrating into the ground. Development will also probably affect the quality of the water (chemically and bacteriologically). In the earlier letter, Navy asked that these three questions be addressed in the EIS: First, will there be a reduction in ground water levels because of reduction in recharge due to the residential building? Second, will the water supply become contaminated by trace contaminants due to the application of pesticides and fertilizers by individual residents? Third, the Navy has a concern that siltation means poorer water quality and more frequent dredging requirements. Will this development cause a more rapid siltation of Middle Loch?

c. The U. S. Navy is concerned that all development construction be monitored to present surface runoff into streams that enter into Pearl Harbor. Siltation from such streams, including Waiawa Stream, has been a problem in past years.

JAN 29 1987

The U. S. Navy looks forward to receiving a copy of the draft subject EIS for review. Mr. Bill Liu of this command is the U. S. Navy point of contact and can be reached at 471-3703.

Sincerely,

T. C. CRANE
Captain, CEC, U.S. Navy
Facilities Engineer
By direction of the Commander

Copy to:
F. J. Rodriguez
Environmental Communications, Inc.
P. O. Box 536
Honolulu, HI 96809

ENVIRONMENTAL
COMMUNICATIONS
INC.

F J RODRIGUEZ
PRESIDENT

February 6, 1987

Captain T.C. Crane
Department of the Navy
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96856-5020

Dear Captain Crane:

We are in receipt of your office's comments dated January 23, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 project. The comments have been forwarded to the applicant and the civil engineering firm who will be responsible for the project grading and excavation. Further, Gordon L. Dugan, Ph.D. will be assessing the surface runoff and drainage concerns contained in your comments.

Please be assured that we will be responding to your agency's comments to the best of our ability and to the extent that data is available. Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

FJR:ls

1148 FORT STREET MALL, SUITE 200 • P O BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8701

HAWAIIAN ELECTRIC COMPANY, INC. • PO BOX 2750 • HONOLULU, HI 96840-0001

ENV 2-1
JA/G

HEI

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

January 27, 1987

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

Dear Mr. Clegg:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for Gentry 515, Waiawa Central, Oahu, Hawaii

We have reviewed the above subject (EISPN). Since the project is in close proximity to HECO's existing overhead facilities, we recommend that the following notes be included as part of the final construction plans:

1. The Contractor is to exercise extreme caution when the excavation and construction crosses or is in close proximity of HECO lines and is to maintain 13'- 0" clearance for his equipment while close to and/or under the overhead facilities.

2. When trench 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.

3. If field conditions and/or construction procedures require that poles be braced to facilitate construction, the Contractor shall contact the Waiau District Superintendent at 455-2933 or 455-7022, a minimum of 72 hours in advance.

4. Should it become necessary, any work required to relocate HECO facilities shall be done by HECO and the Contractor shall be responsible for such coordination.

JAN 29 1987

5. The Contractor shall be liable for any damage to HECO's facilities.

6. The Contractor shall report any damage to HECO's facilities to the HECO trouble dispatch at 548-7961.

7. On January 6, 1987, we forwarded comments and HECO drawings on an EIS for Waiawa by Gentry. We believe that the subject document is an EISPN for an increment (Gentry 515) of the larger development. Accordingly, our submittal of January 6, 1987 is pertinent to this project as well. As a result, Paragraph IV.I.3 given on Page IV-3 of this subject EISPN should be revised to include our comments in that submittal.

Sincerely,

Brenner Munger

cc: F. J. Rodriguez

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

February 6, 1987

Dr. Brenner Munger, Manager
Environmental Department
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Munger:

We are in receipt of your Company's comments dated January 27, 1987 on the Environmental Impact Statement Preparation Notice (EISPN) prepared for the Gentry 515 project. The comments have been forwarded to the applicant and the civil engineering firm responsible for the onsite design work. They will in turn coordinate the HEI activities with their electrical sub-contractor at the appropriate time.

We will retain and use the maps provided in your office's review of the Waiawa-Gentry Draft Environmental Impact Statement (DEIS). Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 FORT STREET MALL, SUITE 200 • P O BOX 536 • HONOLULU HAWAII 96809 • TELEPHONE (808) 521-6361

XII. ORGANIZATIONS AND AGENCIES CONSULTED DURING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT COMMENT PERIOD

ORGANIZATIONS/AGENCIES		Date of Comment	Date Comment Received	Date of Response
State				
OEQC		3/02/87	3/10/87	3/23/87
Department of Agriculture		3/05/87	3/06/87	3/23/87
Department of Accounting & General Services		2/13/87	2/17/87	NRN
Department of Defense		3/06/87	3/09/87	3/23/87
Department of Education		2/13/87	2/25/87	NRN
Department of Health	*	3/06/87	3/13/87	3/23/87
Department of Land & Natural Resources	*	3/12/87	3/13/87	3/23/87
Department of Planning and Economic Development	*	3/09/87	3/12/87	3/23/87
Department of Social Services & Housing		2/27/87	3/06/87	3/23/87
Department of Transportation		3/02/87	3/12/87	3/23/87
State Energy Office		2/09/87	2/12/87	NRN
University of Hawaii				
Environmental Center		3/10/87	3/11/87	3/23/87
Water Resources Research Center		3/02/87	3/06/87	3/23/87
City & County				
Board of Water Supply		3/05/87	3/06/87	3/23/87
Building Department		2/17/87	2/19/87	NRN
Department of Housing and Community Development	*	3/11/87	3/13/87	3/23/87
Department of General Planning		2/23/87	2/24/87	3/23/87
Department of Land Utilization		3/06/87	3/09/87	3/23/87
Department of Parks and Recreation		2/24/87	2/27/87	3/23/87
Department of Public Works		2/20/87	2/24/87	3/23/87
Department of Transportation Services		---	---	---
Fire Department	*	3/11/87	3/16/87	NRN
Police Department		2/19/87	2/20/87	3/23/87

Organizations and Agencies Consulted

ORGANIZATIONS/AGENCIES	Date of Comment	Date Comment Received	Date of Response
Federal			
Army-DAFE (Facilities Eng. USASCH)	---	---	---
Navy	2/26/87	2/27/87	NRN
Soil Conservation Service *	3/06/87	3/13/87	3/23/87
U.S. Army Corps of Engineers	2/12/87	2/18/87	NRN
U.S. Coast Guard	---	---	---
U.S. Fish & Wildlife Service	2/19/87	2/20/87	NRN
U.S. Geological Survey	---	---	---
Private Organizations			
American Lung Association	---	---	---
Hawaiian Electric Co., Inc.	3/09/87	3/11/87	3/23/87
Office of Hawaiian Affairs	---	---	---
Waipahu Neighborhood Board No. 22	---	---	---

* COMMENT RECEIVED AFTER DEADLINE DATE

John Waihee

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

DIRECTOR
TELEPHONE NO.
548-6915

March 2, 1987

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

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement for Gentry 515, Waiawa, Oahu

We have reviewed your draft EIS and offer the following comments:

1. Gentry 515 will have 4,990 housing units and associated with it will be a great traffic impact. The EIS proposes mitigating measures in the form of traffic improvements which are beyond the developer's control. We believe that it is inappropriate to rely on the Department of Transportation to accommodate every development project and question whether the migitating measures proposed in the EIS will ever take place.

2. The EIS states that construction of onsite water source storage reservoirs, transmission and distribution mains are planned; however, there is no discussion of where the water will come from. The project is in the Pearl Harbor Ground Water Control Area where the withdrawal of water is restricted. The EIS should discuss the project's source of water.

Thank you for allowing us the opportunity to comment on the EIS.

Sincerely,

JOHN C.LEWIN, M.D.
Director of Health

cc: F. J. Rodriguez

MAR 10 1987

ENVIRONMENTAL COMMUNICATIONS INC.

F. J. RODRIGUEZ, PRESIDENT

March 23. 1987

Dr. John C. Lewin
Director of Health
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Lewin:

We are in receipt of your office's comments dated March 2, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the proposed Gentry 515 project. They have been provided to the applicant and we respond as follows:

1. Traffic as a broad and general subject, is not getting better anywhere on the island of Oahu. Mitigation measures to relieve congestion have come from all areas of government as well as the private sector. Reliance on the State Department of Transportation (DOT) is the only avenue available to the private and public sectors since it is their function to coordinate and administer the State transportation network. Whether it is appropriate or not to rely on the State DOT to accommodate "every development project," there is really very little choice. As to whether or not the mitigation measures proposed in the EIS will ever be built is subject to the future and how much money the State DOT will have.

2. As you know, the source development for potable water required for this project as well as the adjacent Waiawa by Gentry project, will draw its water from the Pearl Harbor Ground Water Control Area (PHGWCA). This PHGWCA is administered by the Department of Land and Naturel Resources who must grant permission to drill wells and withdraw water from the PHGWCA. In turn, the Health Department must review the plans for the withdrawal and also grant permission as coordinated with the Board of Water Supply. This is an established routine procedure and will be initiated during the appropriate time prior to Zoning review.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 Fort St. Mall . Suite 200 . P O BOX 538 . HONOLULU HAWAII 96809 . TELEPHONE (808) 521 8391

JOHN WAIHEE
GOVERNOR

SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

TADASHI TOJO
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

March 5, 1987

MEMORANDUM

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

Subject: Draft Environmental Impact Statement (DEIS) for
Gentry 515 Project
The Gentry Companies
TMK: 9-4-06: por. 10
9-6-04: por. 1 and 4 Waiawa, Oahu
Area: 515 acres

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

Appendix I of the DEIS contains the soils information referred to in our letter of January 19, 1987, to Mr. Fred Rodriguez concerning the EIS Preparation Notice (EISPN) (DEIS, Section XI).

The DEIS does not specifically address the following concerns found in our comments on the EISPN:

- How does the proposed project conform to the State Agriculture Functional Plan and its objectives and policies, particularly, Implementing Action B(5)(c)?

- How does the proposed project relate to Hawaii State Plan priority guidelines 226-104(b)(2) and 226-106(1), which direct development into marginal or non-essential agricultural lands to meet housing needs and "...(maintain) agricultural lands of importance in the agricultural district"?

- Will groundwater recharge of the Pearl Harbor Groundwater Control Area be reduced due to urbanization of the project site, and will this have an impact on agricultural viability in the area?

The DEIS (page X-3) and Appendix I point out that the project site has the "...agronomic potential to be productive agricultural lands". However, existence of an excess of lands suitable for crop production, relatively high water costs, limited size of the local market and the difficulties in developing crops for export indicate that the urbanization of the subject property "...will not have a significant impact on the agricultural sector of Honolulu County or the State".

We understand from Appendix I (page 7) and our own information that the Waiahole Ditch runs in an east-west direction and adjacent to the northernmost subject parcel and approximately one mile from the remaining parcels. According to our information, areas utilizing water from the Ditch for irrigation purposes include approximately 691 acres of Oahu Sugar Company sugarcane fields north of Village Park in Kunia which is proposed for development, and 269 acres of Dole Wahiawa Plantation pineapple fields, proposed for the Waiola Estates housing project. These developments could conceivably free some quantity of relatively low-cost water for agricultural use in the Waiawa area.

It is difficult at best to predict the future of agriculture in the Central Oahu area, much less the State. The economic returns to private landowners from alternative non-agricultural uses of the land under current economic conditions would almost invariably be superior to the returns from agriculture. The economic decisions of individual landowners, to put agricultural land to "higher and better" use may, however, have significant cumulative adverse effects upon the State's total agricultural production, especially if adverse economic events make the importing of food an increasing expense. In considering the need to retain agricultural lands in their agricultural designation, the State must consider such economic and other conditions and events beyond the scope and time frame of private landowners' plans. The broader interests of society must be considered.

There is need to maintain an adequate land area for agricultural activities which are presently considered non-viable or marginal, but which may in the future be the equivalent of macadamia nuts today. Examples include the pending cultivation of cacao on former Puna Sugar Company lands,

and coffee on Molokai. The State will be unable to provide for these new export-oriented agricultural commodities unless we protect the irreplaceable land resource today from land use decisions that heavily discount or do not consider such future possibilities. The DEIS has not addressed this broader issue in depth.

Thank you for the opportunity to comment.

Suzanne D Peterson

SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: Environmental Communications, Inc.✓
LUC
DPED
DLU
OEQC

ENVIRONMENTAL
COMMUNICATIONS
INC.

F J RODRIGUEZ
PRESIDENT

March 23, 1987

Ms. Suzanne D. Peterson
Department of Agriculture
1428 So. King Street
Honolulu, Hawaii 96814-2512

Dear Ms. Peterson:

We are in receipt of your department's comments dated March 5, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments have been reviewed by the applicant and the technical consultant and we respond as follows:

1. It is acknowledged that the proposed Gentry 515 project is in conflict with Agricultural Functional Plan Implementing Action B(5)(c). As Section VI of the subject DEIS states, the project is located on important agricultural land which was fallowed by the previous landowner.

   We understand the Department of Agriculture's role in protecting the State's agricultural land inventory and we agree that it is difficult to predict the future of agriculture in Central Oahu and the State. We also concur that non-agricultural uses of the land would probably provide superior economic returns to agricultural uses. However, as stated in your comments, the broader interest of society must be considered. The potential for the increased need of agricultural lands does exist but it is speculative and not predictable while the demand for housing is immediate and tangible.

2. Hawaii State Plan priority guidelines 226-104(b)(2) and 226-106(1), which direct development into marginal or non-essential agricultural lands to meet housing needs, are not in consonance with the intended use of the subject parcels. Although the use of marginal or poor agricultural lands would be desirable, it should be understood that the project site is important and valuable for both agricultural and urban uses.

3. Groundwater recharge will be reduced at the point of land use change; this is inevitable since irrigation of crops which contributes to percolation into the aquifer will be eliminated and urban uses will be much lower in terms of irrigation of residential usage. Onsite runoff ponds will collect surface runoff to mitigate impacts into the Pearl Harbor estuary and at these pond locations, there will be percolation taking place.

   Agricultural viability in the area is not expected to be significantly impacted since the source or irrigation water comes from a variety of

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sources at the present time. There will be limited and undefined impact on the PHGWCA aquifer in terms of water withdrawal for irrigation purposes.

4. Water from the Waiahole ditch has been used to irrigate 691 acres in the proposed Village Park and 269 acres in the proposed Waiola Estates developments. If and when these development proceed, this water will become available for reallocation to other uses. However, this does not imply that there will be "excess water" available. The disposition of water from the Waiahole ditch is under control of the current owners of the lease, Waiahole Ditch Co., a subsidiary of Oahu Sugar Co., with the exception that any sublease has to be approved by DLNR. While it is impossible to say what they will decide, it seems obvious that the most likely use would be to substitute it for some of the higher cost water currently used by Oahu Sugar Co.

5. Your comments on the future of agriculture in Central Oahu in essence, argue that there is a need for a long term plan for the agricultural resources of the State. This clearly is not a role that should be assigned to a developer. Such activities are traditionally, and I believe properly, the responsibility of government. The statements in the DEIS are based on the projected requirements for agricultural land found in the LESA report published by the State Department of Agriculture, and as such, incorporate the available information on projected demands for agricultural land.

The adverse economic conditions referred to that would make the importation of food more expensive would have tremendous impacts on the entire economy of the State. In particular, they would depress the tourist industry and the entire economy of the State. They also would make the export of goods more expensive. Thus, the very phenomena that is being used as a rationale to preserve agricultural lands would, if it occurred, probably free up more land, particularly the lands used for sugar, pineapples, and macadamia nuts.

The argument that "there is a need to maintain an adequate land area for agricultural activities which are presently considered non-viable or marginal" is essentially that we must maintain a strategic land reserve. Such a statement however, to have any value in planning, must take into account current resource levels as well as a projected changes to these levels. Given the current trends in Congress with respect to agricultural support programs, especially those pertaining to sugar, it is extremely unlikely that the current support prices will increase, and almost certain that they will decline. In Hawaii, a declining sugar price will make sugar a less attractive land use relative to alternative uses, and thus, if a new crop becomes viable, land which is currently used for sugar would be available.

Thank you for your comments and continuing interest; we trust that we have responded adequately to your comments.

Very truly yours,

F. J. Rodriguez

FJR:ls

[illegible] OF DEFENSE
[illegible]

MAR 6 1987

HIENG

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:

EIS - Gentry 515, Waiawa, Oahu

A review of the above subject EIS forwarded by the Office of Environmental Quality Control letter dated February 6, 1987 indicates problems may also arise from this phase of the project when it is established. Our concerns will be the same as the first phase of this planned community (Waiawa by Gentry) as stated in our letter to you dated December 30, 1986 (enclosed).

Thank you for allowing this opportunity to comment. Should you have any questions, Lieutenant Colonel Wayne Tomoyasu, our Facilities Management Officer, may be contacted at 735-3522.

Yours truly,

signed

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

Enclosure

cc: Mr. F. J. Rodriguez, Pres.
(Environmental Communications, Inc.)

MAR 9 1987

[illegible]

DEC 30 1986

HIENG

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:

EIS - Waiawa by Gentry, Waiawa, Oahu

A review of the above subject EIS forwarded by the Office of Environmental Quality Control letter dated December 5, 1986 indicates problems may arise when the Waiawa Community is established. Complaints would probably concern noise and air pollution resulting from the Hawaii Army National Guard, as other shops engage in light industrial activities. In addition to the weekday activities, the Hawaii Army National Guard performs inactive duty training (IDT) on the weekends. Since the IDT commences in the early morning hours, noise from this activity may impact the adjacent residential community.

Thank you for allowing this opportunity to comment. Should you have any questions, please contact LTC Wayne Tomoyasu, our Facilities Management Officer, at 735-3522.

Yours truly,

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

cc: Mr. F. J. Rodriguez, Pres.
(Environmental Communications, Inc.)

(P)1113.7

FEB 13 1987

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

Dear Mr. Clegg:

Subject: Gentry 515
Draft Environmental Impact Statement

We have reviewed the subject document and have no comments to offer.

Very truly yours,

J. Dominaga

TEUANE TOMINAGA
State Public Works Engineer

EM:jk
cc: Mr. F. J. Rodriguez

NO RESPONSE NEEDED

FEB 17 1987

John Waihee

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
[illegible] SOUTH KING STREET, ROOM 104
[illegible]

TELEPHONE NO.
[illegible]

FEB 9 1987

February 6, 1987

Dear Reviewer:

Attached for your review is an Environmental Impact Statement (EIS) that was prepared pursuant to Chapter 343, Hawaii Revised Statutes and Chapter 11-200, Administrative Rules, EIS Rules:

TITLE: *Gentry 515*

LOCATION: *Waiawa, Oahu*

CLASSIFICATION: *Applicant Action*

Your comments or acknowledgments of no comments on the EIS are welcomed. Please submit your reply to the accepting authority or approving agency:

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

Please send a copy of your reply to the proposing party:

Mr. F. J. Rodriguez, President
Environmental Communications, Inc.
P.O. Box 536
Honolulu, HI 96809

Your comments must be received or postmarked by: *March 10, 1987.*

If you have no further use for this EIS, please return it to the Office of Environmental Quality Control.

Thank you for your participation in the EIS process.

Feb. 9, 1987
No comments
Energy Division - DPE

NO RESPONSE NEEDED

FEB 12 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

March 23, 1987

Major Jerry M. Matsuda
Hawaii Air National Guard
Department of Defense
Office of Adjutant General
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Major Matsuda:

We are in receipt of your office's comments dated March 6, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments have been provided to the applicant and we respond as follows:

The described potential impacts to the Gentry 515 project parallel the impacts described in your prior comments on the Gentry-Waiawa project dated December 30, 1986. We concur with those comments and also provide essentially the same response in that the analysis of the Findings of No Significant Impact (FONSI) Environmental Assessment prepared by the U.S. Army Support Command provide an adequate description of the anticipated activities for the adjacent lands. Since this 515 project is a planning document, the future proposed uses of both activities will need to be monitored closely by the Department of General Planning as well as your agency.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 Fort St. Mall . Suite 200 · P. O. BOX 936 · HONOLULU HAWAII 96808 · TELEPHONE (808) 521-8391

JOHN WAIHEE
GOVERNOR

CHARLES T. TOGUCHI
SUPERINTENDENT

OFFICE OF THE SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

February 13, 1987

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

Dear Mr. Clegg:

SUBJECT: Gentry 515 EIS

Our January 21, 1987, letter to you on the subject matter is still valid and applicable to the Environmental Impact Statement review.

Should there be any questions, please contact Mr. Richard Inouye at 737-4743.

Sincerely,

Charles T. Toguchi
Superintendent

CTT:dk (MRI)
cc Mr. F.J. Rodriguez
Leeward District
OBS

NO RESPONSE NEEDED

FEB 25 1987

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

FILE COPY

March 6, 1987

Mr. Donald A. Clegg, Chief Planning Officer
Department of General Planning
City & County of Honolulu
650 S. King St.
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement (DEIS) for Gentry 515, Waiawa, Oahu

Thank you for allowing us to review and comment on the subject DEIS. We offer the following comments for your consideration:

Wastewater Disposal

The draft EIS did not address our concerns which were previously submitted in our letter of January 22, 1987. The proposed project will have a significant impact on the Honouliuli Sewerage System and this must be addressed in the final EIS.

Drinking Water

The Gentry 515 Development appears to be a second phase of the proposed Waiawa by Gentry Project. Both projects are located over the Waiawa Shaft. The Department of Health has repeatedly expressed concern about the potential contamination of Waiawa Shaft and the loss of recharge for the Pearl Harbor Ground Water Control Area. A discussion of the potential impacts on groundwater should have been included in the ANTICIPATED IMPACTS AND MITIGATIVE MEASURES section. The groundwater concerns have not been adequately addressed in either this draft EIS or the final EIS for the Waiawa by Gentry Project.

The final EIS for this project should include a thorough analysis of the potential groundwater effects by this project and an estimate of the cumulative impact on groundwater analysis by the two adjacent projects. The potential for contamination of such a vital resource as Waiawa Shaft is too critical to be ignored.

Air Pollution

The air quality assessment for this draft EIS did note that previous air pollution modeling studies of that portion of the H-1 Freeway leading from the proposed project to urban Honolulu has indicated severe peak hour congestion along the freeway segment between Waiawa and Halawa interchanges that could result in exceedance of the State ambient air quality standards for carbon monoxide. Traffic from the proposed project

MAR 13 1987

FILE COPY

would only exacerbate the situation. Since potential violations have been determined, the draft EIS should address the mitigating actions which shall be implemented.

Noise

1. Concerns toward this proposed development regarding potential noise impacts were addressed in comments to the EIS Preparation Notice (January 22, 1987).

2. There are additional concerns which must be addressed in the final EIS for this project. Noise emanating from the following sources may affect future residents of the proposed development.

   a. Recreational and grounds maintenance activities associated with the proposed golf course.

   b. The existing Pearl City Industrial Park.

   c. Military aircraft operations.

3. 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.

4. Traffic noise from heavy vehicles 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.

JOHN C. LEWIN, M.D.

cc: Fred Rodriguez

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

March 23, 1987

Dr. John C. Lewin
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Lewin:

We are in receipt of your department's comments dated March 6, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The applicant and the technical subconsultants have reviewed the comments and we respond as follows:

1. Wastewater Disposal

Revisions have been made to pp. VII-17 (Section I, Impact on Infrastructure and Utilities) for wastewater management in terms of sewage treatment and disposal from this project and the adjacent Waiawa project.

2. Drinking Water

This is the approprite place to cite the information provided on pp. II-1 which states: "This document is primarily intended for long range planning use and should not be construed as an action which will commence upon EIS acceptance. The plan presented represents a possible development alternative which could take place 10 to 20 years after commencement of the adjacent Waiawa Development." In simple terms, the concerns expressed by the various branches of the DOH/EHD are appropriate and proper if projects described in EIS documents are those projects which are able to be developed within normal or reasonable time periods.

A study is being planned at the request of the U.S. Navy to determine the real impacts of the recharge area for the Waiawa Shaft. This study is being conducted by the Water Resources Research Center at the University of Hawaii with the cooperation of the Board of Water Supply. The study is expected to be completed in approximately 18 months, at which time, the answers to many questions such as yours may be answered. We cannot provide the extent of "thorough analysis" requested by the Drinking Water Branch on cumulative and potential aquifer impacts for the simple reason that it is not available to us for reasons stated previously; we are not dodging our responsibilities.

Air Pollution

Our response to this subject will be limited to the last sentence of the

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DOH comment that states, "Since potential violations have been determined, the draft EIS should address the mitigating actions which shall be implemented." As we have stated earlier in our response to your drinking water comment, we cannot be assured of what mitigation technology will be available in 10-20 years. Therefore, we cannot be assured that proposed mass transit improvements will not be in place, whether by fixed rail, rubber tired buses, etc. and we cannot be assured that this project will see implementation. Finally, at the time that specific mitigation for the projected traffic generation is prescribed, then DOH would be assured that mitigating actions shall be implemented.

Noise

1. Duly noted.

2. Noise emanating from these sources (a. b. c.) which may affect future residents of the proposed development would be governed and controlled by Title 11, Administrative Rules Chapter 43, Community Noise Control for Oahu.

   a) Golf Course activities are by their nature, quiet recreational activities, subject to those rare outbursts of exuberant joy when a spectacular golf shot is executed, i.e. hole in one, or when a badly executed shot, i.e. out of bounds, occurs. Maintenance on the golf course is usually done during normal daylight hours and includes grass cutting, fertilizing, trimming of shrubbery, trees, and plants, etc. None of these activities are major or constant noise generators.

   b) The existing Pearl City Industrial Park may have potential impacts on the project site if land planning is done without consideration to the proximity of the Park to the proposed residential uses. However, it is not expected that the Pearl City Industrial Park will have any significant effect on the project site.

   c) Military aircraft operations are imposed throughout the State and are unavoidable no matter where we live. Jurisdiction over Department of Defense policy is not within the purview of the DOH.

3. All items under this section will be complied with at the time of building permit review and award of construction contract by the developer. Contract specifications would prescribe adherence with the requirements of this section.

4. Same response as item #3.

Thank you for your comments and continuing concern; we hope that we have responded adequately.

Very truly yours,

F. J. Rodrigues

FJR:ls

JOHN WAIHEE
GOVERNOR OF HAWAII

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

WILLIAM W. PATY
BOARD OF LAND & NATURAL RESOURCES

LIBERT K. LANCRAF
DEPUTY TO THE CHAIRMAN

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WATER AND LAND DEVELOPMENT

MAR 12 1987

DOC. NO. 0962C
FILE NO.: 87-39

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

Dear Mr. Clegg:

We've completed our review of the Gentry 515 Proposal at Waiawa, Oahu and have the following comments:

The proposed Gentry 515 Development is an extension of Gentry's Waiawa Development (also known as the Waiawa Ridge Project). The current proposal includes residential and commercial/industrial land uses in areas mauka and makai of the Waiawa Development. The Gentry 515 Development is contingent upon completion of the Waiawa Development.

The draft EIS estimates project water demand at 1.81 mgd and states that this amount will be supplied through the Waiawa Development Water System (pg. VII-17). We find that there is no discussion of the Waiawa Development system or the water source for that system in the draft EIS. We also reviewed the draft EIS for the Waiawa Development and find a similar text that lacks specific information on water source development. This information should be provided.

The EIS should also clearly state that the project area is located within the Pearl Harbor Ground Water Control Area (PHGWCA) as designated by the Department of Land and Natural Resources under Chapter 177, HRS, and administered through the Department's Administrative Rule, Chapter 166 of Title 13, and as such, a water use permit from DLNR will be required if the project plans for either the Gentry 515 Development or the Waiawa Development call for the development of groundwater sources or require the modification or exchange of present groundwater uses.

Numerous small streams in this area converge into Waiawa Stream which follows a course to the east of the proposed project before it flows into the Middle Loch of Pearl Harbor. The natural drainage patterns were modified in the past for sugar cane irrigation

RECEIVED AFTER DEADLINE DATE

MAR 13 1987

facilities. Middle Loch, particularly near the Waiawa Stream outlet, is a major source of bait for the State's commercial pole-and-line skipjack tuna fishery.

In order to minimize the potential for adverse impact on aquatic resource values in Pearl Harbor, construction activities should be scheduled for periods of minimum rainfall and low runoff, and areas denuded of vegetation or susceptible to erosion should be replanted (or planted) as soon as practical, to minimize erosion and excessive siltation. Further, precautionary measures should include preventing construction materials, petroleum products, wastes, debris, and landscaping substances (herbidides, pesticides, fertilizers) from blowing, falling, flowing, or leaching into the streams and hence into Pearl Harbor's Middle Loch.

A review of our records indicates that the project area does not contain historic sites that are listed on the Hawaii Register or the National Register of Historic Places, or that have been determined eligible for inclusion on the National Register of Historic Places.

In general, we concur with the findings of "no effect" on the basis of the archaeological report contained in the EIS. However, we are concerned that the subsurface testing was done only in the north end of the project area. The test pit distribution does not constitute a representative sample. We need clarification of this point before we finalize our review. We have contacted the applicant to obtain clarification for us. As soon as we obtain this information, we will finalize our review.

These previous comments were on the Draft EIS for this project. We noted that we could not finalize our review until clarification was received relative to our questions about the sampling procedure used in the archaeological subsurface testing. Our office contacted the applicant in early January to supply further information. We are still waiting for this information.

Thank you for allowing us to comment.

Very truly yours,

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

cc: Mr. Fred Rodrigues

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

Mr. William W. Paty
Department of Land and Natural
Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

We are in receipt of your department's comments dated March 12, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments were received after the stated deadline of March 10, 1987. They have been reviewed by the applicant and the technical consultants and we respond as follows:

1. Water Availability and Demand

The entire project site is currently undeveloped and, therefore, no infrastructure or utilities are available on the site. Prior to 1982, Oahu Sugar Company irrigated its canefields with basal water pumped from deepwells located on-site adjacent to Waiawa Stream. Pumpage from these wells of up to 7 mgd was discontinued just prior to termination of cane cultivation on Waiawa Ridge in 1982.

For Waiawa Ridge, the developer proposes to fund and construct onsite, the required water deepwells, storage reservoirs and transmission and distribution mains. The system will be designed and constructed to the Board of Water Supply's standards. Upon completion, the system will be dedicated to the Board of Water Supply for operation and maintenance.

For water source, the developer proposes to request allocation of the project's required 4.7 million gallons per day (mgd) from the Board of Water Supply. Said request would be made against present and future surplus BWS water allocated by the Department of Land and Natural Resources in the Pearl Harbor Water Control District.

Surplus water should be available in the Pearl Harbor district upon completion of several BWS projects which would reduce present export as well as replace present use of potable water with waste spring water for irrigation of highway landscaping. Additionally, water transfers from agricultural use may be approved and, therefore, become available at the time of project implementation. In this manner, no additional water will be withdrawn from the Pearl Harbor Water Control District over its designated sustainable yield of 225 mgd.

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The cost estimate for construction of the water deepwells, booster stations, storage reservoirs and major transmission and distribution mains is approximately $14,326,000.

A master plan for the project's proposed water system will be prepared and submitted for the Board of Water Supply's approval after State and County land use amendments are granted but prior to County rezoning.

2. Surface Runoff/Drainage

Present plans call for the development and construction of onsite sediment basins that will be used to control onsite anticipated surface runoff drainage flows attributed to the project. These basins are to be included in the golf course design, and as such, will function in a dual capacity as golf course amenities. These sediment basins will be included in the Project Drainage Master Plan to be developed by the retained civil engineering consultant, Community Planning, Inc. during the Zoning application review process.

3. Archaeological Impacts

We are enclosing copies of responses prepared by the archaeological consultant and provided to the State Historic Preservation Office on March 3, 1987. We regret any inconvenience that the delayed response may have caused your office. If there is anything further on this matter, please advise our office.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

FJR:ls

Enclosure

ENVIRONMENTAL COMMUNICATIONS, INC.
P.O. BOX 888
HONOLULU, HAWAII 96809

TO Ms. Joyce Bath
Department of Land & Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

DATE March 3, 1987

SUBJECT Waiawa by Gentry

Transmitted herewith for your information and files is a response prepared by Chiniago, Inc. for your comments of January 30, 1987 regarding the Waiawa by Gentry archaeological report contained in the EIS.

F. J. Rodriguez

F. J. Rodriguez

enclosure

CHINIAGO INC.

Archaeological Consulting

P.O. BOX 80 • KAMUELA, HAWAII 96743 • TELEPHONE: (808) 885-7262

February 27, 1987

Mr. Fred Rodriguez
Environmental Communications Inc.
1146 Fort Street Mall
Suite 200
Honolulu, Hawaii 96813

Dear Mr. Rodriguez:

This letter is in reply to your request for information concerning the locations of the test pits excavated during the Waiawa Ridge golf courses survey.

During our field investigation of the property we observed that the bottoms of some of the narrow, steep-sided gulches had been scoured by runoff to such an extent that no cultural remains could possibly be present. Therefore, no test pits were required in those particular gulches. However, there did appear to be thick sedimentation in the bottoms of some gulches, and for this reason it was decided that subsurface testing would be required. It only became clear after the excavations had begun that no such alluvium was present, and that what had appeared to be alluvium was in fact the culturally sterile basal saprolite common to the area. Thus, what appears on the basis of the map to be a non-representative sample is in fact representative of those areas which warranted subsurface testing.

If you have any further questions, please do not hesitate to contact me.

Sincerely yours,

William Barrera, Jr.
President

MAR 2 1987

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
MURRAY E. TOWILL
DEPUTY DIRECTOR
BARBARA KIM STANTON
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KAMAMALU BUILDING, 250 SOUTH KING ST, HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359 HONOLULU, HAWAII 96804 • TELEX: 723-8210 HCPD

Ref. No. P-6039

March 9, 1987

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

Dear Mr. Clegg:

Subject: Gentry 515 - Draft Environmental Impact Statement (DEIS)
Waiawa, Oahu

We have reviewed the subject DEIS and have the following comments. We note that many of our comments from the review of the Environmental Impact Statement Preparation Notice remain unaddressed and we view this information as important and significant in the EIS process.

1. With reference to our concerns regarding the scope of the project and desirability of a comprehensive EIS for the entire Waiawa development, the DEIS indicates that as a "Planning Only EIS," the DEIS is required by the Department of General Planning, City and County of Honolulu, to assess "impacts on the total acreage on a 10-10-10 year basis."

2. The final EIS should utilize market projections to compare the economic viability of the project site for agricultural and residential purposes. For example, page 17 of Appendix I indicates that the current market weakness of locally produced crops limits the economic viability of the project site for agricultural purposes. Projections of future market demand during the period of project development is not specifically addressed. It is likely that the market for both residential and agricultural products will be much different 10 to 20 years from now. These market projections to determine future demand are needed to assess both residential and agricultural viability of the project site closer to the estimated project development period.

The final EIS should expand in greater detail the agronomic and economic potential of the project site for pineapple production. Page 8 of Appendix I states, "Pineapple is the most feasible export crop for the subject lands." Unfortunately, no further analysis of this potential agricultural use is offered. In addition, the demand for additional pineapple acreage (referred to on page 8 and Figure 1), should be extrapolated to determine the economic viability of pineapple production for the project site closer to the estimated project development period. It should be noted that the prime agricultural lands which may be converted to pineapple production, will mostly be fields at lower elevations with high insolation.

3. The DEIS states on page VII-8 that, "Inclusion of the proposed development is assumed to not affect the total expected population in the area but to redistribute it." Further clarification of this statement is required since redistribution appears to assume that other proposed developments in the area will not be completed and no explanation is given as to why this assumption is made. Major housing and mixed use projects proposed in Central Oahu have gone through the LUC boundary amendment process in the past few years. All have been approved with the exception of Mililani Mauka which has been resubmitted to the Commission and Waiola which is pending. These projects are further along in the approvals process than the proposed project. Therefore, it would be appropriate to include a thorough analysis of downstream impacts on the H-1 Freeway and other primary collectors based on the assumption that the proposed project will create an increase in area population. The final EIS should also include specific statements indicating how each of the proposed transportation improvements will be funded.

4. We note that the Updated Traffic Noise Study utilizes a 65 Ldn contour to determine minimum setback distances to facilitate site location of residential units below this noise threshold level. While this is the standard FHA/HUD guideline, it should be noted that the unique construction techniques used in Hawaii for residential structures is less effective in attenuating Ldn levels over 60 than typical mainland residential structures with heavy insulation. For this reason, the Honolulu International Airport utilizes a more realistic figure of 60 Ldn in determining appropriate land use patterns within the flight approach contours. Consequently, a residence within a Gentry 515 noise contour of 65 Ldn could expect a higher level of noise intrusion than a similar unit in the vicinity of the airport.

5. The final EIS should provide maps of greater detail in regard to proposed improvements and existing physical features as requested in our comments of January 21, 1987, for the DEIS.

6. The final EIS should include a more extensive Archaeological Survey which covers the entire Waiawa/Gentry project site. We note that the current survey was completed primarily within the gulches where earlier studies suggest evidence may exist for agricultural sites. If the increased flooding potential of project development threatens these low-lying areas, mitigating measures may be necessary prior to development.

7. The final EIS should contain the best estimates available on comparative pricing and percent of units available for low, moderate and gap-group income levels. No information on the pricing of housing units was provided in the DEIS as requested in our previous comments.

8. The final EIS should analyze the impact of the project on groundwater supply and quality as requested in DPED's comments for the EISPN. Section VII-B, Impacts on Hydrological Characteristics, should identify the impacts of the project on groundwater supply and quality of the Pearl Harbor Ground Water Control Area in terms of: availability of water supply, possible contamination from chemical percolation, possible quality degradation from salt water intrusion due to a reduction of the groundwater aquifer, and impact upon the Waiawa shaft, the Navy's water supply source.

9. The final EIS should indicate what specific growth policies target the area for major growth as referred to on page V-6.

10. The final EIS should include a list of review agencies and appropriate permits required for the proposed project.

11. The DEIS indicates on page VII-14 that the carbon monoxide allowable standards of the State of Hawaii cannot be met "in the vicinity of Waipahu Street and Kamehameha Highway and along the H-1 Freeway between the Waiawa Interchange and the Halawa Interchange." We acknowledge that these standards may be exceeded from time to time; however, it seems likely that the proposed development will add to these already high carbon monoxide levels.

12. The hydrologic section of the final EIS should clarify whether the sedimentation/retention basins are included in the project estimates of runoff and constituent levels. Features such as these could significantly reduce the runoff and constituent levels while improving groundwater recharge potential.

13. Section VII-B, 3, Storm Drainage, states that, "the development of Waiawa will increase the quantity of surface runoff flowing into Waiawa Stream." The Final EIS should address the potential of this increased runoff to adversely affect the flood hazard potential of Waiawa Stream, both in the project area and downstream.

14. The Final EIS should identify that the Pearl Harbor National Wildlife Refuge, which provides habitat and feeding grounds for the four species of Hawaiian endangered waterbirds--stilt, coot, gallinule, and koloa, will directly receive runoff from the project site via Waiawa Stream. The potential impacts upon these endangered species should be discussed.

Thank you for the opportunity to review and comment on this DEIS. We request that a copy of the FEIS be sent to us.

Sincerely,

Roger A. Ulveling

cc: Office of Environmental Quality Control
Mr. Fred J. Rodriguez, President
Environmental Communications, Inc.

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ.
PRESIDENT

March 23, 1987

Mr. Roger A. Ulveling, Director
Department of Planning and
Economic Development
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

We are in receipt of your department's comments dated March 9, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The applicant and the sub-consultants have reviewed the comments and we respond as follows:

1. Comments duly noted.

2. We agree that market for agricultural products can be expected to change during the next 30 years. During the past 25 years, the market supply of fresh fruits and vegetables in Hawaii has more than doubled, from 90.6 million pounds to 203.1 million pounds in 1985. However, the great majority of the increased supplies came from imports. In 1965 local supplies accounted for 52 percent of the market and this fell to 39 percent in 1985. The increased share of imports is due to several factors, the two most important being, an increase in demand for fruits and vegetables from temperate climates, and improvements in production and transportation technology that allowed imports to compete favorably with locally produced commodities. As pointed out in the DEIS, it is these cost related factors that are limiting local production, not the availability of land.

   The DEIS includes projected demands for agricultural land on Oahu and in the State contained in the LESA commission report and extrapolated to the year 2015 in five year increments (page 4 and Table 2 of Appendix I). These estimates were prepared by the State of Hawaii Department of Agriculture and are the most recent data available.

   The two largest agricultural exports from the State and from Oahu are sugar and pineapple. The subject lands have not proven to be viable for the production of sugarcane. The future demand of the pineapple industry for additional acreage is difficult to project. It will depend on not only on domestic efficiency, but also on such factors as the US trade policy, the value of the dollar, the political climate in competing regions of the world, and the price of the pineapple relative to competing fruits. Pineapple acreage in the State and Oahu is still declining, but at a much slower rate than in the past (Statistics of Hawaiian Agriculture). The most reasonable assumption is that past trends will continue with one possible caveat. If the proposed alternate planting of sugarcane and pineapple on the same fields proves viable, the number of acres of pineapples harvested could

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increase. In this case, however, the increase would occur solely through the more efficient use of lands currently devoted to sugarcane and pineapple and there would not be a demand for additional acreage.

3. The analysis of "downstream" traffic impacts requires a comprehensive land use plan and projections of population, employment, and other economic factors. The simple addition of the traffic generated by the proposed project does not reflect the interrelationships between the various land uses. As an example, employment opportunities in the proposed project could contribute to a decrease in traffic from Central Oahu to downtown Honolulu by intercepting some of the existing traffic, while at the same time the residential units could add to this major flow. A comparison of the different population and economic activity projections for an area like Central or Leeward Oahu illustrates another problem in trying to identify downstream impacts.

   Alternatively, an adopted plan, such as the City's Oahu General Plan and Development Plans, could be used as a basis for the regional analysis. The impact of a proposed project within a limited area, such as where the project connects to the regional highway system, could be identified, assuming full development in order to identify the greatest expected impact. This approach was taken in the traffic studies for the Walawa and Gentry 515 projects; the downstream impacts are expected to be a continuation of the near-capacity conditions. There will be a need to implement programs to modify travel behavior, to increase system-wide capacities, or a combination of these in order to mitigate congestion.

4. Y. Ebisu & Associates has provided a specific response to the comments posed in this area; it is attached as an enclosure to this letter in its' entirety since the technical nature and length of the response is best provided in total.

5. We regret that the FEIS will not be able to provide any additional maps beyond those in the DEIS since the "proposed improvements and existing physical features" will not be mapped beyond the conceptual stage as provided. This project's future life expectancy is contingent completely on the ability of Gentry-Walawa to survive the rigors of land use policy review at the City & County, State Land Use Commission, and State of Hawaii stages.

6. It was not considered cost-effective to conduct anymore than the survey effort provided since the planning only parameters did not afford the developer/applicant any real benefits on the expenditure of funds for research done for research's sake. You may be assured that as this and the Walawa project continue forward in the approximately 2-4 years of planning review, the probability of archaeological research will increase as the success factor increases. All concerns as expressed by the State Historic Preservation Office will be responded to adequately.

7. Again, the lack of even the best estimates available for comparative pricing of residential units to be built to satisfy the low, moderate, and gap-group income levels are due to the long-range future implementation schedule this project would hope to attain. Beyond Gentry-Waiawa is an infinity of future planning.

8. Water Supply

The entire project site is currently undeveloped and, therefore, no infrastructure or utilities are available on the site. Prior to 1982, Oahu Sugar Company irrigated its canefields with basal water pumped from deepwells located on-site adjacent to Waiawa Stream. Pumpage from these wells of up to 7 mgd was discontinued just prior to termination of cane cultivation on Waiawa Ridge in 1982.

For Waiawa Ridge, the developer proposes to fund and construct onsite, the required water deepwells, storage reservoirs, and transmission and distribution mains. The system will be designed and constructed to the Board of Water Supply's standards. Upon completion, the system will be dedicated to the Board of Water Supply for operation and maintenance.

For water source, the developer proposes to request allocation of the project's required 4.7 million gallons per day (mgd) from the Board of Water Supply. Said request would be made against present and future surplus BWS water allocated by the Department of Land and Natural Resources in the Pearl Harbor Water Control District. This surplus is contingent on completion of several BWS projects which would reduce present export as well as replace present use of potable water with waste spring water for irrigation of highway landscaping. Additionally, water transfers from agricultural use may be approved and, therefore, become available at the time of project implementation. In this manner, no additional water will be withdrawn from the Pearl Harbor Water Control District over its designated sustainable yield of 225 mgd.

The cost estimate for construction of the water deepwells, booster stations, storage reservoirs and major transmission and distribution mains is approximately $14,326,000.

A master plan for the project's proposed water system will be prepared and submitted for the Board of Water Supply's approval after State and County land use amendments are granted but prior to County rezoning.

The groundwater recharge in the project site area will be reduced during major storm events, however, minor storm $\leq$ 0.25 in./day would probably not be affected since this is near the area's average evaportion rate. Overall annual evaporation is greater than annual rainfall around the project site area.

However, the additional runoff from the project site may recharge the groundwater elsewhere. On site sedimentation ponds will help contain water in the location of groundwater recharge, as well as reduce runoff and decrease off-site sedimentation.

There has been no particular evidence presented that municipal development on Oahu (specifically, in Central Oahu) has impacted the quality of the underlying ground water. Statements about possible contamination are only speculatory.

The U.S. Navy has requested that a study be conducted by the Water Resources Research Center, U.H. Manoa Campus with the cooperation of the Board of Water Supply to determine the real impacts of the recharge area for the Waiawa Shaft. In the approximately 18-months required to complete the study, many of these type of questions will be answerable with the results of this work.

9. Based on the Department of Planning and Economic Development's population projection for Oahu in the year 2005, Central Oahu's population allocation from the adopted Central Oahu DP, is approximately 139,800 which is 14.7 percent of the year 2005 projection. This represents a net increase of 25,400 over 1984's estimated population of 114,400 or 14.2% of the islandwide total. While the percentage of the island's population does not increase drastically, the net increase is significant and is capable of supporting several major developments.

10. The DEIS listed on pp. VI-12 the required procedural steps in the land use changes that will be required for this Gentry 515 project. Section XI lists all agencies consulted and includes copies of their respective comments.

11. This is a natural assumption based on the current state of the art in terms of automotive emissions mitigation measures, the sheer density of additional autos, and the inborn reluctance of the American driver to relinquish his almost civil rights to drive when and where he wants. Should nothing change in 10-20 years when this proposed project would be implemented, it would be a correct assumption. However, with mitigation measures such as a mass transit system, Park and Ride programs, and other non-highway construction measures pending, there may be relief from increasing CO levels.

12. The section on storm drainage on pp. VII-5 has been revised to reflect the changes requested on sediment basins and their beneficial remedies to ground water percolation, reduced impacts on Pearl Harbor from runoff, and other factors affecting hydrological impacts.

13. This is also addressed in the Storm Drainage section on pp. VII-5.

14. The concerns over the avifauna found at the Pearl Harbor National

Wildlife Refuge possibly being impacted by the surface runoff from this project via Waiawa Stream were posed to Dr. Andrew J. Berger, Ph.D. His comments were that it would be difficult if not impossible to ascertain if the endangered species or other species finding refuge at Pearl Harbor could be accurately depicted as being impacted from Waiawa Stream runoff only. The wide ranging nature of these birds who fly and feed at Kawainui Marsh, Kaneohe Marine Corps Air Station, Haleiwa Stream, Wilson Reservoir, and various golf courses that provide secondary treated effluent aeration basins, and other sources for food and habitat, preclude the ability to see with any degree of accuracy, that impacts from Waiawa Stream are the only causal factors for study.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

FJR:ls

enclosure

Y. Ebisu & Associates
Acoustical and Electronic Engineers
1126 12th Avenue
Room 305
Honolulu, Hawaii 96816
(808) 735-1634

March 13, 1987

Environmental Communications, Inc.
P.O. Box 536
Honolulu, Hawaii 96809

Attention: Mr. Fred Rodriguez

Subject: Response to Para. 4, DPED letter dated 3/9/87
Gentry 515 - Draft EIS

Dear Fred:

The question as to why an apparent double standard is being used to define setback distances for residences subjected to aircraft vs. traffic noise is a valid one. Although construction methods may differ between local and mainland homes, that is not the reason for use of the lower 60 Ldn planning level when aircraft noise is involved. If it were so, the proper solution might be to adopt mainland construction methods (thermal insulation, double walls, etc).

The issue is a very complex one, but I will attempt to summarize the reasons for the apparent double standard as follows:

The zero risk level for noise impact is probably in the order of 55 Ldn. The scientific evidence to support this and the correlation between Ldn value vs. annoyance is stronger for aircraft noise than for road traffic noise. (See EPA Levels Document, Appendix D). Also, from local experiences and published data, we cannot assume that community response to road traffic noise are identical to aircraft noise, when each have the same Ldn value. I tend to agree with the results of the study, "Direct Comparison of Community Response To Road Traffic Noise and To Aircraft Noise," by F. Hall, S. Birnie, etc., JASA, December, 1981, that "for the same value of Ldn, a greater percentage of the sample is highly annoyed by aircraft noise than by road traffic noise."

Recognizing the desirability, cost, difficulties, and practicality of using a 55 Ldn standard for noise, all agencies of the Federal government (FHWA being the exception) have selected 65 Ldn as a more appropriate regulatory standard. The FHWA standard uses the Leq descriptor, which relates to only the peak hour of traffic, and not the 24-hour period.

FHA/HUD utilizes 65 Ldn as an exterior noise standard for all noise sources, but does not have an explicit interior noise standard. In general, when the FHA/HUD standard is applied locally, maximum interior noise levels can be limited to approximately 55 Ldn. This is because, under natural ventilation conditions (with open windows and doors, which are the weak links), and irrespective of the type of wall or roof construction, only 10 dB of exterior-to-interior noise reduction is possible. This interior level of 55 Ldn is 10 Ldn units above the zero risk interior level of 45 Ldn for residences (EPA Levels Document).

FAA uses 65 Ldn as an exterior noise standard, but explicitly states that "normal residential construction can be expected to provide a NLR (exterior-to-interior Noise Level Reduction) of 20 dB." (notes to Table 1, FAR, Part 150). The implication of this is that the FAA is using 65 Ldn as an exterior noise standard, and 45 Ldn as an interior standard. Therefore, the FAA has a more conservative interior standard (by 10 Ldn) for aircraft noise than FHA/HUD, although both agencies use the same exterior noise standard for regulatory purposes.

It is extremely difficult to achieve 20 dB of exterior-to-interior noise reduction (when aircraft noise is the object of concern) without resorting to total closure and air conditioning. This is true whether or not single wall, double wall, thermal insulation, etc. is used (see "Honolulu International Airport Noise Levels", by Y. Ebisu, Hawaii Architect, February, 1981. Additionally, mitigation of aircraft noise levels outdoors is generally not possible. The reason for this is that aircraft noise usually originates from up high, and the noise cannot be easily attenuated by the use of walls or closure of windows on only one side of the home (due to noise reflections from adjacent structures). So the 60 Ldn planning level represents a compromise position between the desirable level of 55 Ldn and the regulatory level of 65 Ldn, due to the lack of generally easy means of mitigating aircraft noise.

On the other hand, when road traffic noise is the object of concern, alternate tools (besides air conditioning or project siting) are available for mitigation. Representative tools are sound attenuation walls or berms for outdoor areas and lower floor dwelling units, and sound attenuation windows for upper floor dwelling units. The reason for the greater variety of mitigation measures is the confined (and more predictable) location of the road traffic sources, the generally lower elevation of the sources, and the usual

ventilation openings to compensate for the more restrictive openings on the nosier (roadway) side of the dwelling.

I hope this helps to clarify the issue without causing additional confusion. There are other reasons for the apparent double standard, but the ones described above are the primary ones.

Sincerely,

Yoichi Ebisu, P.E.

John Waihee
GOVERNOR

Winona E. Rubin
DIRECTOR

Harold Falk
DEPUTY DIRECTOR

ALFRED K. SUGA
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING
P. O. Box 339
Honolulu, Hawaii 96809

February 27, 1987

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, Gentry 515

The Department of Social Services and Housing has reviewed the draft environmental impact statement for the Gentry 515 project and submits the following general comments.

The project location (Figure 2, page III-3) indicates that Gentry 515 is to be developed in two parcels. We direct your attention to the parcel entitled "Residential," which is located at the top of Figure 2. This parcel of land abuts directly upon, at its upper or northern boundary, the Waiawa Correctional Facility, a minimum security prison which is operated and managed by the Department's Corrections Division. Since the location of such institutions are oftentimes controversial, we are curious that nowhere in the impact statement is any indication given that the correctional facility exists or that entry to the facility is through a roadway which traverses directly through the middle of this proposed residential area.

The Department is not only concerned that residential or commercial development takes place in and around its correctional establishments since such activity naturally occurs. We believe, however, that in addition to the discussion related to flora, fauna, air quality, roadways, etc., this impact statement should include information that a prison facility adjoins this parcel of the Gentry 515 project; that it is a facility that operates 24 hours a day; and that throughout the day and into the early evening, there will be a stream of traffic to and from the prison consisting of prison officials, staff, inmates and their escorts, counselors, families and friends.

MAR 6 1987

Thank you for giving us the opportunity to review and comment on this draft environmental impact statement.

Sincerely,

Winona E. Rubin
Director

cc: Mr. F.J. Rodrigues

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

March 23, 1987

Mrs. Winona E. Rubin, Director
Department of Social Services
and Housing
P.O. Box 339
Honolulu, Hawaii 96809

Dear Mrs. Rubin:

We are in receipt of your department's comments dated February 27, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments have been provided to the applicant and we respond as follows:

The applicant is aware that the Waiawa minimum security Correctional Facility (WCF) is located on TMK 9-6-5:11 in close proximity to the subject development. This understanding of the WCF's location was brought to our attention by the Department of Accounting and General Services in correspondence dated January 14, 1987 on the Gentry-Waiawa Final Environmental Impact Statement (FEIS).

We will include this identification of the WCF proximity in Section III, the Project Description section of the Final EIS and also in Section IX, "Any Probable Adverse Environmental Effects Which Cannot be Avoided."

We regret the omission in the Draft EIS; thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 Fort St. Mall . Suite 200 . P O BOX 536 . HONOLULU HAWAII 96809 . TELEPHONE (808) 521 8291

DGP 3/87 746

JOHN D. WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

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

IN REPLY REFER TO:
STP 8.1883

March 2, 1987

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

Dear Mr. Clegg:

Draft EIS - Gentry 515

Since Gentry 515 is an expansion of the proposed Waiawa by Gentry development, we find our comments submitted to you earlier on the Waiawa by Gentry EIS (STP 8.1810 - January 22, 1987) are still applicable. A copy of these comments are attached for your convenience.

Thank you for this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

Attachment

535
#335
STP 8.1810

January 22, 1937

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

Dear Mr. Clegg:

EIS - Waiawa by Gentry
Waiawa, Oahu

After reviewing the subject EIS, we have the following comments for your consideration:

1. We do not agree with the statement on page VII-10, "The total traffic demand into the Waiawa interchange would remain constant in year 2002 with or without the Waiawa project." It appears that this is based on the assumption that growth will come from Waiawa Ridge and traffic/growth from other areas will remain relatively constant.

2. Figure 2, Site Plan, shows an interchange located between the Waipio and Waiawa Interchanges. The Highways Division is opposed to any more new interchanges within this segment of H-2.

3. The double-lane loop ramp serving the Waiawa Ridge development to H-2 at the Waipio Interchange should be limited to only a single-lane loop ramp. A two-lane loop ramp would require widening H-2 from the Waipio Interchange through the Waiawa Interchange to maintain freeway lane balance.

4. Costs of improvements to mitigate the development's traffic impacts shall be borne by the developer. This shall include any necessary improvements at Waipio Interchange, on Kamehameha at Ka Uka Boulevard, on

Kamehameha Highway at Waipahu Street and any other improvements required by traffic utilizing the Waihona Street access or any other access point.

5. The new proposed access connection to the existing T-intersection at Waipahu Street and Kamehameha Highway must be re-evaluated. The existing intersection already has severe problems. Adding a 4th leg will only compound the problem. If the proposed Waikele and Haiola developments also become a reality, in addition to Waiawa by Gentry, the problems at this intersection will become even greater.

6. Other alternatives for access should be investigated.

7. Will the development create new jobs that would reduce residents' need to use our highway facilities to get to their jobs during the peak traffic period? Has this been considered in the traffic generation study?

8. The EIS mentions that an increase in the use of high-occupancy vehicles has the potential to reduce traffic demand. What kind of resources is the developer willing to commit toward achieving this change in commuter pattern?

9. The developer should be informed that we are seriously concerned about the effects of developments such as Waiawa on downstream sections of our highways system. Consequently, we will be considering methods to obtain developer's assistance to fund needed improvements.

We appreciate this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

March 23, 1987

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

Dear Mr. Hirata:

We are in receipt of your department's comments dated March 2, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project.

We are forwarding for your review, a copy of the letter of February 24, 1987 with its attached response prepared by the subconsultant, Parsons Brinckerhoff Quade & Douglas, Inc. regarding the DOT comments on the Draft EIS for the Waiawa by Gentry project.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

FJR:ls

Enclosure

1146 Port St. Mall . Suite 200 . P O BOX 538 . HONOLULU, HAWAII 96809 . TELEPHONE (808) 521-8791

Parsons Brinckerhoff 100 YEARS

Parsons Brinckerhoff Quade & Douglas, Inc.
Engineers
Planners

700 Bishop Street
Suite 819
Honolulu, HI 96813-4108
808-531-7094
Telex: RCA 723-8362

February 24, 1987

Mr. F. J. Rodriguez
Environmental Communications, Inc.
P. O. Box 536
Honolulu, Hawaii 96809

Dear Fred:

SUBJECT: Waiawa By Gentry EIS
Comments on Draft by DOT

A "Response to DOT Comments" is attached for your use in preparing a response to DGP, as requested. A draft of these responses was discussed in a meeting held on February 23, 1987 with Ron Tsuzuki, Kenneth Au, and Dan Tanaka of DOT. Their major concern seems to be the correctness of the use of traffic projections based on the General Plan population and employment guidelines, in view of all of the proposed developments in Central and Leeward Oahu.

A copy of the revised Traffic Impact Assessment Report (TIAR) was left with Dan Tanaka. Should you have any questions, please call me at phone 531-7094.

Very truly yours,

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Julian Ng

Attach.
cc: Tosh Hosoda
Ron Tsuzuki

Response to DOT Comments (letter to DGP, STP 8.1810, 1/22/87)

The Traffic Impact Assessment Report has been revised to incorporate findings from other studies and in view of DOT's concerns. Following are responses to their comments:

1. The traffic report has been revised to include additional discussion about the growth of traffic volumes. The only assumption made regarding growth in other areas was that the total traffic from all development in Leeward and Central Oahu would grow at a rate determined by population and employment growth rates. While no assumptions had been made about traffic or growth from other developments within the area, one of the findings from the traffic study indicates that if the project's parameters were accepted, traffic volumes from other parts of Leeward and Central Oahu would remain near today's levels.

2. The proposed project does not include a new interchange between the Waiawa and Waipio Interchanges. The traffic analyses did not assign any traffic onto such a facility. The latest plan is provided in the DEIS for Gentry 515, Figure 2, Site Plan.

3. The traffic analyses indicate that a two-lane loop ramp will be necessary to serve projected demands; preliminary layouts have been prepared for a two-lane ramp, allowing for future widening, if and when necessary. The analyses and discussion of mitigation measures in the report were redone for a single-lane loop ramp.

4. The DOT has indicated that the improvements needed to serve the proposed project have not been programmed, nor are funds available to implement any improvements. The identification of specific improvements and commitments to provide such improvements will be dependent on the type and scale of development that will be permitted.

5. The traffic analyses found that the Kamehameha Highway and Waipahu Street intersection would require additional improvements, whether or not the fourth leg is added. Existing problems at the intersection appear to be

the result of downstream capacity constraints, which would require widening or other improvements; however, no improvements are being proposed because some relief to existing traffic congestion in the area could result from the opening of new interchanges at Paiwa Street at H-1 and at Waipio Interchange. While not specifically studied in the traffic assessment, the provision of an alternative route between Waipahu and Pearl City which avoids the Waiawa Interchange could also improve conditions in the area.

6. Many alternatives for access have been investigated. Existing residential and commercial developments and limited regional highway facilities in the area preclude many alternatives. The three proposed connections were found to be the only available locations to connect the internal roadways to the existing highways. Alternative access schemes will continue to be evaluated.

7. The creation of new jobs within the development has been incorporated into the traffic generation, by considering internal trips.

8. The developer's incentive to committing resources toward a high-occupancy vehicle program is the marketability of his project; the EIS, as a disclosure document, has identified the need to reduce traffic demand from the project.

9. (No response needed)

University of Hawaii at Manoa

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

March 10, 1987
RE:0456

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:

Draft Environmental Impact Statement
Gentry 515
Waiawa, Oahu

The above cited Draft Environmental Impact Statement (DEIS) proposes the development of 515 acres for residential, commercial, industrial, and open space in the Waiawa area of Central Oahu. A total of 4,990 residential units will be developed along with 83 acres of commercial/industrial space and all appurtenant service facilities and infrastructures. The project will be developed within 10 to 20 years after the commencement of the proposed adjacent Waiawa Development. This document addresses among other changes on the site, the rezonation of agricultural land to residential and commercial land.

The Environmental Center has reviewed this document with the assistance of Paul Ekern, Agronomy and Soils; Luciano Minerbi, Urban and Regional Planning; Michael Graves, Anthropology; George Curtis, Hawaii Natural Energy Institute; Pamela Bahnsen and Sonya Myers, Environmental Center.

General Comments

A general comment seems necessary. While the Draft EIS discusses most, if not all, the major environmental topics of concern with regard to the proposed project, much of the information is supperficial and lacks the site specific evaluations needed for objective decision making. We are particularly concerned that this Draft EIS is being prepared for a project that may not take place for 10-20 years or more. Since most, if not all, of the significant environmental impacts, i.e. infrastructure, drainage, traffic, and even archaeological impacts are likely to be significantly different depending on the cumulative impacts experienced over the next 10-20 years of developments in this area, the rationale and justifcation for the preparation and submittal of a statement so far in advance of

contemplated construction dates is subject to question. It should be recognized that a supplemental statement may be necessary if significant changes in the scope of the project or anticipated impacts are likely at the time construction is actually contemplated.

Archaeology

The reconnaissance of the project area is severely lacking in substantive and objective information and does not meet the minimum guidelines as set forth by the Society for Hawaiian Archaeology for reconnaissance surveys. The purpose of a such a survey is to determine the presence or absence of archaeological resources and to determine their general nature. Although it is not necessary for the survey to completely cover large parcels of land. A rationale for the sampling area procedure, and sampling fraction should be provided. Based on the information provided, the level of effort expended to systematically search the area to locate sites is inadequate. Presumably this was due to the lack of personnel and time available (one person, 2 days) to search this large parcel (515 acres). Because of extensive sugar cane cultivation, the surveyor chose to confine his efforts to less disturbed gulches and the flood plains of Waiawa Stream. However, no archaeological rationale was provided to support this sampling procedure. Nor were any maps provided of the areas surveyed. Given that subsurface remains can be expected to occur, based on earlier work cited by the consultant, it is unclear why no systematic attempt was made to sample subsurface contents. In order to assess the archaeological significance of the project area a more comprehensive survey should be done in accordance with the minimum guidelines as set forth by the Society for Hawaiian Archaeology.

Traffic Impact

One of the most serious environmental issues addressed in this Draft EIS is that of the impacts on traffic conditions both in the immediate vicinity of the development as well as the cumulative impacts that will be experienced in feeder areas and intersections including those well removed from the immediate vicinity. We again call attention to the 10-20 year long-term planning of this project and the potential need to reevaluate traffic impacts and mitigative measures when actual construction plans are closer to implementation. Changes in critical traffic areas and needs wrought by cumulative developments should be considered prior to construction. The following specific points with regard to traffic impacts are brought to your attention:

The Draft EIS does not provide information on the number of people and cars and the work areas to which they can be expected to commute. We believe that the level of service (F) indication both in the text of the draft statement and in Appendix E that will be expected to occur on the various ramps that will be affected, is an unacceptable figure and redesign of these ramps should be required.

It is unclear from the traffic impact analysis if the entire Waiawa project is being considered or just the Gentry 515 project. The figures for each should be clearly stated along with the infrastructures and services which can be accommodated in common and those for which individual project address is the more appropriate. It is important that both developments be considered in terms of cumulative and concurrrent needs but that the specific attributes of each also be noted.

Mention is made in the Draft EIS of the need for interchange improvements and alternative behavioral programs such as HOV (high occupancy vehicles) to mitigate traffic impacts. Who will be responsible for funding and coordinating such programs?

Public Facilities and Services

Parks, Recreation and Open Space: The loss of additional open space on Oahu by the development of this project is not fully addressed. The availability of open space and need for more may be a critical issue 10-20 years in the future when this project is proposed to begin. We believe that this is another issue that may need to be addressed in a supplemental statement when construction is actually scheduled.

There is no particular section related to housing needs and analyses that supports the types of housing being proposed. This too will vary of course based on demand and existing facilities in similar markets over the next 20 years. One of the major concerns in this regard is the need to preserve adequate open space not only to provide space for parks or passive recreational activities but also to provide additional water recharge areas. In this regard regulation of industrial discharges as well as residential use of pesticides or herbicides should be considered to assure that ground waters are not contaminated since the site is a ground water recharge area.

Soils/Storm Drainage

We suggest that the Final EIS address the possibility for erosion hazard in the proposed project area. The preparers of the EIS might refer Predicting Rainfall Erosion Losses: A Guide To Conservation Planning. USDA S 537, Dec 1978 pp. 5-9. for further information. Likewise, we suggest that the information on infiltration rates and runoff potentials from Agricultural Research Service, U. S. Department of Agriculture publication number ARS W-35, May 1976 may be of interest. The article by Keith R. Cooley and Leonard J. Lane entitled Optimized runoff curve numbers for sugarcane and pineapple fields in Hawaii. Journal of Soil & Water Conservation 35(3) pages 137- 41, May-June 1980 may be useful with regard to the optimized runoff curve numbers for Hawaii soils in the prediction of the changes in runoff for storm drainage before and after developments. We have attached copies of these publications for your information and convenience.

Greater attention should be paid to the problem of safely conveying the storm water from the upland ridges to the gulch bottoms. Currently Mililani Town encounters problems with the disposal of accumulated storm waters. Given the expected increase in runoff due to a decrease in recharge surfaces, the discharge of these storm waters into existing gulches may not provide an adequate solution. Alternative mitigative measures should be addressed and discussed in the Final EIS.

Thank you for the opportunity to comment on the Draft EIS. We look forward to reviewing the final document.

Sincerely,

Jacquelin N. Miller

Jacquelin N. Miller
Acting Associate Director

cc: OEQC
F. J. Rodriguez, President
Environmental Communications, Inc.
Stephen Lau
Paul Ekern
Luciano Minerbi
Michael Graves
George Curtis
Pamela Bahnsen
Sonya Myers

PREDICTING RAINFALL EROSION LOSSES

A GUIDE TO CONSERVATION PLANNING

Supersedes Agriculture Handbook No. 282,
"Predicting Rainfall-Erosion Losses From Cropland East of the Rocky Mountains"

Science and Education Administration
United States Department of Agriculture
in cooperation with
Purdue Agricultural Experiment Station

December 1978

RAINFALL AND RUNOFF FACTOR (R)

Rills and sediment deposits observed after an unusually intense storm have sometimes led to the conclusion that the significant erosion is associated with only a few storms, or that it is solely a function of peak intensities. However, more than 30 years of measurements in many States have shown that this is not the case (51). The data show that a rainfall factor used to estimate average annual soil loss must include the cumulative effects of the many moderate-sized storms, as well as the effects of the occasional severe ones.

The numerical value used for R in the soil loss equation must quantify the raindrop impact effect and must also provide relative information on the amount and rate of runoff likely to be associated with the rain. The rainfall erosion index derived by Wischmeier (49) appears to meet these requirements better than any other of the many rainfall parameters and groups of parameters tested against the assembled plot data. The local value of this index generally equals R for the soil loss equation and may be obtained directly from the map in figure 1. However, the index does not include the erosive forces of runoff from thaw, snowmelt, or irrigation. A procedure for evaluating R for locations where this type of runoff is significant will be given under the topic R Values for Thaw and Snowmelt.

Rainfall Erosion Index

The research data indicate that when factors other than rainfall are held constant, storm soil losses from cultivated fields are directly proportional to a rainstorm parameter identified as the EI (defined below) (49). The relation of soil loss to this parameter is linear, and its individual storm values are directly additive. The sum of the storm EI values for a given period is a numerical measure of the erosive potential of the rainfall within that period. The average annual total of the storm EI values in a particular locality is the rainfall erosion index for that locality. Because of apparent cyclical patterns in rainfall data (33), the published rainfall erosion index values were based on 22-year station rainfall records.

Rain showers of less than one-half inch and separated from other rain periods by more than 6 hours were omitted from the erosion index computations, unless as much as 0.25 in of rain fell in 15 min. Exploratory analyses showed that the EI values for such rains are usually too small for practical significance and that, collectively, they have little effect on monthly percentages of the annual EI. The cost of abstracting and analyzing 4,000 location-years of rainfall-intensity data was greatly reduced by adopting the 0.5-in threshold value.

EI Parameter

By definition, the value of EI for a given rainstorm equals the product, total storm energy (E) times the maximum 30-min intensity (I_{30}), where E is in hundreds of foot-tons per acre and I_{30} is in inches per hour (in/h). EI is an abbreviation for energy-times-intensity, and the term should not be considered simply an energy parameter. The data show that rainfall energy, itself, is not a good indicator of erosive potential. The storm energy indicates the volume of rainfall and runoff, but a long, slow rain may have the same E value as a shorter rain at much higher intensity. Raindrop erosion increases with intensity. The I_{30} component indicates the prolonged-peak rates of detachment and runoff. The product term, EI, is a statistical interaction term that reflects how total energy and peak inensity are combined in each particular storm. Technically, it indicates how particle detachment is combined with transport capacity.

The energy of a rainstorm is a function of the amount of rain and of all the storm's component intensities. Median raindrop size increases with rain intensity (62), and terminal velocities of free-falling waterdrops increase with increased drop-size (13). Since the energy of a given mass in motion is proportional to velocity-squared, rainfall energy is directly related to rain intensity. The relationship is expressed by the equation,

$$E = 916 + 331 \log_{10} I, \qquad (2)$$

where E is kinetic energy in foot-tons per acre-inch and I is intensity in inches per hour (62). A limit of 3 in/h is imposed on I by the finding that median dropsize does not continue to increase when intensities exceed 3 in/h (7, 15). The energy

of a rainstorm is computed from recording-rain gage data. The storm is divided into successive increments of essentially uniform intensity, and a rainfall energy-intensity table derived from the above formula (app., table 19) is used to compute the energy for each increment. (Because the energy equation and energy-intensity table have been frequently published with energy expressed in foot-tons per acre-inch, this unit was retained in table 19. However, for computation of EI values, storm energy is expressed in hundreds of foot-tons per acre. Therefore, energies computed by the published formula or table 19 must be divided by 100 before multiplying by I_{30} to compute EI.)

Isoerodent Maps

Local values of the rainfall erosion index may be taken directly from the isoerodent maps, figures 1 and 2. The plotted lines on the maps are called isoerodents because they connect points of equal rainfall erosivity. Erosion index values for locations between the lines are obtained by linear interpolation.

The isoerodent map in the original version of this handbook (64) was developed from 22-year station rainfall records by computing the EI value for each storm that met the previously defined threshold criteria. Isoerodents were then located between these point values with the help of published rainfall intensity-frequency data (47) and topographic maps. The 11 Western States were omitted from the initial map because the rainfall patterns in this mountainous region are sporadic and not enough long-term, recording-rain gage records were available to establish paths of equal erosion index values.

The isoerodent map was extended to the Pacific Coast in 1976 by use of an estimating procedure. Results of investigations at the Runoff and Soil Loss Data Center at Purdue University showed that the known erosion index values in the Western Plains and North Central States could be approximated with reasonable accuracy by the quantity $27.38\ P^{2.21}$, where P is the 2-year, 6-h rainfall amount (55). This relationship was used with National Weather Service isopluvial maps to approximate erosion index values for the Western States. The resulting isoerodents are compatible with the few point values that had been established within the 11 Western States and can provide helpful guides for conservation planning on a site basis. However, they are less precise than those computed for the 37-State area, where more data were available and rainfall patterns are less erratic. Also, linear interpolations between the lines will not always be accurate in mountain regions because values of the erosion index may change rather abruptly with elevation changes. The point values that were computed directly from long-term station rainfall records in the Western States are included in table 7, as reference points.

Figure 2 was developed by computing the erosion index for first-order weather stations in Hawaii and deriving the relation of these values to National Weather Service intensity-frequency data for the five major islands. When the present short-term, rainfall-intensity records have been sufficiently lengthened, more point values of the index should be computed by the standard procedure.

Figure 1 shows that local, average-annual values of the erosion index in the 48 conterminous States range from less than 50 to more than 500. The erosion index measures the combined effect of rainfall and its associated runoff. If the soil and topography were exactly the same everywhere, average annual soil losses from plots maintained in continuous fallow would differ in direct proportion to the erosion index values. However, this potential difference is partially offset by differences in soil, topography, vegetative cover, and residues. On fertile soils in the high rainfall areas of the Southern States, good vegetal cover protects the soil surface throughout most of the year and heavy plant residues may provide excellent cover also during the dormant season. In the regions where the erosion index is extremely low, rainfall is seldom adequate for establishing annual meadows and the cover provided by other crops is often for relatively short periods. Hence, serious soil erosion hazards exist in semiarid regions as well as in humid.

Frequency Distribution

The isoerodent maps present 22-year-average annual values of EI for the delineated areas. However, both the annual and the maximum-storm values at a particular location vary from year to year. Analysis of 181 station rainfall records showed that they tend to follow log-normal frequency distributions that are usually well defined by continuous records of from 20 to 25 years (49). Tables of specific probabilities of annual and maximum-storm EI values at the 181 locations are presented in the appendix (tables 17 and 18).

R Values for Thaw and Snowmelt

The standard rainfall erosion index estimates the erosive forces of the rainfall and its directly associated runoff. In the Pacific Northwest, as much as 90 percent of the erosion on the steeply rolling wheatland has been estimated to derive from runoff associated with surface thaws and snowmelt. This type of erosion is not accounted for by the rainfall erosion index but is considered either predominant or appreciable in much of the Northwest and in portions of the central Western States. A linear precipitation relationship would not account for peak losses in early spring because as the winter progresses, the soil becomes increasingly more erodible as the soil moisture profile is being filled, the surface structure is being broken down by repeated freezing and thawing, and puddling and surface sealing are taking place. Additional research of the erosion processes and means of control under these conditions is urgently needed.

In the meantime, the early spring erosion by runoff from snowmelt, thaw, or light rain on frozen soil may be included in the soil loss computations by adding a subfactor, R_s, to the location's erosion index to obtain R. Investigations of limited data indicated that an estimate of R_s may be obtained by taking 1.5 times the local December-through-March precipitation, measured as inches of water. For example, a location in the North-

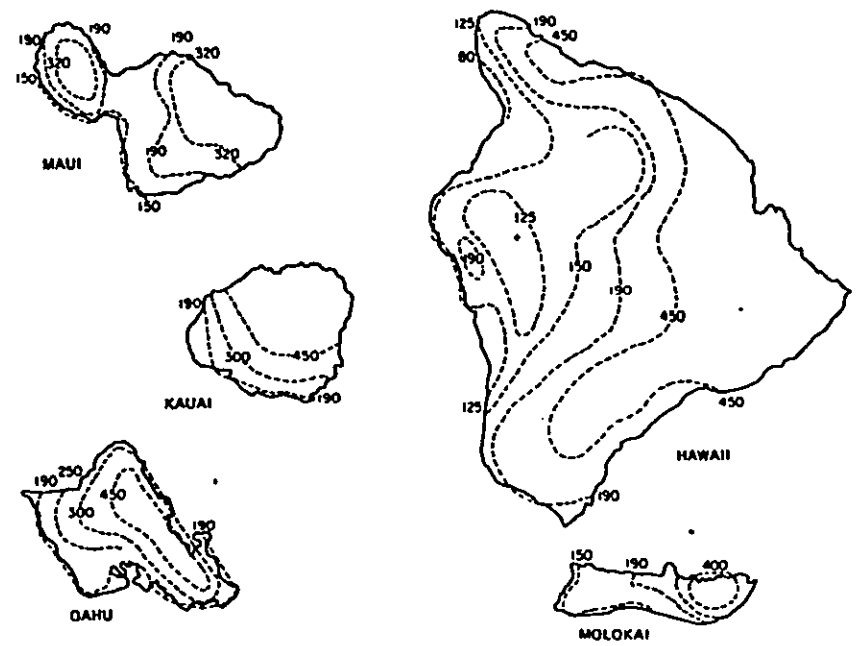

FIGURE 2.—Estimated average annual values of the rainfall erosion index in Hawaii.

west that has an erosion index of 20 (fig. 1) and averages 12 in of precipitation between December 1 and March 31 would have an estimated average annual R of 1.5(12) + 20, or 38.

This type of runoff may also be a significant factor in the northern tier of Central and Eastern States. Where experience indicates this to be the case, it should be included in R and also in the erosion index distribution curves as illustrated on page 27.

SOIL ERODIBILITY FACTOR (K)

The meaning of the term "soil erodibility" is distinctly different from that of the term "soil erosion." The rate of soil erosion, A, in the soil loss equation, may be influenced more by land slope, rainstorm characteristics, cover, and management than by inherent properties of the soil. However, some soils erode more readily than others even when all other factors are the same. This difference, caused by properties of the soil itself, is referred to as the soil erodibility. Several early attempts were made to determine criteria for scientific classifications of soils according to erodibility (6, 18, 28, 35), but classifications used for erosion prediction were only relative rankings.

Differences in the natural susceptibilities of soils to erosion are difficult to quantify from field observations. Even a soil with a relatively low erodibility factor may show signs of serious erosion when it occurs on long or steep slopes or in localities with numerous high-intensity rainstorms. A soil with a high natural erodibility factor, on the other hand, may show little evidence of actual erosion under gentle rainfall when it occurs on short and gentle slopes, or when the best possible management is practiced. The effects of rainfall differences, slope, cover, and management are accounted for in the prediction equation by the symbols R, L, S, C, and P. Therefore, the soil erodibility factor, K, must be evaluated independently of the effects of the other factors.

Definition of Factor K

The soil erodibility factor, K, in the USLE is a quantitative value experimentally determined. For a particular soil, it is the rate of soil loss per erosion index unit as measured on a "unit" plot, which has been arbitrarily defined as follows:

A unit plot is 72.6 ft long, with a uniform lengthwise slope of 9 percent, in continuous fallow, tilled up and down the slope. Continuous fallow, for this purpose, is land that has been tilled and kept free of vegetation for more than 2 years. During the period of soil loss measurements, the plot is plowed and placed in conventional corn seedbed condition each spring and is tilled as needed to prevent vegetative growth and severe surface crusting. When all of these conditions are met, L, S, C, and P each equal 1.0, and K equals A/EI.

The 72.6 ft length and 9 percent steepness were selected as base values for L, S, and K because they are the predominant slope length and about the average gradient on which past erosion measurements in the United States had been made. The designated management provides a condition that nearly eliminates effects of cover, management, and land use residual and that can be duplicated on any cropland.

Direct measurements of K on well-replicated, unit plots as described reflect the combined effects of all the soil properties that significantly influence the ease with which a particular soil is eroded by rainfall and runoff if not protected. However, K is an average value for a given soil, and direct measurement of the factor requires soil loss measurements for a representative range of storm sizes and antecedent soil conditions. (See Individual Storm Soil Losses under **APPLYING THE SOIL LOSS EQUATION**.) To evaluate K for soils that do not usually occur on a 9-percent slope, soil loss data from plots that meet all the other specified conditions are adjusted to this base by S.

Values of K for Specific Soils

Representative values of K for most of the soil types and texture classes can be obtained from tables prepared by soil scientists using the latest available research information. These tables are available from the Regional Technical Service Centers or State offices of SCS. Values for the exact soil conditions at a specific site can be computed by use of the soil erodibility nomograph presented in the next subsection.

Usually a soil type becomes less erodible with decrease in silt fraction, regardless of whether the corresponding increase is in the sand fraction or the clay fraction. Overall, organic matter content ranked next to particle-size distribution as an indicator of erodibility. However, a soil's erodibility is a function of complex interactions of a substantial number of its physical and chemical properties and often varies within a standard texture class.

TABLE 1.—*Computed K values for soils on erosion research stations*

Soil	Source of data	Computed K
Dunkirk silt loam	Geneva, N.Y.	[1]0.69
Keene silt loam	Zanesville, Ohio	.48
Shelby loam	Bethany, Mo.	.41
Ladd loam	Blacksburg, Va.	.39
Fayette silt loam	LaCrosse, Wis.	[1]38
Cecil sandy clay loam	Watkinsville, Ga.	.36
Marshall silt loam	Clarinda, Iowa	.33
Ida silt loam	Castana, Iowa	.33
Mexico clay loam	Hays, Kans.	.32
Hagerstown silty clay loam	State College, Pa.	[1]31
Austin clay	Temple, Tex.	.29
Mexico silt loam	McCredie, Mo.	.28
Honeoye silt loam	Marcellus, N.Y.	[1]28
Cecil sandy loam	Clemson, S.C.	[1]28
Ontario loam	Geneva, N.Y.	[1]27
Cecil clay loam	Watkinsville, Ga.	.26
Bonneau find sandy loam	Tyler, Tex.	.25
Cecil sandy loam	Watkinsville, Ga.	.23
Zanesville fine sandy loam	Guthrie, Okla.	.22
Tifton loamy sand	Tifton, Ga.	.10
Freehold loamy sand	Marlboro, N.J.	.08
Both Boggy silt loam with surface stones > 2 inches removed	Arnot, N.Y.	[1]05
Albia gravelly loam	Bloomsville, N.J.	03

[1] Evaluated from continuous fallow. All others were computed from row-crop data.

Values of K determined for 23 major soils on which erosion plot studies under natural rain were conducted since 1930 are listed in table 1. Seven of these values are from continuous fallow. The others are from row crops averaging 20 plot-years of record and grown in systems for which the cropping effect had been measured in other studies. Other soils on which valuable erosion studies have been conducted* were not included in the table because of uncertainties involved in adjustments of the data for effects of cropping and management.

Direct measurement of the erodibility factor is both costly and time consuming and has been feasible only for a few major soil types. To achieve a better understanding of how and to what extent each of various properties of a soil affects its erodibility, an interregional study was initiated in 1961. The study included the use of field-plot rainfall simulators in at least a dozen States to obtain comparative data on numerous soils, laboratory determinations of physical and chemical properties, and operation of additional fallow plots under natural rain. Several empirical erodibility equations were reported (3, 60). A soil erodibility nomograph for farmland and construction sites (58) provided a more generally applicable working tool. Approximate K values for 10 benchmark soils in Hawaii are listed in table 2.

* See footnote 3, p. 2.

TABLE 2.—*Approximate values of the soil erodibility factor, K, for 10 benchmark soils in Hawaii*

Order	Suborder	Great group	Subgroup	Family	Series	K
Ultisols	Humults	Tropohumults	Humoxic Tropohumults	Clayey, kaolinitic, isohyperthermic	Wahiawa	0.10
Oxisols	Torrox	Torrox	Typic Torrox	Clayey, kaolinitic, isohyperthermic	Molokai	.24
Oxisols	Ustox	Eutrustox	Tropeptic Eutrustox	Clayey, kaolinitic, isohyperthermic	Wahiawa	.17
Vertisols	Usterts	Chromusterts	Typic Chromusterts	Very fine, montmorillonitic, isohyperthermic	Lualualei	28
Aridisols	Orthids	Camborthids	Ustollic Camborthids	Medial, isohyperthermic	Keawehee	.32
Inceptisols	Andepts	Dystrandepts	Hydric Dystrandepts	Thixotropic, isothermic	(Extremely stony phase)	
Inceptisols	Andepts	Eutrandepts	Typic Eutrandepts	Medial, isohyperthermic	Kaimuu	.17
Inceptisols	Andepts	Eutrandepts	Entic Eutrandepts	Medial, isohyperthermic	Honolulu (Variant)	20
Inceptisols	Andepts	Hydrandepts	Typic Hydrandepts	Thixotropic, isohyperthermic	Pahoi	49
Inceptisols	Tropepts	Ustropepts	Vertic Ustropepts	Very fine, kaolinitic, isohyperthermic	Hilo	.10
					Waipahu	20

SOURCE: El Swaify and Dangler (9).

ERODIBILITY OF SELECTED HAWAII SOILS BY RAINFALL SIMULATION

ARS W-35
May 1976

ABSTRACT

Sediment losses were determined under simulated rainstorms for 10 soil series representing four orders on the island of Oahu and two on Hawaii. Two successive rainstorms were generally applied, the first (dry run) at prevailing field moisture conditions and the second (wet run) after nearly 13 hours from the first storm. Each had an approximate intensity of 2.5 in/hr and a duration of 120 minutes. Soil loss data were used to calculate erodibilities (K values) from dry and wet runs for various increments within each storm and for several soil surface preparations.

Erodibilities for cultivated sites on Oahu generally increased during successive intervals of the dry runs. The erodibilities appeared to reach constant values only during latter intervals of the wet runs. Thus, wet runs yielded higher K values (0.001 to 0.41) than did the dry runs (0 to 0.26). This was attributed to faster runoff initiation, which was in turn dependent upon soil-water saturation deficit, and to gradual weakening of soil aggregates after wetting. Construction sites and plantation roads generally exhibited higher erodibilities than agricultural sites.

Differences between dry and wet runs were found on only two of the five volcanic ash soils studied on the island of Hawaii. Erodibilities for their soils were 0.08 to 0.60 for dry runs and 0.07 to 0.51 for wet runs.

KEYWORDS: Soil erosion, Soil conservation, Sediment loss, Rainfall-runoff hydrology, Tropical soils, Universal soil loss equation.

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the Molokai soil, although the variation in B.D. values at eight different sites is of nearly the same magnitude as for that of the Molokai. Factors other than B.D. may have also caused variation observed in the data. Some possible reasons are discussed farther on in this section. Even in the Kukaiau soil, a majority of data points are fairly well described by a linear relationship between the runoff initiation time and the soil's saturation deficit.

Figure 5, *A* to *D*, shows data for the four remaining soils from the island of Oahu where four to six runs were made on two or three different sites. B.D. variation and the number of investigated sites are given in the figure for each soil. The data for Waipahu (a Vertic Ustropept) and Lualualei (a Typic Chromustert) soils exhibit fairly good linear relationships, whereas those for the Waikane (a Humoxic Tropohumult) and Wahiawa (a Tropeptic Eutrustox) do not show clear trends.

Figure 6, *A* to *D*, shows data for the four remaining soils from the island of Hawaii where six to eight runs were made on two different sites. The data for Kawaihae (a Ustollic Camborthid), Pakini (an Entic Eutrandept), and Naalehu (a Lithic Eutrandept) soils are fairly well described by linear relationships, whereas those for Hilo (a Typic Hydrandept) soil show too much scatter.

Among the many factors that could have caused variability in the data and, possibly, deviations from the Green-Ampt predictions are natural soil variability between different sites of any given soil series, roughness and crusting of the soil surface before the rainfall application, variation in rainfall intensity of the simulator within each run, slope, errors in measuring the runoff initiation time, and errors in determining average final and initial water contents. When the results presented above are examined in this light, it may be concluded that equation 4 does a fair job, overall, in describing the experimental data. In Molokai and Kukaiau soils, for which there were a large number of data points, the predicted linear relationship between runoff initiation time and the soil's saturation deficit is fairly well illustrated. In other soils, for which there were a small number of data points, the predicted linear relationship appears to

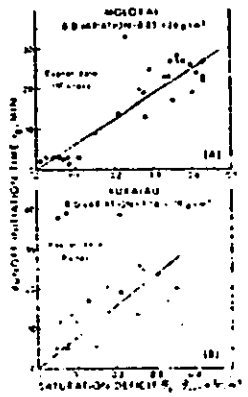

Figure 4.--Runoff initiation time as a function of antecedent soil-water saturation deficit measured in 20 or 27 runs at 8 or 10 sites of Molokai and Kukaiau soil series. B.D. = bulk density variation between sites.

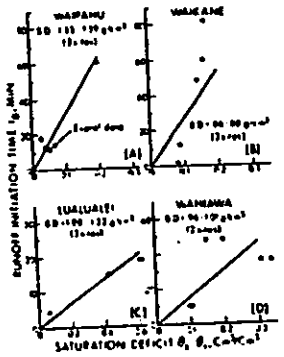

Figure 5.—Runoff initiation time as a function of antecedent soil-water saturation deficit measured at 2 to 3 sites of 4 different soil series on the island of Oahu. B.D. = bulk density variation between sites.

hold in some soils, but is not so well illustrated in others because of considerable scatter in the data. In general, the simple equation 4 is useful for approximate prediction of runoff initiation times on the uncropped soils used in this study. For practical application, equation 4 requires measurement of a relatively simple soil variable (initial water content) once the linear relationship has been defined. Subsequently, one may be able to make intelligent estimates of the effective erosion fraction of a storm and to determine the extent to which the erosion hazard depends on the prevailing water content of soil. This is important because erodibilities of Hawaii soils generally showed strong dependence on antecedent soil water contents, a matter that necessitated the use of two different K factors (dry and wet) for most soils (section VI).

B. Infiltration Characteristics Governing Runoff Hydrographs

The rates and amounts of runoff during a given rainstorm are very important factors in determining the rates and amounts of soil loss by erosion. The runoff hydrograph is, in turn, determined by the infiltration characteristics of a soil and the prevailing initial and boundary conditions. The purpose of this subsection is to analyze the infiltration data collected during the present study to deduce, as far as possible, the infiltration characteristics of different soils. A simple empirical-physical model is applied to describe infiltration rates, and its utility is evaluated. Because the field rain simulation studies were conducted with the primary objective of measuring soil erodibilities, not all the parameters for a detailed physical characterization of infiltration were measured.

1. The Infiltration Model

The simple approach of Green and Ampt (19) for describing water infiltration into a soil has recently been revived and successively applied to several

2. Results and Discussion

The detailed infiltration rates versus time for all soils, sites, and plots are presented in table 13. Table 8, shows the infiltration rates measured at the end of the runs, whether steady state was achieved, constants for fitting equation 6 to the data, the nature of fits, as well as comments on problems encountered during runs where applicable. Examples of the data and values predicted by equation 6 for eight selected cases are depicted in figures 7 to 10.

Achievement of steady state was judged visually based on plots of infiltration rate against time (Appendix). The data in table 8 indicate that infiltration of applied rain into a "dry" soil profile did not reach the steady state for any of the soils in the initial 2-hour period. Even for subsequent rainstorms, or wet runs, steady state was achieved only during two-thirds of the tests. There do not seem be consistent differences between soils in this regard.

The steady state infiltration rates were high in Waipahu (1.6 in/hr), Waikane (1.14 in/hr), and Kukaiau (0.8 to 1.02 in/hr) soils. They were moderately high in Pakini soil (0.61 to 0.82 in/hr), and rather moderate in Molokai (0.31 to 0.88 in/hr), Hilo (0.26 to 0.462 in/hr), Kawaihae (0.40 in/hr), and Naalehu (0.26 to 0.30 in/hr). In Lualualei soil, the steady infiltration rate was low (0.09 in/hr).

Selected cases of measured and predicted transient infiltration rates for three different soils presented in figures 7 to 10 showed a range of from good to poor fits of equation 6.

Figure 7 gives data for dry runs on two sites of Molokai soils where the fits are good. Figure 8 shows data from a dry and a wet run on the same plot at one of the sites of Molokai soil, where the fits are fair. Figure 9 depicts the data from a dry and a wet run on Waikane soil, where the fits are fair to poor. Examples of a dry and wet run on Kukaiau soil, shown in figure 10, are fair to good.

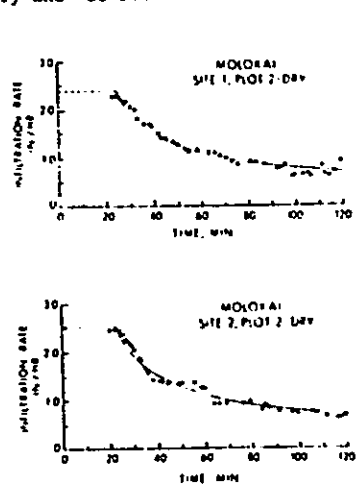

Figure 7.—Measured (circles) and predicted (curve) infiltration rates versus time for two selected sites of Molokai soil.

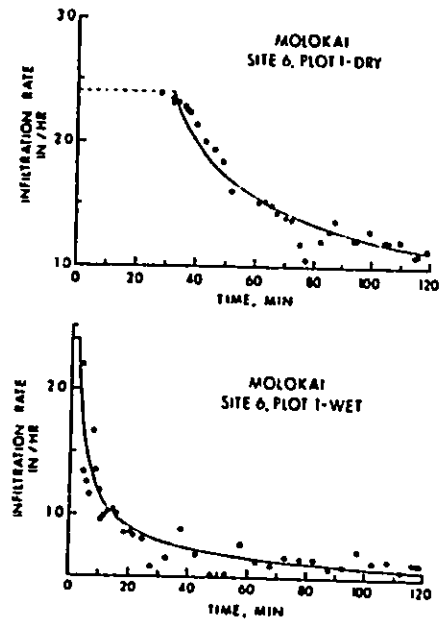

Figure 8.—Measured (circles) and predicted (curve) infiltration rates during dry and wet runs on a site of Molokai soil.

As mentioned earlier, table 8 gives the constants for fitting equation 6 to the measured infiltration rates for all the runs on different sites and soils. The nature of fit, whether good, fair, or poor, is indicated in each case. In several cases, the poor fit was a result of errors and scatter in the data due to machine breakdowns and water pressure fluctuations causing variable water application rates during the runs. In general, equation 6 provides reasonably acceptable fits to the field data for any given run. However, there is an appreciable variation in the values of coefficients fitted for different runs and different sites. Strictly, one may have to distinguish between different sites of a given soil, due to natural variation among them.

For practical predication of infiltration using equation 6, average values of the parameters *A* and *B* for the different soil series are listed in table 9. For each series, a dry run average, a wet run average, and an overall average value are tabulated. Parameters for runs in which data showed poor fits of equation 6 were not included in the averaging. Table 9 indicates that for parameter *A* some differences between the dry-run and wet-run average are not consistent among the different soils. Comparing equation 5 and 6, this parameter would not be expected to depend upon initial water content. Averaging over all the runs would, thus, provide the best estimate for the value of *A*. For parameter *B*, table 9 indicates that the dry-run averages are larger than the wet-run averages for all soils except Hilo. Initial water-content data presented in table 2

Table 2.—*Antecedent and final average soil moisture values*—Continued

Site	Plot	θ_i for depth of 0–3 in			θ_i for depth of 3–6 in			θ_i for depth of 6–12 in			θ_i for depth of 12–18 in			θ_i for depth of 18–24 in		
		θ_i	θ_f		θ_i	θ_f		θ_i	θ_f		θ_i	θ_f		θ_i	θ_f	
							HAIPAHU SERIES									
10	wet	11.3	40.1		14.6	42.0		18.6	47.3		34.8	45.9		34.5	47.2	
10	wet	10.1	41.9		39.0	40.6		38.4	44.0		38.0	39.2		35.5	43.3	
11	wet	21.3	39.0		25.1	38.8		25.9	37.2		26.5	36.8		26.0	36.1	
11	wet	11.9	45.0		39.2	40.4		40.4	41.2		39.0	40.4		36.8	40.6	
12	wet	22.9	42.2		30.5	41.2		35.3	43.2		35.3	38.7		36.3	39.8	
12	wet	21.0	44.0		21.2	45.5		43.8	45.0		41.5	40.0		41.0	39.7	
							WAHIAWA SERIES									
18		26.2	63.4		33.4	64.8		46.3	66.5		47.9	60.3		70.1	60.4	
12	wet	31.6	70.0		34.6	67.4		55.8	67.3		57.3	62.2		52.3	60.7	
	wet	29.5	67.7		51.6	64.3		61.5	67.7		56.3	55.3		50.3	60.3	
	wet	4.7	65.0		50.5	69.4		53.7	61.7		50.5	54.8		51.8	60.5	
	wet	55.0	68.2		50.4	66.6		63.2	72.0		59.5	62.8		56.7	63.7	
	wet	39.1	70.5		62.6	70.3		65.2	61.7		59.7	66.6		54.4	67.6	
							LUALUALEI SERIES									
20	wet	17.1	60.5		22.0	59.0		23.1	63.1		26.7	36.0		28.0	41.2	
20	wet	26.3	74.6		30.3	59.8		34.5	67.0		44.8	37.4		33.7	35.2	
21	wet	14.3	67.4		30.4	58.4		23.9	51.3		26.7	54.3		27.7	46.7	
22	wet	6.9	69.1		30.5	58.4		58.2	47.5		38.1	47.5		43.6	50.7	
22	wet	24.9	74.3		30.3	60.3		58.0	48.2		33.6	43.4		30.7	39.2	
							MAILANI SERIES									
23	wet	16.7	66.8		40.5	64.9		74.1	69.7		63.8	96.8		70.0	92.5	
23	wet	56.6	72.6		57.3	71.4		68.0	84.0		85.0	96.3		65.5	101.5	
24	wet	27.2	71.2		54.1	54.1		47.7	53.0		46.7	51.8		49.5	52.0	
24	wet	24.8	58.4		33.5	54.5		53.0	55.8		56.8	56.0		52.5	52.8	
25	wet	13.2	58.4		40.2	40.9		50.2	58.4		54.5	64.2		53.3	54.8	
25	wet	27.6	55.1		40.2	55.4		52.3	54.1		51.8	49.4		52.2	51.5	
							MOLOKAI (KAIU)									
19	wet	21.6	60.2		33.6	35.1		24.1	24.1		25.2	---		---	---	
18	wet	41.5	46.4		32.5	31.1		27.7	37.2		28.5	28.4		---	---	

ing site index requires standing trees and site index curves. Indirect estimates can be made from soil and site factors in prediction equations. This avoids damaging highly valuable walnut trees by boring the trunk to determine a tree's age.

Our "best" equation requires measuring both field factors and laboratory texture analysis. Although a little less accurate, the "easy-to-measure" equation should give adequate site evaluation information. Both equations make possible the evaluation of potential walnut growing sites on the western fringe of the tree's natural geographic range.

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Optimized runoff curve numbers for sugarcane and pineapple fields in Hawaii

Keith R. Cooley and Leonard J. Lane

ABSTRACT: Runoff curve numbers for Hawaiian sugarcane and pineapple fields were derived from actual rainfall-runoff data and used to adjust handbook values. These handbook values were based mainly on experience under mainland conditions and soils. The data-based curve numbers were slightly lower than previously used handbook values for sugarcane. They were considerably lower for pineapple fields where field roads occupied 11 to 20 percent of the area. Observations suggest that major portions of the runoff come from road areas and that more intensive conservation measures and maintenance programs for these roads would help reduce this runoff and subsequent erosion.

To design soil conservation practices, it is helpful to know the runoff and erosion potential of an area under various field, soil, and precipitation conditions. Agencies assigned the task of helping farmers develop conservation measures must therefore develop or adapt methods to estimate the amount of runoff expected from given rainfall. One method of estimating direct runoff from storm rainfall, based on data from runoff plots and watersheds and on years of field experience, is the runoff curve number method developed by the Soil Conservation Service (6). In most parts of the United States an experienced conservationist can estimate quite accurately the runoff curve number associated with a given field or watershed using the tabulated relationship derived between these curve numbers and various hydrologic soil-cover complexes.

In some areas, such as Hawaii, where data from small watersheds were almost nonexistent, SCS personnel estimated runoff curve number relations on the basis of experience obtained under mainland conditions (6). In 1972 the Science and Education Administration—Agricultural Research initiated a study on five small agricultural watersheds in Hawaii to determine actual runoff and erosion relations on sugarcane and pineapple land. Our report compares calculated runoff curve numbers with handbook values. We present tables of adjusted curve numbers under all soil conditions for both sugarcane and pineapple crops.

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Description of study watersheds

We selected five small, nonirrigated agricultural watersheds for the study. Two of the watersheds, planted to sugarcane, were on the island of Hawaii (Figure 1). The other three, one in sugarcane and two in pineapple, were on the island of Oahu (Figure 2). Data collection started in early 1972 on all of the watersheds except one pineapple site that was instrumented in 1975. Instrumentation on all sites consisted of a recording raingage, a water-stage recorder, a critical-depth flume, and a splitting and rotating sediment sampler (4). We visited each site weekly to maintain the recorders, take sediment samples, and record field crop and cover conditions.

Nonirrigated sugarcane in Hawaii normally requires 28 to 34 months from planting to harvest, depending mostly on rainfall availability at critical growth periods. Harvesting consists of cutting the stalks off at the soil surface, leaving only the roots. After harvest, the plants are allowed to come back, or ratoon, twice. Therefore, 6 to 8 years elapse between plowing, disking, and replanting operations (5).

Pineapple generally is harvested about 18 months after planting. In contrast to sugarcane harvest operations, only the fruit is picked in the first pineapple harvest. Two more such harvests are normally completed at 9-month intervals before the crop is chopped, allowed to dry, and burned. The fields are then plowed, disked, and replanted in plastic strips. This cycle takes about 3 years in most cases (1). The plastic strips control weed growth until the pineapple plants are established. The strips cover most of the bed area and about half of the total field. The pineapple shoots are placed through the plastic at designated points by hand.

Both crops provide a dense cover after 4 to 6 months of growth, thus providing the soil surface with considerable protection against rainfall impact. This dense cover affects surface sealing, runoff, and erosion.

A brief description and cropping history of each watershed follows. Table 1 summarizes the main characteristics of each site.

Laupahoehoe. This site was planted to sugarcane in March 1967, harvested in March 1971, ratooned, and harvested again in February 1974. Sugarcane was replanted in May 1974, the first crop harvested in August 1977, again ratooned, and scheduled for harvest in 1979. The watershed, which is 100 percent cultivated, is shaped like a clam shell, ending with a flat portion leading to the flume.

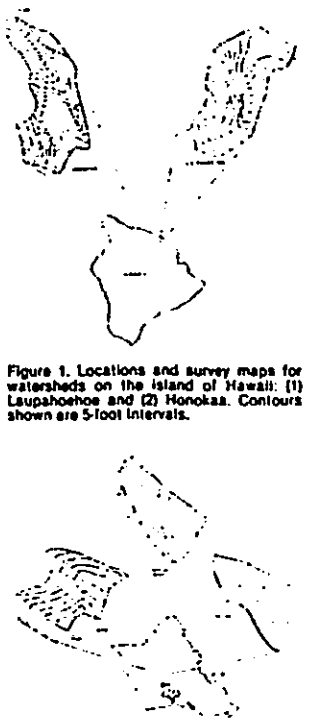

Figure 1. Locations and survey maps for watersheds on the island of Hawaii: (1) Laupahoehoe and (2) Honokaa. Contours shown are 5-foot intervals.

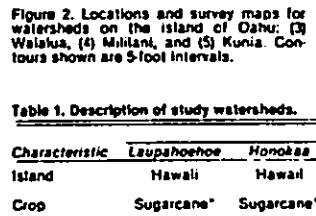

Figure 2. Locations and survey maps for watersheds on the island of Oahu: (3) Waialua, (4) Mililani, and (5) Kunia. Contours shown are 5-foot intervals.

Honokaa. This site was planted to sugarcane in May 1968, harvested in March 1971, ratooned, and again harvested in May 1974. Sugarcane was replanted in June 1974, the first crop harvested in October 1976, followed by a ratoon crop that was scheduled for harvest in 1979. The watershed, which is 100 percent cultivated, is somewhat elongated with alternating slopes of different gradients, the flattest being the area near the flume.

Waialua. This site was planted to sugarcane in December 1966, ratooned in August 1968, September 1970, August 1972, November 1974, and again in May 1977. The field was re-worked at least twice before replanting in March 1978. The watershed surface is convex, flat on the upper portion and steep on the lower site adjacent to the road. The road accounts for about 5 percent of the watershed area and forms the lower boundary.

Mililani. This site was planted to pineapple in late 1968. After the final harvest in mid-1972, weeds and grass were allowed to grow until the spring of 1973 when the site was tilled and planted to Irish potatoes. This cropping, often sparse and intermixed with weeds, lasted until mid-1976 when the field was again prepared for pineapple. Because of the limitation imposed by harvesting equipment, a road is needed at least every 100 feet in pineapple culture; thus, roads cover 15

Table 1. Description of study watersheds.

Characteristic	Watershed				
	Laupahoehoe	Honokaa	Waialua	Mililani	Kunia
Island	Hawaii	Hawaii	Oahu	Oahu	Oahu
Crop	Sugarcane*	Sugarcane*	Sugarcane*	Pineapple	Pineapple
Size (acres)	2.05 (2.72; 4.74) 1.52 (4.74; 79)	5.17	5.97	5.09 (2.72,4.73) 3.60 (4.73, 79)	7.02
Average annual precipitation (inches)	150-200	70-100	60-90	40-60	24-50
Soil series	Kaiwiki	Kukaiau	Paaloa	Wahiawa	Kolekole
Field texture	Silty clay loam	Silty clay loam	Silty clay	Silty clay	Silty clay loam
General soil slope (%)	18	17	10	5	7
Hydrologic soil group	A	A	B	B	C
Percent roads	0	0	5	15	11†

*All sugarcane watersheds cropped in nearly straight row cultivation, runoff curve numbe for roads taken as 90 (3).
†Some data were recorded from an earlier planting where roads occupied 20 percent an pineapple 80 percent of the area.

percent of the watershed area.

Kunia. This site has been planted to pineapple for nearly 50 years. The field was planted in May 1974, harvested in December 1975, and again in December 1976. A new crop was planted in May 1977. This watershed, the largest, has the most complex drainage pattern and the highest percentage of roads (17%) before the May 1977 planting. It also contained a waterway representing 3 percent of the area prior to the 1977 planting. In 1977 the road and waterway area were reduced to 11 percent of the watershed by eliminating most of the with-slope roads and planting across most of the waterway.

Rainfall on the watersheds ranges from a high of 150 to 200 inches at Laupahoehoe to 30 to 50 inches at Kunia. Most storms are of relatively low intensity, although they may last for rather long durations, and fit into the Type IA or I storm category defined by SCS (7). Higher intensity storms of Type II and IIA do occur on the islands occasionally (2), and very large storms of even low to medium intensity can cause considerable runoff and erosion. The winter months, November through March, are generally the wettest; June and July are the driest, although rainfall can occur at any time. In some areas it rains almost every day (8, 9).

Study procedures

The SCS procedure for estimating runoff volume due to rainfall uses the equation:

$$Q = \begin{cases} 0 & , P \le 0.2\,S \\ \dfrac{(P-0.2S)^2}{(P+0.8S)} & , P > 0.2\,S \end{cases} \quad [1]$$

where, Q is the runoff volume in inches, P is the storm rainfall in inches, and S is the retention parameter in inches.

From S in equation 1 a runoff curve number, CN, is defined as:

$$CN = \frac{1,000}{10+S} \quad [2]$$

with values between 0 (no runoff) and 100 (all rainfall becomes runoff).

This procedure incorporates four soil classifications, three antecedent moisture classifications, and various cover complexes. The soil classification is broken into four hydrologic soil groups, A, B, C, and D, varying from relatively low runoff potential (A) to high runoff potential (D). Antecedent moisture condition I represents a relatively dry condition, II represents an average or normal condition, and III represents a wet antecedent condition. Runoff

Table 2. Summary of optimized runoff curve numbers (CNs) for small sugarcane watersheds in Hawaii.

	SCS Runoff Curve Numbers and Statistics for Various Cover Conditions*											
	Bare Condition			Limited Cover			Partial Cover			Complete Cover		
Watershed	CN	R^2	N	CN	R^2	N	CN	R^2	N	CN	R^2	N
Laupahoehoe	50	.83	33	-	-		-	-	-	36	34	50
Honokaa	60	20	6	-	-		-	-	-	20	.05	44
Waialua	80	.89	16	-	-		62	.87	16	49	64	34

*Cover condition classifications. Bare, no vegetative cover; limited cover, cane new or ratooned with less than 50 percent canopy cover; partial cover, transition from limited to complete cover with over 50 percent canopy cover; complete cover, full canopy provided until time of harvest.

curve numbers also reflect land use, such as fallow, row crops, and pasture, as well as treatments or practices, such as straight-row cultivation, contour farming, and terracing, as described in the National Engineering Handbook (6). The usual SCS procedure, which we followed here, is to determine runoff curve numbers for the given soil and cover complexes for antecedent moisture classification II. In actual practice, the curve number for condition II is selected and then adjusted for the existing moisture condition (6).

However, if observed rainfall and runoff data are available, S (or CN) can be determined in equation 1 by optimization. The objective function, G, is defined as:

$$G = \sum_{i=1}^{n} (Q_i - Q_{ei})^2 \quad [3]$$

where, Q_i is an observed runoff volume, Q_{ei} is a computed runoff volume using equation 1, and n is the number of storms in the data set. The optimal CN is that value that minimizes G in equation 1. Associated with the "best" or least squares estimate of CN from equation 3 is a coefficient of determination, R^2. Values of R^2 near zero would indicate that fitting the SCS model, equation 1, was little better than using the mean runoff volume as a predictor. Values of R^2 near one would indicate nearly perfect fit.

When a watershed consists of heterogeneous land use, a common procedure is to average the curve numbers associated with each land use to form a composite curve number. However, under Hawaiian conditions of sugarcane and pineapple cultivation, where access roads have very high curve numbers and cultivated areas have low curve numbers, this procedure did not seem appropriate. Therefore, we decided to distribute the curve numbers based upon the percentages of watershed area in roads and in crops. With this distribution, the runoff equation becomes:

$$Q = \frac{A_r(P-0.2S_r)^2}{(P+0.8S_r)} + \frac{A_c(P-0.2S_c)^2}{(P+0.8S_c)} \quad [4]$$

where, A_r is the proportion of the total watershed area in roads and A_c is the proportion of the total watershed area in crops. In equation 4, $A_r + A_c = 1.0$ and $Q = 0$ unless $P > 0.2S_c$ (rainfall must exceed the smaller initial abstraction that occurs on the roads in this case). Again, given A_r and A_c, it is possible to determine the optimal S_c value (or CN) for the second term in equation 4 using an objective function described by equation 3. Thus we specified curve numbers for the roads (3) and derived optimal curve numbers for the cultivated areas. For relatively large values of A_r, the contribution of the roads to total runoff can be significant. Under conditions such as those described above, where almost all sediment comes from the roads, even small values of A_r can be significant in calculating runoff and sediment yield.

Results

Sugarcane. We used observed rainfall and runoff data from two small watersheds without roads and from one watershed with roads covering 5 percent of the watershed area to determine optimal CNs for sugarcane cultivation (Table 2). Curve numbers decrease as the cover conditions change from bare to full. Also, there is a great deal of variability among watersheds, and the curve numbers are greater for the soils in hydrologic soil group B than for those soils in group A. Figures 3 and 4 show the data for the A and B soils, respectively. Also shown in these figures are curve numbers taken from the SCS National Engineering Handbook (6). The handbook values are generally higher than corresponding optimized curve numbers for straight-row cultivation of sugarcane.

Table 3. Runoff curve numbers for sugarcane cover, hydrologic soil groups on small Hawaiian watersheds. All curve numbers for nearly straight-row cultivation.

	Hydrologic Soil Group†			
Cover*	A	B	C	D
Bare	50 (77)‡	80 (86)	89 (91)	92 (94)
Limited cover	45 (67)	71 (78)	82 (85)	87 (89)
Partial cover	40 (49)	62 (69)	75 (79)	81 (84)
Complete cover	36 (39)	49 (61)	60 (74)	66 (80)

*Cover conditions: Bare, no vegetative cover; limited cover, cane new or ratooned with less than 50 percent canopy cover; partial cover, transition from limited to complete cover with over 50 percent canopy cover; complete cover, full canopy provided until time of harvest.
†Curve numbers for Hydrologic Soil Group C and D extrapolated from figure 5.
‡Italic values are optimized curve numbers from observed data. Values in parentheses are from handbook (6)

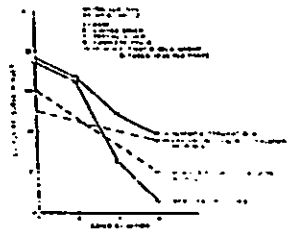

Figure 3. Relation between cover condition and runoff curve number for sugarcane, A soils.

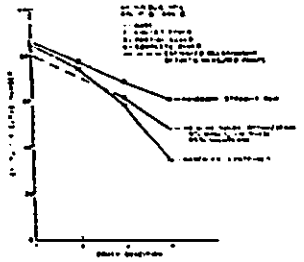

Figure 4. Relation between cover condition and runoff curve number for sugarcane, B soils.

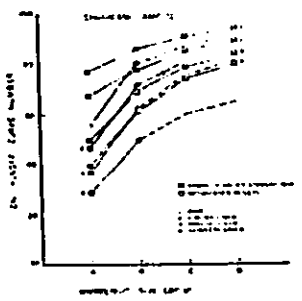

Figure 5. Variation in curve numbers with soil groups for various cover conditions, sugarcane.

Pineapple. We used observed rainfall and runoff data from two small watersheds with 11 to 20 percent of the area occupied by field roads and the remainder planted to pineapple to determine curve numbers. Table 4 summerizes the optimized curve numbers for these two watersheds. The curve numbers decrease as crop cover increases, and they are greater for the C soils than for the B soils. Figures 6 and 7 show the data for the B and C soils, respectively. Also shown are curve numbers from the SCS handbook. The handbook values are higher than corresponding optimized curve numbers for cultivated pineapple. The magnitude of the difference is much greater than is the difference for sugarcane, suggesting that the pineapple crop provides a much better cover than originally postulated. The optimized values for sugarcane generally fall between the straight-row and contoured handbook values, whereas the optimized values for pineapple are 20 to 30 percent lower than the lowest (contoured and terraced) handbook values for both B and C soils.

Because the observed data were limited to watersheds with A and B soils, we needed a method to extrapolate the results to C and D soils. The square points with solid lines in figure 5 illustrate changes in curve numbers for the four hydrologic soil groups with various cover conditions, as given in the SCS Handbook (6). We used these same trends with soil groups to extrapolate the optimized curve numbers for C and D soils, as shown by the dashed lines with the circled points in figure 5.

We used the optimized curve numbers (Table 2) and the extrapolated curve numbers (Figure 5), along with curve number values obtained using the SCS "Curve Number Aligner," to derive the curve numbers in table 3. Because of the extreme scatter of data from the Honokaa site (poor R^2 in table 2), we gave little weight to these data. Three of the curve numbers for A and B soils (Table 3) are interpolated from figures 3 and 4 and all curve numbers for C and D soils are extrapolated from figure 5. However, these curve numbers represent the best available information from observed data and from trends established in the SCS handbook (6). Also shown in table 3 are handbook curve numbers presently used in Hawaii for comparison.

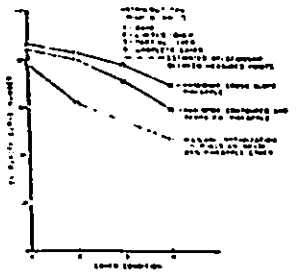

Figure 6. Relation between cover condition and runoff curve number for pineapple, B soils.

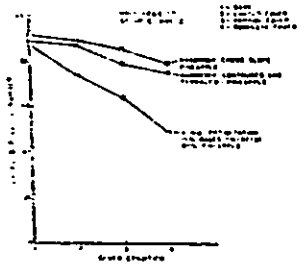

Figure 7. Relation between cover conditio and runoff curve number for pineapple, soils.

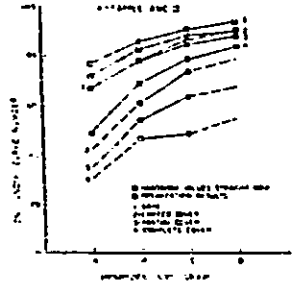

Figure 8. Variation in curve numbers wi soil groups for various cover condition pineapple.

to watersheds with B and C soil types, t method described previously for sugarca was used to extrapolate values for A and soils. The square points with solid lir (Figure 8) illustrate changes in curve nu bers for the four hydrologic soil grou with various cover conditions, as given the SCS handbook (6). We used these sa general trends with soil groups and th

obtained using the curve number aligner to extrapolate the optimized curve numbers for A and D soils. We did not use the data for mixed cover of various crops and weeds to develop the values in table 4, but used them as reference values only. In developing the values in table 4, we observed that the C soil at Kunia may respond more like a B soil under full cover conditions, but insufficient data were available to verify this observation or change soil groupings.

One of the curve numbers for the B soils (Table 5) is interpolated from figure 6, and all of the curve numbers for A and D soils are extrapolated from figure 8 and the curve number aligner. However, these curve numbers represent the best available information from observed data and from trends established in the SCS handbook (6). Table 5 also shows handbook curve number values in parentheses presently used by SCS in Hawaii. Handbook values are not included for the limited cover stage because SCS does not use this breakdown. The agency includes everything between the time when a crop is planted until initial closing in, in the partial cover stage.

Discussion and conclusions

The runoff curve numbers we developed are slightly lower than previously used handbook values for sugarcane and considerably lower for pineapple. Although a considerable amount of extrapolation was needed to obtain values for all conditions, these curve numbers represent the best available information.

The slightly lower curve number values obtained for sugarcane would probably not change design criteria significantly. However, the considerably lower values obtained for pineapple indicate that the pineapple offers much more protection than was anticipated. It could well be that, except for very large storms, all runoff comes from field roads. If this is the case (and the data indicate that it is, but the watersheds were not instrumented to provide proof), perhaps present conservation design procedures need modification. At present, roads and fields are apparently treated similarly. Field roads are periodically graded, which aggravates the situation and eliminates in many cases the runoff checks and collection ditches originally installed. The results of this study indicate that the most intensive conservation measures should be applied to the roads and that present field practices may be adequate, especially once the pineapple is established. Maintenance of the conservation measures on road areas would be possible at all times, whereas field measures cannot be easily repaired or changed once the crop has been planted until after final harvest and cultivation.

Reducing runoff from the road areas could significantly reduce erosion from pineapple fields because the soil on the road areas is generally fine and unstable due to effects of vehicle traffic. In this condition, it is susceptible to erosion from even small runoff events.

Table 4. Summary of optimized runoff curve numbers (CNs) for small pineapple watersheds in Hawaii.

	SCS Runoff Curve Numbers and Statistics for Various Cover Conditions*											
	Bare Condition			Limited Cover			Partial Cover			Complete Cover		
Watershed	CN	R²	N	CN	R²	N	CN	R²	N	CN	R²	N
Mililani	78	.37	20	61†	.93	24	-	-	-	47	.93	15
Kunia	87	.74	11	74	.88	7	64	.85	7	49	.83	33

*Field roads were considered separately and assigned CNs of 90 for Mililani and 92 for Kunia (3).
†Values computed from mixed cover of crops and weeds rather than pineapple

Table 5. Runoff curve numbers for pineapple cover, hydrologic soil groups on small Hawaiian watersheds. All curve numbers for nearly cross-sloped row cultivation.

	Hydrologic Soil Group†			
Cover*	A	B	C	D
Bare	74 (77)	*84 (86)*‡	89 (91)	92 (94)
Limited cover	58 -	74 -	*82* -	87 -
Partial cover	43 (67)	64 (78)	76 (85)	81 (89)
Complete cover	18 (49)	*48 (69)*	65 (79)	73 (84)

*Cover conditions. Bare, no vegetative cover; limited cover, stage of cover between time of planting until plants extend beyond plastic strips (provide about 50% cover)—this stage is not used by SCS, but is included in partial cover stage; partial cover, from 50 percent cover to initial closing in (greater than 80% cover); complete cover, stage of growth when crop is completely closed in.
†Curve numbers for Hydrologic Soil Groups A and D extrapolated from figure 8.
‡Italic values are optimal curve numbers from observed data. Values in parentheses are from handbook (6).

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Dates to remember

July 16-18, National Association of Conservation Districts North Central Region Meeting
Chicago, Illinois
Write: NACD, 1025 Vermont Avenue, N.W., Washington, D.C. 20005

July 20-28, National Association of Conservation Districts Southeastern Region Meeting
Richmond, Virginia
Write: NACD, 1025 Vermont Avenue, N.W., Washington, D.C. 20005

July 21-23, Symposium on Watershed Management
Boise, Idaho
Write: Richard Hawkins, UMC 52, Utah State University, Logan, 84322, or Clifton W. Johnson, SEA-USDA,

July 21-25, International Conference on Soil Conservation
Silsoe, Bedford, England
Write: National College of Agricultural Engineering, Silsoe, Bedford, England MK45 4DT

July 23-25, Irrigation and Drainage—Today's Challenges
Boise, Idaho
Write: American Society of Civil Engineers, 345 East 47th Street, New York, N.Y. 10017

July 28-30, Toxic and Hazardous Substances Annual Educational Conference
Milwaukee, Wisconsin
Write: National Environmental Health Association, 1200 Lincoln Street, Denver, Colorado 80203

SOIL SURVEY OF THE ISLANDS OF KAUAI, OAHU, MAUI, MOLOKAI, AND LANAI, STATE OF HAWAII

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D STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF HAWAII AGRICULTURAL EXPERIMENT STATION

UAI, OAHU, MAUI, MOLOKAI, and LANAI—ive of the eight major islands in the State of ii—make up the survey area (fig. 1). The Hawaiian ts, the 50th State of the United States, lie in the c Ocean about 2,100 miles west southwest of San isco, California. Honolulu, on the island of Oahu is the principal city and the State capital. It is on the crossroads of the Pacific and serves as a gateway to Asia and the South Pacific.

The area surveyed covers 1,463,820 acres, or 2,287 square miles. The total land area of Kauai is 355,000 acres, or 555 square miles; Oahu 386,500 acres, or 604 square miles;

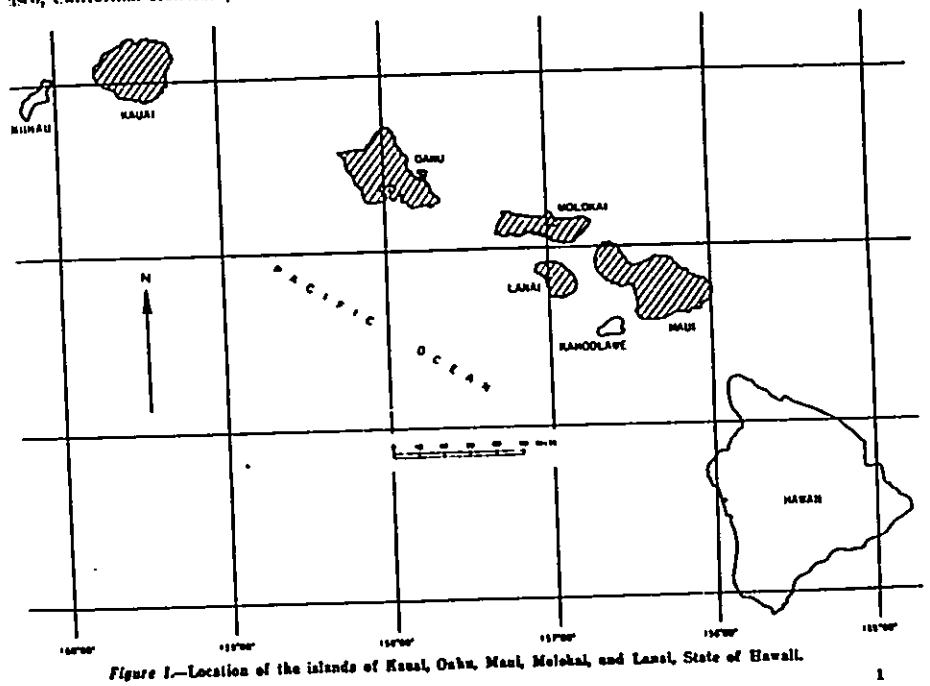
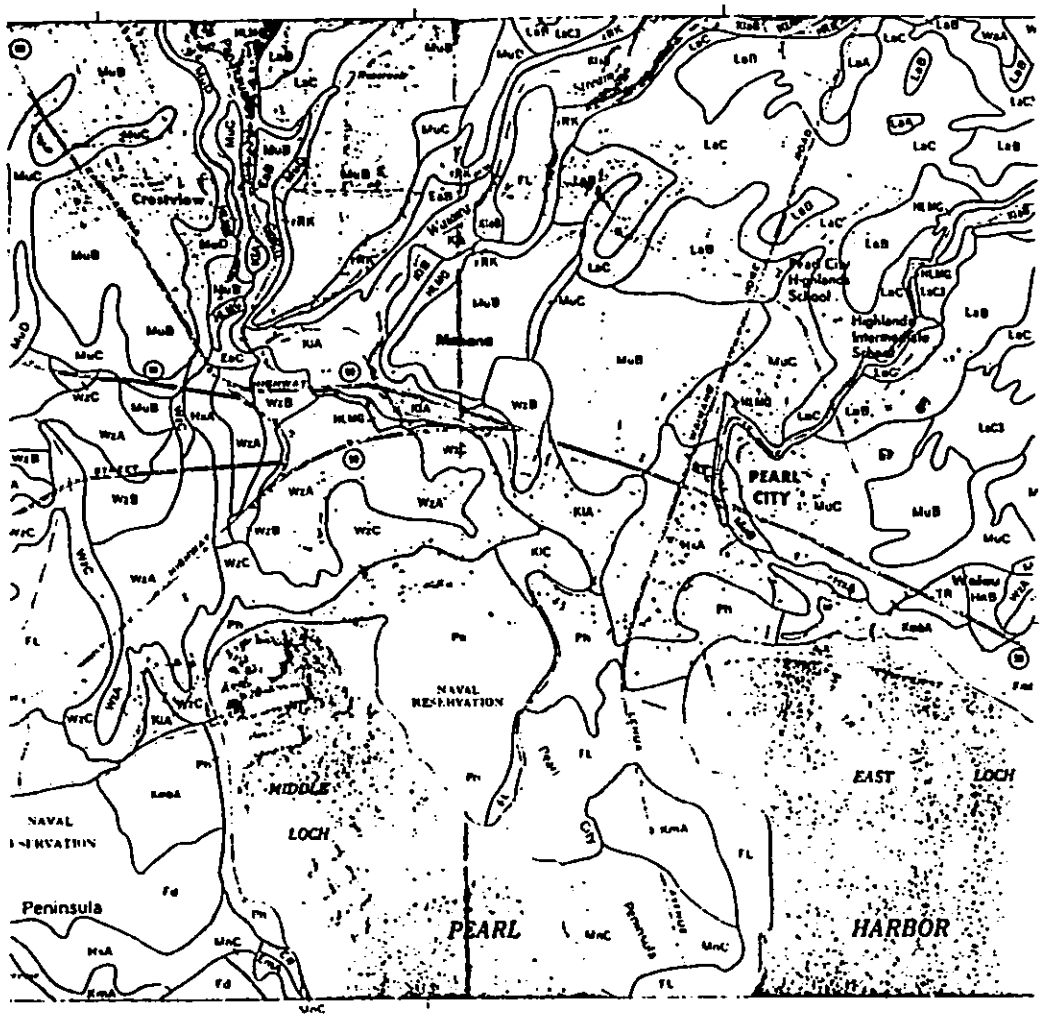
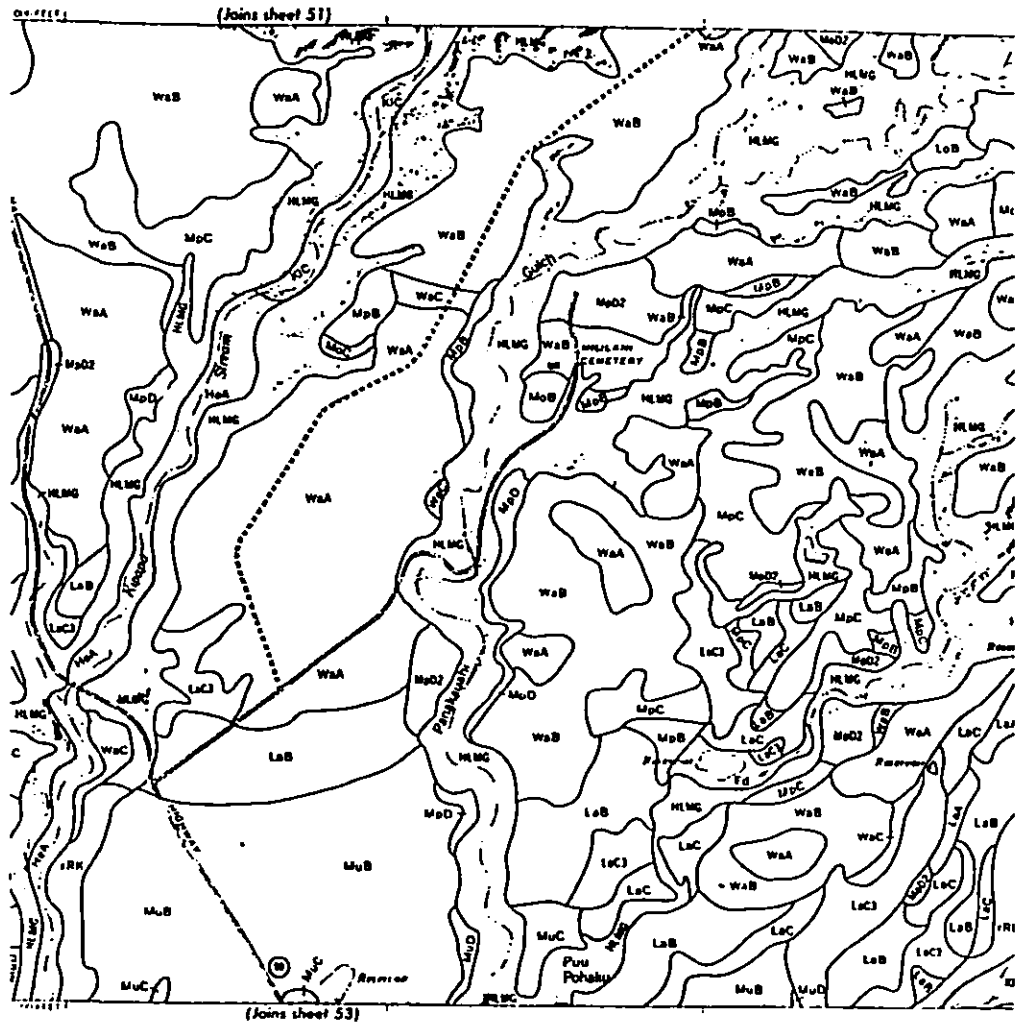


Figure 1.—Location of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.

OAHU ISLAND, HAWAII — SHEET NU





Scale 1:24 000

TABLE 3.—*Engineering interpretations*—Continued

Soil series and map symbols	Suitability as a source of—		Soil features affecting—								
	Topsoil	Road fill	Highway location	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings[1]	Degree and kind of limitations for septic tank filter fields
				Reservoir areas	Embankments						
Kunuwela: KZC	Poor: very low fertility.	Fair to good: wet in winter.	Slopes as much as 15 percent.	Moderately rapid permeability.	(?)		(?)	(?)	Very low fertility	Moderate bearing capacity; slopes as much as 15 percent.	Moderate: slopes generally more than 5 percent.
Lahaina: LaA, LaB, LaB3, LaC, LaC3, LaD, LaD3, LaE3.	Good	Good	Slopes as much as 40 percent.	Slopes as much as 40 percent; moderate permeability.	(?)		Moderate permeability; slopes as much as 40 percent.	Slopes as much as 40 percent.	Slopes as much as 40 percent.	Slopes as much as 40 percent.	Slight on slopes of 0 to 7 percent; moderate on slopes of 7 to 15 percent; severe on slopes of more than 15 percent.
Laumaia: LME, LMF	Good	Fair: moderate compressibility; unstable slopes; low compacted density.	Moderate compressibility; moderate bearing capacity; unstable; slopes as much as 70 percent.	High seepage rate; slopes as much as 70 percent.	Low compacted density; high erodibility; subject to piping; unstable.		Slopes as much as 70 percent.	Slopes as much as 70 percent; highly erodible.	Highly erodible; slopes as much as 70 percent.	Moderate bearing capacity; moderate compressibility; slopes as much as 70 percent.	Severe: slopes generally more than 10 percent.
LNE	Good, except stony.	Fair: moderate compressibility; unstable slopes; low compacted density; stony.	Moderate compressibility; moderate bearing capacity; unstable slopes; slopes as much as 40 percent; stoniness.	Stoniness; slopes as much as 40 percent; high seepage rate.	Low compacted density; high erodibility; subject to piping; unstable; stoniness.		Stoniness; slopes as much as 40 percent.	Highly erodible; stoniness; slopes as much as 40 percent.	Highly erodible; slopes as much as 40 percent; stoniness.	Moderate bearing capacity; moderate compressibility; stoniness; slopes as much as 40 percent.	Severe: slopes generally more than 10 percent.
Lawai: LcB, LcC, LcD	Fair: low fertility.	Fair: subject to seepage.	Subject to seepage; slopes as much as 25 percent.	Moderate to moderately rapid permeability; slopes as much as 25 percent.	Poor workability. See also (?).	ct to age.	Slopes as much as 25 percent; subject to seepage.	Poor workability; subject to seepage; slopes as much as 25 percent.	Poor workability; slopes as much as 25 percent.	Subject to seepage; slopes as much as 25 percent.	Severe: subject to seepage; slopes as much as 25 percent.
Leilehua: LeB, LeC	Fair: low fertility.	Good	(?)	Moderately rapid permeability.	(?)		Moderately rapid permeability; slopes as much as 12 percent.	(?)	Slopes as much as 12 percent.	Moderate shrink-swell potential; high shear strength; slopes as much as 12 percent.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent.
Lihue: LhB, LhC, LhD, LhE2, LIB, LIC	Good	Good	All features favorable, except slopes as much as 40 percent.	Moderately rapid permeability; slopes as much as 40 percent.	High shear strength; high compacted density.		Moderately rapid permeability; slopes as much as 40 percent.	All features favorable where slopes are not more than 20 percent.	Slopes as much as 40 percent.	Slopes as much as 40 percent; high shear strength.	Slight on slopes of 0 to 8 percent; moderate on slopes of 8 to 15 percent; severe on slopes of more than 15 percent.
Loiehua: LoB, LoC, LoD, LoE, LoF	Fair: low fertility.	Good	All features favorable, except slopes as much as 70 percent.	Moderately rapid permeability; slopes as much as 70 percent.	(?)		(?)	Slopes as much as 70 percent.	Slopes as much as 70 percent.	Susceptible to sliding; slopes as much as 70 percent.	Slight on slopes of 3 to 8 percent; moderate on slopes of 8 to 15 percent; severe on slopes of more than 15 percent.

See footnotes at end of table.

TABLE 3.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Farm ponds	
				Reservoir areas	Embankments
Lualualei: LuA, LuB	Poor: very sticky and very plastic.	Poor: very plastic; high shrink-swell potential.	Very plastic; high shrink-swell potential.	High shrink-swell potential; slow permeability.	Low shear strength; very plastic; high shrink-swell potential.
LvA, LvB, LPE	Poor: very sticky and very plastic; stony.	Poor: very plastic; high shrink-swell potential; stony.	Very plastic; high shrink-swell potential; stoniness; slopes as much as 35 percent.	High shrink-swell potential; slow permeability.	Low shear strength; very plastic; high shrink-swell potential; stoniness.
Mahana: MaC, MaD, MaD3, MaE, MaE3, MeC2, MeD2, MeE2, MBL. For Badland part of MBL, see Badland.	Fair: low fertility.	Fair: erodible; unstable on steep slopes.	Slopes as much as 35 percent.	Moderately rapid permeability; slopes as much as 35 percent.	Poor stability; erodible; subject to piping.
Makaalae: MID, MWE	Poor: very sticky and very plastic.	Poor: very plastic; high shrink-swell potential.	High shrink-swell potential; slopes as much as 40 percent.	High shrink-swell potential; slopes as much as 40 percent; moderate permeability.	High shrink-swell potential; poor workability; limited volume of material.
MJD	Poor: very sticky and very plastic; stony.	Poor: very plastic; high shrink-swell potential; stony.	High shrink-swell potential; slopes as much as 25 percent; stoniness.	High shrink-swell potential; slopes as much as 25 percent; moderate permeability.	High shrink-swell potential; poor workability; limited volume of material; stoniness.
Makalapa: MdB, MdC, MdD	Poor: very sticky and very plastic.	Poor: very plastic; high shrink-swell potential.	High shrink-swell potential; poor workability; slopes as much as 20 percent.	High shrink-swell potential; slopes as much as 20 percent; slow permeability.	High shrink-swell potential; low shear strength.
Makapili: MeB, MeC, MeD, MeE	Fair: low fertility.	Good	All features favorable, except slopes as much as 40 percent.	Moderately rapid permeability; slopes as much as 40 percent.	(1)
Makawao: MfB, MfC	Fair: low fertility.	Fair to good: fair compaction characteristics.	(1)	Moderately rapid permeability.	Moderate compressibility; moderate shear strength.
Makawell: MgB, MgC, MgD, MgE2, MhB, MhC, MhD, MhE	Good, except stony in places.	Good, except stony in places.	Slopes as much as 35 percent.	Moderate permeability; slopes as much as 35 percent.	All features favorable, except stony in places.

See footnotes at end of table.

tions—Continued

ltural age	Soil features affecting—Continued				Degree and kind of limitations for septic tank filter fields
	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings[1]	
.....	Slow intake rate; high available water capacity.	Poor workability; high shrink-swell potential.	Poor workability; difficult to establish plants.	High shrink-swell potential; low shear strength.	Severe: slow permeability.
.....	Slow intake rate; high available water capacity; slopes as much as 35 percent.	Poor workability; high shrink-swell potential; stoniness; slopes as much as 35 percent.	Poor workability; difficult to establish plants; stoniness; slopes as much as 35 percent.	High shrink-swell potential; low shear strength; stoniness; susceptible to sliding on slopes more than 15 percent.	Severe: slow permeability; slopes as much as 35 percent.
.....	Slopes as much as 35 percent; erodible.	Slopes as much as 35 percent; erodible; susceptible to siltation.	Slopes as much as 35 percent; susceptible to siltation of channels.	Slopes as much as 35 percent.	Moderate on slopes of 6 to 12 percent; severe on slopes of more than 12 percent.
.....	Slopes as much as 40 percent; moderate permeability.	Poor workability; slopes as much as 40 percent.	Poor workability; slopes as much as 40 percent.	High shrink-swell potential; slopes as much as 40 percent; low shear strength.	Severe: slopes generally more than 10 percent.
.....	Slopes as much as 25 percent; stoniness.	Poor workability; slopes as much as 25 percent; stoniness.	Poor workability; stoniness; slopes as much as 25 percent.	High shrink-swell potential; slopes as much as 25 percent; stoniness.	Severe: slopes generally more than 10 percent.
.....	Slow intake rate; slopes as much as 20 percent; high available water capacity.	Poor workability; high shrink-swell potential.	Poor workability; difficult to establish plants.	High shrink-swell potential; low shear strength; susceptible to sliding where slopes are more than 15 percent.	Severe: slow permeability.
.....	(1)	Slopes as much as 40 percent.	Slopes as much as 40 percent; low fertility.	Slopes as much as 40 percent.	Slight on slopes of 0 to 8 percent; moderate on slopes of 8 to 15 percent; severe on slopes of more than 15 percent.
.....	High intake rate; moderately rapid permeability.	(1)	Slopes as much as 15 percent; low fertility.	Moderate shrink-swell potential; moderate shear strength.	Slight on slopes of 3 to 7 percent; moderate on slopes of 7 to 15 percent.
.....	Slopes as much as 35 percent; stony in places.	Susceptible to siltation; slopes as much as 35 percent; stony in places.	Susceptible to siltation of channels; difficult to establish plants; stony in places.	Slopes as much as 35 percent.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; severe on slopes of more than 12 percent.

TABLE 3.—*Engineering*—Continued

Soil series and map symbols	Suitability as a source of—		Soil features affecting—						Degree and kind of limitations for septic tank filter fields
	Topsoil	Road fill	Highway location	Farm ponds		Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings[1]	
				Reservoir areas	Embankments					
Makena: MXC	Good, except stony in places.	Fair: erodible; unstable slopes; stony in places.	Erodible; unstable slopes; stoniness.	Moderately rapid permeability.	Poor stability; poor compaction characteristics; erodible; piping hazard; stoniness in places.	Complex slopes; stoniness; susceptible to wind erosion; erodible.	Stoniness in places; complex slopes; susceptible to wind erosion; erodible.	Highly erodible; stoniness in places; susceptible to siltation of channels; difficult to establish plants; slopes as much as 15 percent.	Stoniness in places; slopes as much as 15 percent.	Moderate on slopes of 3 to 15 percent; stoniness in places.
Makiki: MkA, MlA	Fair: very sticky and very plastic; stony in places.	Fair: very sticky and very plastic; moderate shrink-swell potential; stony in places.	Very sticky and very plastic; moderate shrink-swell potential; stony in places.	Moderate shrink-swell potential; moderately rapid permeability; stony in places.	Moderate shrink-swell potential; fair compaction characteristics; stony in places.	(?)	(?)	(?)	Moderate shrink-swell potential; moderate shear strength; stony in places.	Slight: moderately rapid permeability.
Mala: MmA, MmB	Good	Good	Subject to flooding on 0 to 3 percent slopes.	Subject to flooding on 0 to 3 percent slopes; moderate permeability.	(?)	Slopes as much as 7 percent; moderate permeability.	Susceptible to siltation.	Susceptible to siltation of channels; difficult to establish plants.	Subject to flooding on 0 to 3 percent slopes; high shear strength.	Slight, except where subject to flooding.
Malama: MYD	Poor: extremely stony; less than 10 inches to fragmental Aa lava.	Good: fragmental Aa lava at a depth of less than 10 inches.	Fragmental Aa lava.	Very rapidly permeable; fragmental Aa lava.	Fragmental Aa lava at a depth of less than 10 inches.	Very high intake rate; very low available water capacity; extremely stony.	Fragmental Aa lava at a depth of less than 10 inches.	Fragmental Aa lava at a depth of less than 10 inches.	Extremely stony; fragmental Aa lava at a depth of less than 10 inches.	Severe: lack of filter material; may pollute underground water.
Mamala: MrC	Poor: coral below a depth of 8 to 20 inches.	Poor: less than 20 inches deep over coral; stony.	Coral at a depth of less than 20 inches; stoniness.	Coral at a depth of less than 20 inches; moderate permeability.	Limited volume of material; stoniness; coral at a depth of less than 20 inches.	Coral at a depth of less than 20 inches; stoniness; slopes as much as 12 percent.	Coral at a depth of less than 20 inches; stoniness.	Coral at a depth of less than 20 inches; stoniness; slopes as much as 12 percent; difficult to establish plants.	Coral at a depth of less than 20 inches; slopes as much as 12 percent; stoniness.	Severe: coral at a depth of less than 20 inches.
Manana: MoB, MoC, MoD2, MpB, MpC, MpD, MpD2, MpE	Good	Good	Slopes as much as 40 percent.	Slopes as much as 40 percent; moderate permeability.	Slopes as much as 40 percent.	Slopes as much as 40 percent; thin panlike layer at a depth of 15 to 30 inches.	All features favorable where slopes are not more than 20 percent.	Slopes as much as 40 percent.	Slopes as much as 40 percent; high shear strength.	Slight on slopes of 2 to 8 percent; moderate on slopes of 8 to 15 percent; severe on slopes of more than 15 percent.
Mokuleia: Me, Ms, Mt, Mtb	Good to a depth of 20 inches; fair below 20 inches.	Good to a depth of 20 inches; fair below 20 inches; unstable, erodible.	Loose sand at a depth of 20 inches.	Rapid permeability below a depth of 20 inches.	Unstable; erodible material below a depth of 20 inches; subject to piping; poor compaction characteristics.	Rapid permeability and low available water capacity below a depth of 20 inches.	Sand at a depth of less than 20 inches; erodible below a depth of 20 inches.	Sand at a depth of less than 20 inches; erodible below a depth of 20 inches.	Sand at a depth of less than 20 inches; low shrink-swell potential below a depth of 20 inches.	Slight: rapid permeability below a depth of 20 inches.
Mtu	Fair: high water table.	Poor: high water table.	High water table.	High water table.	High water table; unstable; erodible material below a depth of 20 inches; poor compaction characteristics.	High water table; needs drainage.	High water table; sand at a depth of less than 20 inches.	Sand at a depth of less than 20 inches; high water table.	High water table; sand at a depth of less than 20 inches	Severe: poorly drained.

See footnotes at end of table.

TABLE 3.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Farm ponds	
				Reservoir areas	Embankments
Molokai: MuA, MuB, MuB3, MuC, MuC3, MuD.	Good	Good	Slopes as much as 25 percent.	Slopes as much as 25 percent; moderate permeability.	(?)
MuD3	Poor: soft, weathered rock at a depth of 12 to 20 inches.	Good	Slopes of 15 to 25 percent.	Slopes of 15 to 25 percent; moderate permeability.	(?)
Naiwa: NAC, NAC3	Fair: low fertility.	Fair: erodible; unstable on steep slopes.	Slopes as much as 20 percent; unstable on moderately steep slopes; erodible.	Moderately rapid permeability; slopes as much as 20 percent.	Poor stability; erodible; subject to piping.
Niu: NcC, NcD, NcD2, NcE2.	Good	Good	Slopes as much as 35 percent.	Slopes as much as 35 percent; moderate permeability.	(?)
Niulil: NLE, NME	Fair: low fertility.	Poor: poor workability; low shear strength; low compacted density.	Slopes as much as 30 percent; low bearing capacity; high compressibility.	High seepage rate	Low compacted density; high compressibility; high shrinkage.
Nohili: Nh	Poor: very sticky and very plastic; 20 to 40 inches to high-lime layer.	Poor: high shrink-swell potential; poorly drained; poor workability; highly plastic.	High shrink-swell potential; poorly drained; low shear strength.	High shrink-swell potential; poorly drained; moderately slow permeability.	High shrink-swell potential; very plastic; poor workability; low shear strength.
Nonopahu: NnC	Poor: very sticky and very plastic.	Poor: highly plastic; high shrink-swell potential; poor workability.	High shrink-swell potential; low shear strength.	High shrink-swell potential; moderately slow permeability.	High shrink-swell potential; very plastic; poor workability; low shear strength.
NoC	Poor: very sticky and very plastic; stony.	Poor: highly plastic; high shrink-swell potential; poor workability; stony.	High shrink-swell potential; low shear strength; stoniness.	High shrink-swell potential; moderately slow permeability.	High shrink-swell potential, very plastic; poor workability; low shear strength; stoniness.
Oanapuka: OAD, OED	Poor: stony	Fair: erodible; unstable on steep slopes; slopes as much as 25 percent; stony.	Slopes as much as 25 percent; stoniness.	Slopes as much as 25 percent; moderately rapid permeability.	Poor compaction characteristics; piping hazard; stoniness.

See footnotes at end of table.

...—Continued

...ral ...e	Soil features affecting—Continued				Degree and kind of limitations for septic tank filter fields
	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings[1]	
.....	Slopes as much as 25 percent; moderate permeability.	Slopes as much as 25 percent; susceptible to siltation.	Susceptible to siltation of channels; slopes as much as 25 percent; difficult to establish plants.	Slopes as much as 25 percent.	Slight on slopes of 0 to 7 percent; moderate on slopes of 7 to 15 percent; severe on slopes of more than 15 percent.
.....	Slopes of 15 to 25 percent; moderate permeability.	Slopes of 15 to 25 percent; susceptible to siltation.	Slopes of 15 to 25 percent; susceptible to siltation of channels; difficult to establish plants.	Slopes of 15 to 25 percent.	Severe: 15 to 25 percent slopes.
.....	Slopes as much as 20 percent; erodible.	Slopes as much as 20 percent; erodible; subject to siltation.	Slopes as much as 20 percent; susceptible to siltation of channels.	Slopes as much as 20 percent.	Moderate: slopes generally 7 to 15 percent.
.....	Moderate permeability; slopes as much as 35 percent.	Slopes as much as 35 percent.	Slopes as much as 35 percent.	Slopes as much as 35 percent.	Moderate on slopes of 6 to 12 percent; severe on slopes of more than 12 percent.
.....	Slopes as much as 30 percent; moderately rapid permeability.	Slopes as much as 30 percent; poor workability.	Slopes as much as 30 percent; poor workability.	Low bearing capacity; high compressibility; susceptible to sliding on steep slopes; slopes as much as 30 percent.	Severe: slopes generally more than 10 percent.
...ua- ...ch ...ile.	Moderately slow permeability; high water table; high available water capacity.	Poorly drained; poor workability; high shrink-swell potential.	Poorly drained; poor workability.	Poorly drained; high shrink-swell potential; low shear strength.	Severe: poorly drained.
...y slow ...ility.	Moderately slow permeability; slopes as much as 10 percent.	Poor workability; high shrink-swell potential.	Poor workability; high shrink-swell potential.	High shrink-swell potential; low shear strength; moderately well drained; slopes as much as 10 percent.	Severe: moderately well drained; moderately slow permeability.
...y slow ...ility.	Moderately slow permeability; stoniness; slopes as much as 12 percent.	Poor workability; high shrink-swell potential.	Poor workability; high shrink-swell potential; stoniness.	High shrink-swell potential; low shear strength; moderately well drained; stoniness; slopes as much as 12 percent.	Severe: moderately well drained; moderately slow permeability.
.....	Stoniness; slopes as much as 25 percent; erodible.	Stoniness; slopes as much as 25 percent; erodible; susceptible to siltation.	Stoniness; slopes as much as 25 percent; susceptible to siltation of channels; difficult to establish plants.	Stoniness; slopes as much as 25 percent; moderate compressibility.	Severe: stoniness; slopes generally more than 10 percent.

TABLE 3.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Farm ponds	
				Reservoir areas	Embankments
Wahiawa: WaA, WaB, WaC, WaD2.	Good	Good	All features favorable, except where slopes are as much as 25 percent.	Moderately rapid permeability; slopes as much as 25 percent.	(1)
Wahikuli: WbB, WcB	Fair to good: stony in places; bedrock at a depth of 20 to 40 inches.	Fair to good: stony in places; bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches; slopes as much as 15 percent.	Moderate permeability; bedrock at a depth of 20 to 40 inches; slopes as much as 15 percent.	Bedrock at a depth of 20 to 40 inches; stoniness in places.
Waiakoa: WeB, WeC, WfB, WgB, WgC, WhB, WhC, WlD2.	Good, except cobbly or stony in places.	Good, except cobbly or stony in places.	Bedrock at a depth of 20 to 40 inches; slopes as much as 25 percent; cobbly or stony in places.	Moderate permeability; bedrock at a depth of 20 to 40 inches.	Poor stability; piping hazard; bedrock at a depth of 20 to 40 inches.
Waialeale: rWAF	Poor: always wet; saprolite below a depth of 10 to 22 inches.	Poor: always wet; low shear strength; low bearing capacity.	Wetness; low shear strength; slopes as much as 70 percent.	Slopes of 30 to 70 percent; high seepage rate.	Wetness; poor compaction characteristics; low shear strength.
Walahua: WkA, WkB, WlB, WlE, WmD, WnB.	Fair: very sticky and very plastic; stony in places.	Poor: very sticky and very plastic; moderate shrink-swell potential; stony in places.	Moderate shrink-swell potential; low shear strength; slopes as much as 30 percent; stony in places.	Moderate permeability; moderate shrink-swell potential; slopes as much as 30 percent.	Moderate shrink-swell potential; low shear strength stoniness in places.
Waiawa: WJF	Very poor: very sticky and very plastic; rocky; less than 20 inches deep.	Very poor: very sticky and very plastic; rocky; bedrock at a depth of less than 20 inches.	Slopes 30 to 80 percent; bedrock at a depth of less than 20 inches; high shrink-swell potential; rockiness.	(1)	High shrink-swell potential; limited material; rockiness; low shear strength.
Waihuna: WoA, WoB, WoC, WoD, WohB.	Poor: very sticky and very plastic.	Poor: high shrink-swell potential; very sticky and very plastic.	High shrink-swell potential; slopes as much as 25 percent; low shear strength.	High shrink-swell potential; slopes as much as 25 percent; moderately slow permeability.	High shrink-swell potential; clayey; low shear strength
Waikane: WpB, WpC, WpE, WpF, WpF2, WpsE.	Fair: low fertility; stony in places.	Good	Slopes as much as 70 percent; stony in places.	Slopes as much as 70 percent; moderately rapid permeability.	(1)

See footnote at end of table.

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Soil features affecting—Continued					Degree and kind of limitations for septic tank filter fields
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings[1]	
	Moderately rapid permeability; slopes as much as 25 percent.	All features favorable where slopes are less than 20 percent.	Slopes as much as 25 percent.	Slopes as much as 25 percent; high shear strength.	Slight on slopes of 0 to 8 percent; moderate on slopes of 8 to 15 percent; severe on slopes of more than 15 percent.
	Moderate permeability; slopes as much as 15 percent; stoniness in places.	Bedrock at a depth of 20 to 40 inches; stoniness in places.	Bedrock at a depth of 20 to 40 inches; slopes as much as 15 percent; stoniness in places.	Bedrock at a depth of 20 to 40 inches; slopes as much as 15 percent; stoniness in places.	Severe: bedrock at a depth of less than 40 inches.
	Erodible; slopes as much as 25 percent; bedrock at a depth of 20 to 40 inches.	Susceptible to siltation; bedrock at a depth of 20 to 40 inches; cobbly or stony in places.	Susceptible to siltation of channels; difficult to establish plants; slopes as much as 25 percent, cobbly or stony in places.	Slopes as much as 25 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
stones; saprolite at a depth of 10 to 22 inches.	(1)	Slopes of 30 to 70 percent; wetness.	Slopes of 30 to 70 percent; wetness.	Slopes of 30 to 70 percent; wetness; low shear strength; susceptible to sliding.	Severe: slopes 30 to 70 percent; always wet; saprolite at a depth of 10 to 22 inches.
derate permeability.	Moderate permeability; slopes as much as 30 percent; stoniness in places.	Moderate shrink-swell potential; clayey; stoniness in places.	Slopes as much as 30 percent; stoniness in places.	Moderate shrink-swell potential; low shear strength; stoniness in places.	Slight on slopes of 0 to 8 percent; moderate permeability. Moderate on slopes of 8 to 15 percent; severe on slopes of more than 15 percent.
).	(1)	(1)	(1)	High shrink-swell potential; susceptible to sliding; slopes of 30 to 80 percent; rockiness; low shear strength.	Severe: bedrock at a depth of less than 20 inches; slopes of 30 to 80 percent.
derately slow permeability.	Slow intake rate; slopes as much as 25 percent; moderately slow permeability.	Clayey; high shrink-swell potential; slopes as much as 25 percent.	Clayey; slopes as much as 25 percent.	High shrink-swell potential, low shear strength; slopes as much as 25 percent.	Severe: moderately slow permeability.
	(1)	All features favorable where slopes are less than 20 percent.	Slopes as much as 70 percent.	Slopes as much as 70 percent.	Slight on slopes of 0 to 8 percent; moderate on slopes of 8 to 15 percent; severe on slopes of more than 15 percent.

TABLE 4.—*Engineering test data*

[Tests were performed by the Bureau of Public Roads]

Soil name and location	Parent material	BPR report number	Depth	Mechanical analysis: Percentage passing sieve— No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Percentage smaller than— 0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Liquid limit	Plasticity index	Classification: AASHO	Unified
			In.								Pct.			
Lualualei clay: 0.05 mile west of entrance gate to Lualualei Naval Radio Station and southwest along fence, 100 feet north toward radio tower. Island of Oahu.	Alluvium from basic igneous rock.	S61-790 791	1-10 22-30	------	------	99 99	97 98	91 92	81 82	73 74	60 76	30 49	A-7-6(20) A-7-6(20)	MH CH
Molokai silty clay loam: one mile southwest of Kualapuu in block 4, 0.32 mile northeast of junction 47 and east of Highway 47. Island of Molokai.	Basic igneous rock.	781 783	0-11 37-63	100 100	100 97	92 85	89 80	80 62	62 41	52 33	44 46	16 16	A-7-6(11) A-7-5(12)	ML-CL ML
Naiwa silty clay loam: 1.45 miles north of Wallace School, 0.2 mile west and 0.3 mile south on trail up side of hill. Island of Maui.	Basic igneous rock.	780 781	0-4 14-26	100 100	99 99	94 97	92 97	82 96	64 96	36 83	40 36	8 7	A-4(8) A-4(8)	ML ML
Wahiawa silty clay: 0.5 mile southeast of Waipio. Island of Oahu.	Basic igneous rock.	798 799	0-16 32-60	100	99	92	91 100	89 99	86 98	81 91	62 68	24 29	A-7-5(18) A-7-5(20)	MH MH

The USDA texture is the apparent field texture. By standards of mechanical analysis, most soils described in this survey are clay.

Permeability refers only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on soil structure, soil porosity, and data from a limited number of permeability tests made on undisturbed cores. Plowpans, surface crusts, and other properties resulting from use of the soils were not considered.

Estimated available water capacity is an estimate of the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The estimates are based on extensive laboratory tests, on field experience, and on soil properties.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials. Generally, soils classified CH have a high shrink-swell potential, and those classified ML or SP have a low shrink-swell potential. Many of the soils classified OH occur in high rainfall areas and are continuously wet throughout the year. These soils exhibit high shrinkage and low swell potential when placed in a dry environment.

Corrosivity, as used here, indicates the potential danger to uncoated metal or concrete structures through chemical action that dissolves or weakens the structural material. Structural material may corrode when buried in soil, and a given material corrodes in some kinds of soil more rapidly than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than are installations entirely in one kind of soil or soil horizon.

Engineering interpretations

Table 5 contains information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but some of the important desirable features ar

ENVIRONMENTAL COMMUNICATIONS INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

Mrs. Jacquelin N. Miller
Acting Associate Director
Environmental Center
U.H. of Hawaii at Manoa
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Mrs. Miller:

We are in receipt of your Center's comments dated March 10, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments have been provided to the applicant as well as the specific sub-consultants involved in the preparation of the specific studies used for the DEIS.

I. General Comments

We are in general agreement with the position taken by the Environmental Center on their overall review as provided in this section. On pages I-3 and II-1, it is stated that the purpose of the EIS is to provide the Department of General Planning an opportunity to plan on a 10-10-10 year basis, the future growth patterns of Central Oahu. They have stated by so doing, the shortcomings of current capacity in infrastructure facilities can be targeted for expansion if the planning process dictates that this be done. In this capacity, the DEIS does exactly that in pointing out deficiencies in the infrastructural systems for the Central Oahu area should this and other projects come on line in the next 10-20 years.

Given that market parameters may change drastically within that planning period, the applicant may choose to alter his project plans radically, or abandon the project.

II. Archaeology

These responses to this subject area were provided by Chiniago, Inc. who conducted the preliminary investigations.

1. The Environmental Center commented: "A rationale for the sampling area procedure, and sampling fraction should be provided."

   Our report stated "Because of the extensive ground disturbance associated with this sugarcane cultivation, the primary efforts of

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the survey were directed to the gulches." This was done due to the minimal likelihood that any significant remains are located on the tops of the plateaus because former sugarcane and pineapple cultivation would have destroyed them. The presence of archaeological sites on the plateaus is also unlikely because Hawaiian sites typically are located either close to the shore or in valley bottoms, rather than on plateau tops.

2. The Environmental Center incorrectly presumed that the rationale we chose was "due to the lack of personnel and time available..." In fact, the answer to this point is the same as the previous one, that is, the amount of time spent in the field was determined by the likelihood of finding sites, as limited by the physiographic conditions of the survey area.

3. As for the Environmental Center's concerns regarding what they refer to as "subsurface contents," we in fact recognized the possibility that subsurface deposits might be present, and recommend that the developer retain an archaeologist to monitor construction and grading activities. This approach will ensure that sites and the information contained in them will be adequately studied.

III. Traffic

Appendix E of the Draft EIS provided estimates of the number of vehicles expected to be generated during the peak hours (Table 2) and their origins and destinations. While traffic volumes during peak hours are primarily home-based work trips, other trips also occur and their destinations may be different. Table 3 summarizes the directions which traffic from the various land uses are expected to travel. The mitigation of all Level of Service F conditions identified in Table 5 are discussed in the traffic report, either with a design improvement such as providing multiple-lane ramps or a loop ramp to avoid left turns, or by implementing a demand modification program. These proposed actions were developed to be consistent with long-range plans proposed by the State Department of Transportation for the regional transportation system.

The traffic study considered the entire twenty-year development being proposed by the Gentry Companies for Waiawa. Other development in Central and Leeward Oahu were also considered, but because simply summing all proposed developments would far exceed the official population projections, the traffic study evaluated the most critical situation where the proposed project would be fully developed. The traffic report will be revised to more clearly indicate the contributions to traffic from the Waiawa by Gentry and Gentry 515 projects.

The interchange improvements and other programs that will be needed

have been identified in the EIS, which is a disclosure document; the responsibility of funding and coordination of such programs and improvements will be identified during the review/approval process.

IV. Public Facilities and Services

Final planning for the proposed land uses will be more definitive as this project manuevers its' way through the City Development Plan process, the State Land Use Commission Boundary Review process, and the City's Zoning process. During this period, the applicant will have determined the basis of the development plan they will pursue based on market demands for the proposed retirement communities, commercial/industrial parks, and open space recreational land uses (golf course, parks, etc.). Bearing down during these various review processes will be agencies such as; Department of Land and Natural Resources, Board of Water Supply, Department of Health, Department of General Planning, Department of Planning and Economic Development, Department of Land Utilization, the Land Use Commission, the Planning Commission, the City Council, and the many neighborhood boards and community associations. Insurance against contamination of the Pearl Harbor Groundwater Control Area is not considered a problem on the basis of continued review of proposed development plans by these agencies.

V. Soils/Storm Drainage

Thank you for the publication; they have been forwarded to Dr. Dugan for his information and review.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

F. J. Rodrigues

FJR:ls

University of Hawaii at Manoa

Water Resources Research Center
Holmes Hall 283 • 2540 Dole Street
Honolulu, Hawaii 96822

2 March 1987

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

Dear Mr. Clegg:

SUBJECT: EIS for Gentry 515 Development, Waiawa, Central Oahu, Hawaii, February 1987

We have reviewed the subject draft EIS and offer the following comment. The EIS has not fully considered the impact on the following items:

1. Water System. Is there available water from the Pearl Harbor groundwater control area which has a limited supply of 225 MGD maximum sustainable yield?

2. Groundwater aquifer. What is the impact of urbanization which will reduce the area available for groundwater recharge and may be a possible source of pollution to the aquifer which is the potable source for the Navy (Waiawa Shaft)?

3. Sewage disposal. What is the capacity of Honouliuli Wastewater Treatment Plant and the current flow treated? If the capacity is affected by the total Waiawa project, will the City and County of Honolulu expand their plant to handle the load?

4. Solid waste. What is the capacity of the Waipahu incinerator facility? What are the alternatives for solid waste disposal such as landfill? What is volume of waste estimated to be produced by the total Waiawa project?

Many of the questions have been raised by other agencies in reply to the EISPN and yet the draft EIS contain few or no answers. In particular is the impact on the Waiawa Shaft which is a source of potable water for the Navy. Several agencies have expressed concern about possible contamination from both the Waiawa Development Project and the Gentry 515 Project and yet the EIS for both projects ignore the subject of

groundwater hydrology completely even though the subject matter was acknowledged in letters of reply to comments to the EISPN.

Other comments offered are: Figures 1 and 2 need map scales and north direction to facilitate orientation of both projects.

Thank you for the opportunity to comment. This material was reviewed by WRRC personnel.

Sincerely,

Henry Lee for

Edwin T. Murabayashi
EIS Coordinator

HG:ETM:jm

cc: Mr. F.J. Rodriguez, President
Evironmental Communications, Inc.

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

Mr. Edwin T. Murabayashi
EIS Coordinator
Water Resources Research Center
University of Hawaii at Manoa
Holmes Hall 283
2540 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Murabayashi:

We have received your Center's comments dated March 7, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The aplicant and the civil engineering consulting have reviewed the comments and we respond as follows:

1. For water source, the applicant proposes to request allocation of the project's required 4.7 million gallons per day (mgd) from the Board of Water Supply. This request would be made against present and future surplus BWS water allocated by the Department of Land and Natural Resources in the Pearl Harbor Ground Water Control District. Surplus water should be available in the Pearl Harbor district upon completion of several BWS projects which would reduce present export as well as replace present use of potable water with waste spring water for irrigation of highway landscaping. Additionally, water transfers from agricultural use may be approved and, therefore, become available at the time of project implementation. In this manner, no additional water will be withdrawn from the Pearl Harbor Water Control District over its designated sustainable yield of 225 mgd.

   The cost estimate for construction of the water deepwells, booster stations, storage reservoirs and major transmission and distribution mains is approximately $14,326,000.

   A master plan for the project's proposed water system will be prepared and submitted for the Board of Water Supply's approval after grant of State and County land use amendments but prior to County rezoning.

2. A study is being planned at the request of the U.S. Navy to determine the real impacts of the recharge area for the Waiawa Shaft. The study is being conducted by your Center with the cooperation of the Board of Water Supply. In the approximately 18-months required to complete the study, the results should go a long way to answer questions such as yours about the recharge and groundwater contamination problems.

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3. The Department of Public Works, City & County of Honolulu indicates that existing and approved projects (under present population restraints to year 2005) will require a total capacity of 35.42 mgd at the Honouliuli WWTP whose present capacity is 25 mgd. If so, the WWTP capacity should not be increased to 37.5 mgd, but to its ultimate capacity of 51 mgd and, therefore, provide for Waiawa development and other future projects within the tributary area.

4. Solid Waste service will in all probability be provided by the City for the residential single family detached homes and by private collection on the multi-family residential, commercial, and light industrial land uses. Waipahu Incinerator has a 500 ton/day rating, and the proposed Waste - Energy incinerator at Campbell Industrial Park will be operational in the next 5 - 7 years. Total waste anticipated by the Waiawa project has not been calculated since the land use policy changes have not been finalized. The existing local waste generation rate is 8.8 lbs per capita per day, according to the Refuse Division, Department of Public Works.

We regret that we have not been able to go into the extent of detail that reviewing agencies and offices would normally expect to receive in DEIS; as we stated, this document is unique in the sense that it is essentially a planning document only. We request your indulgence in your review. Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

F. J. Rodrigues

FJR:ls

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 5, 1987

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE PROPOSED GENTRY 515 DEVELOPMENT IN WAIAWA, TMK: 9-4-06: POR. 10 AND 9-6-04: POR. 1 AND 4

Thank you for the opportunity to review the Draft EIS for the proposed Gentry 515 development in Waiawa. We offer the following comments:

1. The water master plan for the proposed Gentry 515 project should incorporate the proposed Waiawa development. The water system should be installed and completed before water can be made available to the proposed Gentry 515 project.

2. If the Waiawa water system is designed to serve the Gentry 515 water system, then the Gentry 515 development can be connected to the Waiawa development. If not, the Gentry 515 development will have to install a completely new water system inclusive of a source, reservoir, and transmission mains.

3. The estimated demand of 1.81 million gallons per day (mgd) of potable water, as shown on page VII-17, is too low. For the proposed development, as shown on page III-4, the demand for potable water should be approximately 2.40 mgd.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

4. The project site is in the Pearl Harbor Ground Water Control Area (PHGWCA) which is controlled by the State Department of Land and Natural Resources (DLNR). Therefore, permission to drill wells and withdraw water from the ground water basin (permitted use) must be obtained from DLNR and coordinated with the Board of Water Supply.

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

KAZU HAYASHIDA

cc: Mr. F.J. Rodriguez, President
Environmental Communications, Inc.

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

March 23, 1987

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

Dear Mr. Hayashida:

We are in receipt of your office's comments dated March 5, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The applicant has reviewed the comments and we respond as follows:

1. There is understanding that the water master plan for the Gentry 515 project will be incorporated into the Gentry Waiawa project water master plan. The two projects will be interdependent for water demand and will be planned on that basis.

2. The Waiawa water system will be designed to accommodate the 515 project and as described in the project summary of this document, the 515 project is planned to fill in the lands on the Waiawa Ridge anticipated for development.

3. The correction on page VII-17 water demand of 2.40 mgd instead of 1.81 mgd will be made in the Final EIS.

4. It is understood that any withdrawal from the PHGWCA must be reviewed and approved by the State Department of Land and Natural Resources and coordinated with your office.

   The project Water Master Plan will be provided at the appropriate time during Zoning Application for review by the Board of Water Supply to substantiate the water requirements.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

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PB 87-147

February 17, 1987

MEMO TO: MR. DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: DRAFT EIS FOR GENTRY 515 DEVELOPMENT
WAIANAE, OAHU

We have reviewed the draft EIS for the proposed Gentry 515 Development and have no comments.

Thank you for the opportunity to review the document.

HERBERT K. MURAOKA
Director and Building Superintendent

TH:ly
cc: J. Harada
F. J. Rodrigues

NO RESPONSE NEEDED

FEB 19 1987

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

MIKE MOON
DIRECTOR

ROBERT MIYABATO
DEPUTY DIRECTOR

March 11, 1987

MEMORANDUM

TO: Donald A. Clegg, Chief Planning Officer
Department of General Planning

FROM: Mike Moon

SUBJECT: Draft Environmental Impact Statement
Gentry 515
Waiawa, Oahu

We have reviewed the draft Environmental Impact Statement (EIS) for the Gentry 515 project. As noted previously in our comments of January 19, 1987 regarding the EIS Preparation Notice for the proposed project, we have concerns relating to the feasibility and marketability of the proposed development. Specifically, we question whether or not there exists the potential for the housing market to absorb the 9,300 retirement units which would cumulatively be developed among the proposed Gentry 515 Waiawa and Mililani-Mauka projects, and find the draft EIS to be deficient in addressing this issue.

Thank you for the opportunity to comment.

MIKE MOON
Director

✓cc: Mr. F. J. Rodriguez

MAR 13 1987

RECEIVED AFTER DEADLINE DATE

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

Mr. Mike Moon, Director
Department of Housing and
Community Development
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Moon:

We are in receipt of your department's comments dated March 11, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments were received after the stated deadline of March 10, 1987. They have been reviewed by the applicant and we respond in following:

Marketing a new concept in residential uses is at best an educated guesstimate by consultants and developers. Ideally, the planned design for new innovations such as "Leisure Villages" can progress through site plans, individual unit floor plans, for the various amenities, and the many other considerations that go into the early stages of market analysis. A great deal of emphasis is also placed on previously established communities that are successful to determine how they were successful, where they made errors, and how best to avoid these errors.

In the final analysis, however, the marketplace will determine whether or not any product will be acceptable and purchased by the intended market segment. It is a learning process that the applicant will be experiencing and sharing with government as the project continues through the land use policy review process; we regret that your office has found the DEIS deficient due to non-availability of marketing data to support the "Leisure Villages" concept.

Thank you for your comments and continuing concern.

Very truly yours

F. J. Rodriguez

FJR:ls

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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 2/87-503

February 23, 1987

Mr. Fred J. Rodriguez, President
Environmental Communications, Inc.
P.O. Box 536
Honolulu, Hawaii 96809

Dear Mr. Rodriguez:

Draft Environmental Impact Statement for
the Proposed Gentry 515 Development
at Waiawa, Central Oahu
Tax Map Keys 9-4-06: por. 10; 9-6-04: por. 1 and 4

We have reviewed the subject Draft Environmental Impact Statement (EIS) and have the following comments:

1. The urban usage chart on page III-4 of the Draft EIS should include acreages and unit counts for the Waiawa Development and the total acreages and unit counts for the Gentry 515 plus the Waiawa Development. It was mentioned earlier in the Draft EIS that the Gentry 515 project is contingent upon the implementation of the proposed Waiawa Development, as such the cumulative impact of the two projects should be considered in this EIS.

2. Section VII-E., Waiawa Population Forecast, should include the total population impact from the Gentry 515 and Waiawa Development.

3. Section VII-F., Impact on Traffic Conditions, should be revised to use the methodology being developed to respond to the concerns of the City Department of Transportation Services and the State Department of Transportation presented in response to the Draft EIS for the Waiawa Development. Impacts should be discussed incrementally (the Gentry 515 project) and cumulatively (the total impact for the Gentry 515 and Waiawa Development).

FEB 24 1987

4. Section VII-I., Impact on Infrastructure and Utilities, discusses the incremental impact of the Gentry 515 project. A discussion of the cumulative impacts of the Gentry 515 and Waiawa Development should also be discussed.

If you have any questions, please contact Keith Kurahashi of my staff at 527-6051.

Sincerely,

Donald Clegg

DONALD A. CLEGG
Chief Planning Officer

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

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:

We are in receipt of your department's comments dated February 23, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments have been reviewed by the applicant and the consultants and we respond as follows:

1. The urban usage chart on page II-4 will be revised to show cumulative acreages and unit counts for the Gentry 515 and Waiawa projects.

2. Section VII-E will include the population figures for both the Gentry 515 and Waiawa projects.

3. The Traffic Impact Report identified future conditions with development of both the Waiawa and Gentry 515 projects, since the latter project is dependent on the former. A comparison of the future conditions with the project, as presented in the traffic report for the Gentry 515 project, and the comparable case for the Waiawa Development project provides an estimate of the "impacts" of the proposed Gentry 515 project. Several traffic measures are presented below to compare the traffic impacts of the Waiawa by Gentry and the Gentry 515 projects:

	Future Traffic Conditions with Project	
Measure	Waiawa by Gentry	Gentry 515 Project
Volume-to-capacity ratio(unmitigated)		
On H-2 south of Waipio		
AM Peak Hour - Southbound	0.95	1.06
- Northbound	0.49	0.54
PM Peak Hour - Southbound	0.67	0.74
- Northbound	0.94	1.04
At Kamehameha/Waipahu intersection		
AM Peak Hour	0.98	0.99
PM Peak Hour	0.89	0.99
Mitigation: Reduction needed in traffic generation at Waipio Interchange		
AM Peak Hour	22 %	36 %
PM Peak Hour	0 %	29 %
Improvements needed at Waipio Interchange (Loop ramp)	single-lane	double-lane

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The projections that provide the basis for these comparisons, however, also account for expected regional traffic increases which are independent of the Gentry 515 project; therefore, the comparisons may not be clearly indicative of the impact of the project.

The responses to the City Department of Transportation Services (DTS) and State Department of Transportation during the review of the Waiawa-by-Gentry project are also applicable to this project. The table presented in the response to DTS is expanded to show that net traffic generation used in the study for the Gentry 515 project still compares favorably with a count of existing traffic:

External Vehicular Trips/Dwelling Unit

		Ewa Beach*	Waiawa	Gentry 515
AM Peak Hour	- Ins	0.15	0.17	0.17
	- Outs	0.26	0.31	0.29
PM Peak Hour	- Ins	0.25	0.28	0.26
	- Outs	0.12	0.18	0.18

* 1985 Traffic Counts by State Highways Division, Station 11-D (G&H), with estimated 4,400 dwelling units and 700 jobs.

4. A revised discussion is provided on pp. VII-17 for the cumulative and incremental impacts that the Gentry-Waiawa and Gentry 515 projects will have on Water Supply and Wastewater management. We have shown the individual figures and would advise that approvals from the DLNR for the water development planning, and the DPW for the wastewater development planning, would move on an "as approved" basis during the land use policy review and approval process. In simple language, as the base project (Waiawa) moves from Development Plan review to the State Land Use Commisison to the DLU for zoning review and approval, the contingent utility and infrastructure planning would move accordingly.

We regret our vagueness in not providing more than what has been indicated in the revisions made in the FEIS, and would request your indulgence in maintaining the perspective that this document is a planning tool for review purposes only.

Thank you for your patience and continuing concern.

Very truly yours,

F. J. Rodriguez

F. J. Rodriguez

FJR:ls

Enclosure

Parsons Brinckerhoff 100 YEARS

Parsons Brinckerhoff Quade & Douglas, Inc.
Engineers
Planners

700 Bishop Street
Suite 813
Honolulu, HI 96813-4109
808-531-7094
Telex: RCA 723-8362

February 24, 1987

Mr. F. J. Rodriguez
Environmental Communications, Inc.
P. O. Box 536
Honolulu, Hawaii 96809

Dear Fred:

SUBJECT: Waiawa By Gentry EIS
Comments on Draft by DTS

A "Response to DTS Comments" is attached for your use in preparing a response to DGP, as requested. A draft of these responses was sent to Kenneth Hirata at DTS on February 20, 1987 for review and comment. They are "looking at it" but have no comments as of today.

A revised Traffic Impact Assessment Report is attached for your use. Should you have any questions, please call me at phone 531-7094.

Very truly yours,

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Julian Ng

Attach.
cc: Tosh Hosoda
Kenneth Hirata

A Century of Engineering Excellence

JAN 16 1987

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU

TEL-7510
FAX-83225

January 9, 1987

MEMORANDUM

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: JOHN E. KIRTH, DIRECTOR

SUBJECT: WAIAWA DEVELOPMENT, DRAFT ENVIRONMENTAL IMPACT STATEMENT
TMK: 9-4-001: POR. 10
9-4-011: POR. 1

This is in response to DGP's letter of December 5, 1986.

We have reviewed the EIS, in particular the Traffic Impact Assessment Report for the subject project and have the following comments:

1. The impacts of projected traffic at ultimate completion along Kamehameha Highway system should be assessed and studied in details to determine appropriate roadway widths of all major internal streets.

2. The method of determining the proportion of internal trips at 30% and 50% during the a.m. and p.m. peak hours, respectively, at the south gate of the project's development should be verified and based on comparable internal trip rates of other similar developments.

3. The developer presently proposes that over half of the commercial, including retail, and all of the residential traffic will be used to access Kamehameha Highway. Due to the relative changes in the daily & minimal numbers of dwelling units in the retirement housing

Donald A. Clegg, Chief Planning Officer
January 9, 1987
Page 2

4. A more definitive layout of the internal roadway system should be provided and must show intersections should be designed to determine the need for traffic signals.

5. A preliminary layout of intersections with either one or additional traffic signals should be provided.

We appreciate this opportunity to comment on this project. If you have any questions, please contact Kenneth Hirata of my staff at 527-5849.

for JOHN E. KIRTH
Director

RECEIVED AFTER DEADLINE

Response to DTS Comments (memo to DGP, TE-7588 PL1.0525, 1/9/87)

1. Estimates of future traffic on the internal roadway system were used to consider alternatives, from which several changes to the proposed layout were made. Roadway widths have been tentatively identified using City standards; additional studies as the project moves into the zoning and subdivision processes could verify the appropriateness of these widths.

2. The trip generation procedure used in the traffic study estimated total trip ends for individual land uses. Because of the mixed uses proposed, estimates of the proportion of internal trips were based on the professional experience of the traffic engineers; the proportions were based in part on generation rates by trip purposes developed in regional studies such as Hali 2000. The lack of extensive origin-destination data prevent a direct comparison of internal trip proportions; however, a comparison of the proposed Waiawa development and the existing Ewa Beach community indicates that the peak hour external trips may be overstated in the Waiawa traffic study:

External Vehicular Trips/Dwelling Unit

	Ewa Beach*	Waiawa
AM Peak Hour - Ins	0.15	0.17
- Outs	0.26	0.31
PM Peak Hour - Ins	0.25	0.28
- Outs	0.12	0.18

* 1985 Traffic Counts by State Highways Division, Station 11-D (G&H), with estimated 4,400 dwelling units and 700 jobs.

Further, if total vehicle trips generated in Ewa Beach were to be estimated with the total trip rates used for Waiawa, the comparison of total trip ends to net trips would be:

	Total Trip Ends	Net Trips	Net/Total
AM Peak Hour	2,515	1,817	72 %
PM Peak Hour	3,324	1,604	48 %

These proportions compare with the 70 % and 50 % used in the Waiawa study.

3. The EIS prepared is a disclosure document, and as such, addressed the impacts of the proposed project. Should the proposed project change significantly during the development process, changes in its potential traffic impact will be identified.

4. The general nature of planning for the Development Plan application does not provide sufficient information to perform detailed analyses. As the project becomes better defined, the roadway system can be laid out and analyses of internal streets, along with determination of locations for traffic signals, can be completed.

5. Attached for your information are schematic layouts of the Kamehameha Highway intersections with Ka Uka Boulevard and Waipahu Street.

Parsons Brinckerhoff Computation Sheet

Page ____ of ____

Subject INTERSECTION SCHEMATICS — WAIAWA BY GENTRY (YEAR 2002)

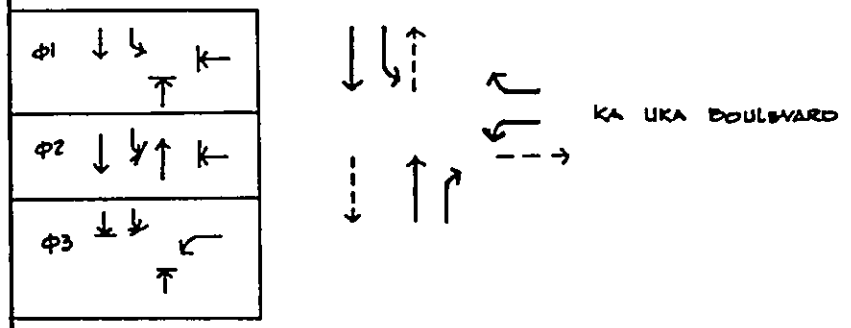
Made by

Date

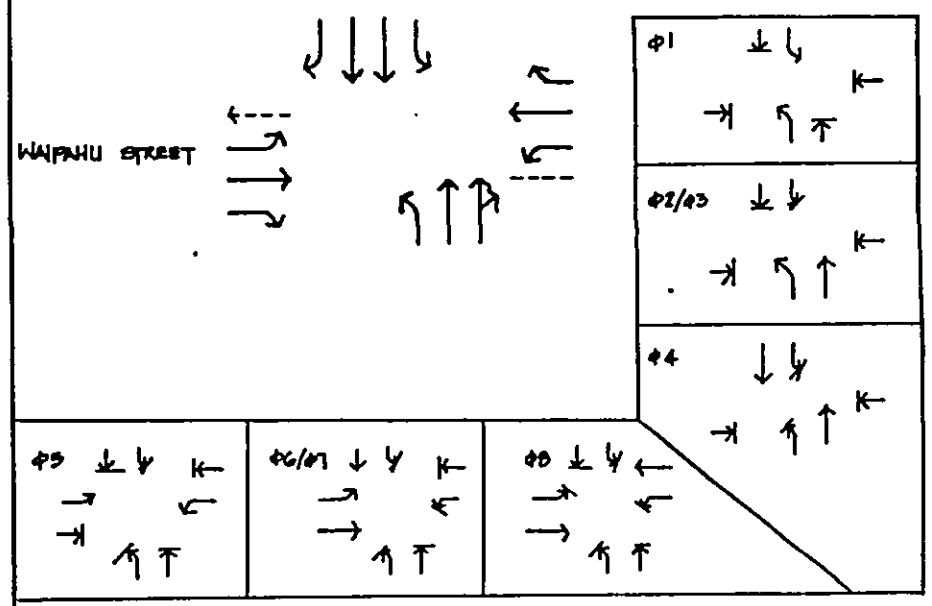
Checked by

Date

KAMEHAMEHA HIGHWAY / KA UKA BOULEVARD



KAMEHAMEHA HIGHWAY / WAIPAHU STREET



DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

JOHN E. HIRTEN
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

TE-1017
PL1.0183

March 9, 1987

Parsons, Brinckerhoff, Quade
& Douglas, Inc.
Suite 615
700 Bishop Street
Honolulu, Hawaii 96813

Attn: Mr. Julian Ing

Gentlemen:

Subject: Waiawa By Gentry
Revised Traffic Impact Assessment Report
TMK: 9-4-04: Por. 1
9-4-06: Por. 10

This is in response to your letter of transmittal dated February 20, 1987.

We have reviewed your response to our comments on the EIS for the subject project and find that although our professional opinions differ on certain items related to internal trip rates, there is no conclusive evidence, either locally or nationally, that specifically states to the contrary. As such, we are assuming that the trip rates used in your study are adequate for planning purposes for this project. We would expect, however, that the layout of the internal roadway system reflect these internal trips and that roadway widths are designed to accommodate the projected volume of traffic. Separate turning lanes should be provided at all critical intersections and access to all major roadways should be limited to cross streets.

As the locations of the proposed land uses become better defined, a layout of the planned roadway system should be submitted to our office and should include proposed roadway widths of all major

streets. We would expect that the traffic study for this project be revised accordingly should the proportion of the types of land uses change significantly (i.e. from retirement housing to residential dwellings).

If you have any questions, please contact Kenneth Hirata of my staff at 527-5009.

Sincerely,

JOSEPH M. MAGALDI, JR.
Acting Director

cc: Department of General Planning

cc: F.J. Rodriguez (ECI)
T. Hosoda (The Gentry Companies)

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

87/EC-9(BWM)

March 6, 1987

MEMORANDUM

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: JOHN P. WHALEN, DIRECTOR

SUBJECT: COMMENTS TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
GENTRY 515, WAIAWA, CENTRAL OAHU
TAX MAP KEY 9-4-06: PORTION 10; 9-6-04: PORTION 1 AND 4

We have reviewed the DEIS and have the following comments and questions:

A. Response to Consultation Comments

Some of the comments and questions indicated in our January 22, 1987 letter to the consultant were not covered in the DEIS which OEQC transmitted to us on February 6, 1987. We realize that it is difficult for the consultant to properly address the comments and questions raised during the short time period between the self-imposed consultation comment deadline and the publication date chosen for the publication of the DEIS. Yet, if consultation comments are not properly addressed in the preparation of a DEIS, its usefulness is diminished. The value of such consultation comments are further diminished, when consulted agencies are given extremely short response times, as was evident in this case.

We suggest that DGP, as accepting authority, require the following: (1) at least a 30-day comment period for consultation comments, and (2) an appropriate time period after consultation comments are submitted to insure that the preparer can properly address the concerns brought up during consultation. It is evident that concerns which surfaced during consultation were not addressed in the DEIS. We trust, however, that these will be fully addressed in the Final EIS.

Our comments repeat those concerns expressed in our January 22, 1987 letter which were not addressed adequately in the Draft EIS.

MAR 9 1987

B. Traffic

1. Time schedule for Highway Improvements

What is the schedule for construction and funding of the proposed Waipio Interchange at H-2 Highway (near the Cemetery Road overpass)?

2. H-2 Highway Interchange between proposed Waipio Interchange and Waiawa Interchange

We previously inquired regarding an interchange on H-2 Highway between the proposed Waipio Interchange and the Waiawa Interchange (which we erroneously referred to as the Waiawa Interchange). Has consideration for this H-2 Highway Interchange between the proposed Waipio Interchange and the Waiawa Interchange been abandoned? We note that this proposed interchange is shown on Figure 1 in the EISPN.

3. Traffic Congestion

Indicate the downstream effects in terms of traffic volume, speed, density, and level of service for H-1 Highway downstream (Honolulu bound) of the Waiawa Interchange.

Table 2, "Trip Generation," in the appended Traffic Impact Report is not clear since it does not specifically indicate that the trip generation estimates include both the Waiawa project and the additional Gentry 515 project. Are the "Leisure Village" trip generation estimates those of the Waiawa development? We suggest that this be clarified. It would be useful to indicate the trips generated by (1) the Waiawa project, (2) the Gentry 515 project, and (3) the combined total of Waiawa and Gentry 515. Other figures should also clearly indicate if they refer to the condition with the combination of Waiawa and Gentry 515.

C. Water

1. No-Action Alternative

The value of retaining these areas for surface water percolation into the soil and for recharge of the groundwater should be noted.

2. Ground Water

How will this development affect groundwater recharge within the Pearl Harbor Ground Water Control Area (PHGWCA)? Will it be necessary to import water to the PHGWCA? Will this development affect the current

export of water to Honolulu from the PHGWCA? The EIS should take into account the new report entitled "Land Use Effects on the Water Balance of a Tropical Island" by Thomas Giambelluca in National Geographic Research 2(2): 125-151 (1986).

D. Wastewater System

How will this development impact the capacity of the Waipahu WWPS and the Honouliuli WWTP? Are these facilities at or near capacity? What is the cumulative impact of this project, the Waiawa Development and other previously approved Central Oahu and Ewa development proposals on these facilities? What improvements will be necessary?

E. Funding Responsibility

What will be the developer's, the State's, and the City's responsibility for funding improvements to:

1. Water facilities,

2. Wastewater facilities, and

3. Traffic improvements, including the proposed Waipio Interchange, and downstream improvements to the H-1 Highway?

Thank you for the opportunity to comment. We trust that the Final EIS will address the concerns we have indicated. If you have any questions, please contact Bennett Mark of our staff at 527-5038.

John P. Whalen
JOHN P. WHALEN
Director of Land Utilization

JPW:sl
0783B

cc: Fred Rodriguez

ENVIRONMENTAL COMMUNICATIONS INC.

F. J. RODRIGUEZ, PRESIDENT

March 23, 1987

Mr. John P. Whalen, Director
Department of Land Utilization
City & County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Whalen:

We are in receipt of your department's comments dated March 6, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The comments have been provided to the applicant and the subconsultants for their review and we respond in the following:

A. Response to Consultation Comments

We would agree in principle with the general position of adequate time to respond to comments from our perspective since our portion of the response period also includes the drafting of responses to the comments, revising of the narrative, and printing the Final EIS within the 14-days.

B. Traffic

1. The proposed Waipio Interchange is presently under design; plans are expected to be complete by August 1987. A tentative schedule from the State Department of Transportation (SDOT) puts the start of construction in late-1987 or early-1988, with completion about 1 1/2 years later. Federal highway funds have been programmed and a request for the local (State) share is pending in the legislature. It is a Federal aid (90-10%) funded project and is under the supervision of the State DOT. Please contact Douglas Orimoto at 548-4710 for further information.

2. The SDOT has indicated that the new interchange shown on some of the earlier documents between the Waiawa and Waipio Interchange will not be approved, and therefore, this connection has not been included in the proposed access schemes. The interchange you comment on has been deleted and Figure 2, Site Plan indicates this deletion.

3. The downstream traffic effects have not been specifically identified because many factors will affect the future traffic demands. These include the type and timing of other development in Central or Leeward Oahu, the future population in the area, and the effect of

1146 Fort St. Mall . Suite 200 . P O BOX 536 . HONOLULU, HAWAII 96809 . TELEPHONE (808) 521-8391

existing and future traffic congestion on travel demand. These questions should be answered in a broader, regional transportation study. The traffic studies for the Waiawa by Gentry and Gentry 515 projects do indicate, however, that near-capacity conditions on H-1 can be expected to continue.

Table 2 estimates the total traffic generated by both the Waiawa by Gentry and the Gentry 515 projects. Table 2 will be revised to clarify the trip generation.

C. Water

1. No-Action Alternatives

We would question the percolation capabilities of the site in a "No-Action" mode since there would be little if any irrigation taking place in which percolation would occur. Natural rainfall is perhaps, the only source of natural irrigation and this source would perhaps percolate.

Other potential sources of recharge would be via the onsite retention basins that will be designed to hold surface runoff/drainage of the project as a mitigation measure for downstream impacts on the Pearl Harbor estuary. Percolation can take place at this point source.

2. Ground Water

A study is being planned at the request of the U.S. Navy to determine the real impacts of the recharge area for the Waiawa Shaft. This study is being conducted by the Water Resources Research Center at the University of Hawaii with the cooperation of the Board of Water Supply. In the approximately 18 months required to complete the study, many answers to questions such as yours on the recharge impacts will be answered, hopefully.

Importation of water to the PHGWCA is unknown at this time since total water demand has not been calculated by the Board of Water Supply (BWS) on the basis of future planning to the year 2005. Their efforts have been determined to this point by the sustainable yield and capacity of the well systems that service the Waiawa tributary.

The exporting and importing of water to and from the PHGWCA is not determinable at this time by the applicant or the BWS since the Water Master Plan for the project has not been completed. Giambelluca's work has been reviewed by Dr. Dugan and was duly noted.

D. Wastewater System

There was some confusion on the nature of the DLU comment since the DEIS referred to the Pearl City WWPS and not the Waipahu WWPS. DPW requested that the Pearl City WWPS be used in the planning and design for Waiawa and Gentry 515 since the Pearl City system is able to handle the flow from this project. In accordance with their request, reference to Waipahu has been deleted.

The DPW notes that the existing and approved projects (under present population restraints to year 2005) will require a total capacity of 35.42 mgd at the Honouliuli WWTP whose present capacity is 25 mgd. If so, the WWTP capacity should not be increased to 37.5 mgd but to its ultimate capacity of 51 mgd and, therefore, provide for Waiawa development and other future projects within the tributary area.

Since many of the approved and planned projects will not be implemented completely for about 20 years, another alternative is to increase the WWTP capacity to 37.5 mgd by 1993 and plan another expansion to 51 mgd in about ten years thereafter.

Capacity at Honouliuli will be utilized to the degree that capacity is available at the time this project will require connection. The Sewerage Master Plan will be designed and provided to the DPW for their review and approval. All additional capacity requirements deemed necessary at the time of review of the Sewerage Master Plan would be considered in negotiations between the applicant and the DPW. We would not begin to assume the Wastewater Management Division's role of managing the sewage systems for Oahu; cumulative impact analyses would best come from their office since our comments would be assumptive and not based on the most current information.

E. Funding Responsibility

If the applicant/developer were able to predict with any degree of certainty, the cumulative costs for these major infrastructure improvements on a 10-20 year future basis, his response would still be that their fair pro-rata share of these improvements required to the extent that his projects were responsible, would be his share of the funding. We could not comment on the governmental share of the anticipated improvements at this time since the costs have not been determined. As is the case, everyone will try to equitably share their costs to the extent practicable.

Thank you for your comments and continuing concern; we trust we have responded adequately.

Very truly yours,

F. J. Rodriguez

FJR:ls

enclosure

5884
STP 8.1810

January 22, 1937

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

Dear Mr. Clegg:

EIS - Waiawa by Gentry
Waiawa, Oahu

After reviewing the subject EIS, we have the following comments for your consideration:

1. We do not agree with the statement on page VII-10, "The total traffic demand into the Waiawa interchange would remain constant in year 2002 with or without the Waiawa project." It appears that this is based on the assumption that growth will come from Waiawa Ridge and traffic/growth from other areas will remain relatively constant.

2. Figure 2, Site Plan, shows an interchange located between the Waipio and Waiawa Interchanges. The Highways Division is opposed to any more new interchanges within this segment of H-2.

3. The double-lane loop ramp serving the Waiawa Ridge development to H-2 at the Waipio Interchange should be limited to only a single-lane loop ramp. A two-lane loop ramp would require widening H-2 from the Waipio Interchange through the Waiawa Interchange to maintain freeway lane balance.

4. Costs of improvements to mitigate the development's traffic impacts shall be borne by the developer. This shall include any necessary improvements at Waipio Interchange, on Kamehameha at Ka Uka Boulevard, on

JAN 29 1987

Kamehameha Highway at Waipahu Street and any other improvements required by traffic utilizing the Waihona Street access or any other access point.

5. The new proposed access connection to the existing T-Intersection at Waipahu Street and Kamehameha Highway must be re-evaluated. The existing intersection already has severe problems. Adding a 4th leg will only compound the problem. If the proposed Waikele and Waiola developments also become a reality, in addition to Waiawa by Gentry, the problems at this intersection will become even greater.

6. Other alternatives for access should be investigated.

7. Will the development create new jobs that would reduce residents' need to use our highway facilities to get to their jobs during the peak traffic period? Has this been considered in the traffic generation study?

Tony Carbonetto

8. The EIS mentions that an increase in the use of high-occupancy vehicles has the potential to reduce traffic demand. What kind of resources is the developer willing to commit toward achieving this change in commuter pattern?

9. The developer should be informed that we are seriously concerned about the effects of developments such as Waiawa on downstream sections of our highways system. Consequently, we will be considering methods to obtain developer's assistance to fund needed improvements.

We appreciate this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

DT:ko

cc: HWY, STP(dt)
P.J. Rodriguez

Response to DOT Comments (letter to DGP, STP 8.1810, 1/22/87)

The Traffic Impact Assessment Report has been revised to incorporate findings from other studies and in view of DOT's concerns. Following are responses to their comments:

1. The traffic report has been revised to include additional discussion about the growth of traffic volumes. The only assumption made regarding growth in other areas was that the total traffic from all development in Leeward and Central Oahu would grow at a rate determined by population and employment growth rates. While no assumptions had been made about traffic or growth from other developments within the area, one of the findings from the traffic study indicates that if the project's parameters were accepted, traffic volumes from other parts of Leeward and Central Oahu would remain near today's levels.

2. The proposed project does not include a new interchange between the Waiawa and Waipio Interchanges. The traffic analyses did not assign any traffic onto such a facility. The latest plan is provided in the DEIS for Gentry 515, Figure 2, Site Plan.

3. The traffic analyses indicate that a two-lane loop ramp will be necessary to serve projected demands; preliminary layouts have been prepared for a two-lane ramp, allowing for future widening, if and when necessary. The analyses and discussion of mitigation measures in the report were redone for a single-lane loop ramp.

4. The DOT has indicated that the improvements needed to serve the proposed project have not been programmed, nor are funds available to implement any improvements. The identification of specific improvements and commitments to provide such improvements will be dependent on the type and scale of development that will be permitted.

5. The traffic analyses found that the Kamehameha Highway and Waipahu Street intersection would require additional improvements, whether or not the fourth leg is added. Existing problems at the intersection appear to be the result of downstream capacity constraints, which would require widening or other improvements; however, no improvements are being proposed because some relief to existing traffic congestion in the area could result from the opening of new interchanges at Paiwa Street at H-1 and at Waipio Interchange. While not specifically studied in the traffic assessment, the provision of an alternative route between Waipahu and Pearl City which avoids the Waiawa Interchange could also improve conditions in the area.

6. Many alternatives for access have been investigated. Existing residential and commercial developments and limited regional highway facilities in the area preclude many alternatives. The three proposed connections were found to be the only available locations to connect the internal roadways to the existing highways. Alternative access schemes will continue to be evaluated.

7. The creation of new jobs within the development has been incorporated into the traffic generation, by considering internal trips.

8. The developer's incentive to committing resources toward a high-occupancy vehicle program is the marketability of his project; the EIS, as a disclosure document, has identified the need to reduce traffic demand from the project.

9. (No response needed)

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

FRANK F. FASI
MAYOR

HIRAM K. KAMAKA
DIRECTOR

WALTER M. OZAWA
DEPUTY DIRECTOR

February 24, 1987

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: HIRAM K. KAMAKA, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)
GENTRY 515 PROJECT - WAIAWA
TAX MAP KEY 9-4-06: POR. 10 AND 9-6-04: POR. 1 AND 4

We have determined that the Draft EIS for the Gentry 515 Project is unacceptable. The report has again not adequately addressed the recreational needs of the project.

We did express our concerns in our review of the project's Environmental Impact Statement Preparation Notice dated January 23, 1987. We have not had the opportunity to discuss our concerns and the project's recreational requirements for the Gentry 515 Project with the applicant. Adequate parks must be established and reflected on the total Waiawa Ridge Development of which the Gentry 515 Project is a part.

HIRAM K. KAMAKA, Director

HKK:ei

Attach.

cc: Gentry Companies
F. J. Rodriguez, Environmental Communications, Inc.

FEB 27 1987

DPR/ADVANCE PLANNING

January 23, 1987

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: HIRAM K. KAMAKA, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT PREPARATION NOTICE (EISPN)
GENTRY 515 - WAIAWA
TAX MAP KEY 9-4-06: POR. 10 AND 9-6-04: POR. 1 AND 4

We have determined that the Environmental Impact Preparation Notice for the Gentry 515 project is unacceptable. The EISPN report has not adequately addressed the project's recreational needs for both the planned residential and retirement community. Public or private parks have not been designated in the Gentry 515 land use map, Fig. 1, to serve a project of this magnitude.

We are presently attempting to assess the recreational needs for the Waiawa Development, Inc. I, of which Gentry 515 is a part of. However, the single-family residential areas A & B of the Gentry 515 project are located outside of the Inc. I boundary area so we will need to revise our assessment of the project. It will be necessary to discuss the applicant's conceptual and phasing plan of the total Waiawa Development in more detail.

We recommend that the applicant contact Mr. Jason Yuen of our Advance Planning Section at 527-6315 to discuss the project's recreational needs and requirements.

HIRAM K. KAMAKA, Director

HKK:ei (J. Yuen, Advance Planning, ext. 6315)

cc: F. J. Rodriguez, Environmental Communications, Inc.
Gentry Companies

FILE COPY
JAN 28 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

Mr. Hiram K. Kamaka, Director
Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Kamaka:

We are in receipt of your department's comments dated February 24, 1987 on the Gentry 515 project. The applicant has reviewed the comments and we respond as follows:

1. The applicant has met with your staff to determine the extent of compliance for the Park Dedication Ordinance requirements.

2. The applicant fully intends to meet with the Park Dedication Ordinance requirements by providing private and public park space and facilities at the 515 Project.

3. Detailed plans that will indicate by symbol, the location and use of these park facilities will be made available for review by the Department of Park and Recreation staff for inclusion in the DP Public Facilities Map. Also, the project will have more information at the time of the Zoning application that will be prepared for filing after the Development Plan Land Use Map process has been completed.

Please be assured that the applicant will comply with the Park Dedication Ordinance requirements. Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

FJR:ls

1146 Fort St. Mall . Suite 200 • P O BOX 536 • HONOLULU HAWAII 96809 • TELEPHONE (808) 521-8791

ENV 87-24

February 20, 1987

MEMORANDUM

TO: MR. DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER

SUBJECT: DRAFT EIS ON GENTRY 515, WAIAWA, OAHU, HAWAII
(TAX MAP KEY: 9-4-06: POR. OF 10;
9-6-04: POR. OF 1 AND 4)

We have reviewed the subject Draft EIS and have the following comments.

1. A drainage master plan is required.

2. The proposed development will increase the severity of flooding of Waiawa Stream. Although retention facilities are planned (page VII-5), there are no indications whether storm runoff flows from the development will be increased, decreased or remain the same.

3. The capacity of the existing Honouliuli WWTP was not constructed to serve the proposed Waiawa Development and Gentry 515 project. According to the EIS for the Waiawa Development, an average daily wastewater flow of about 3.5 mgd will be generated. The proposed Gentry 515 project is expected to generate another 1.63 mgd (page VII-17) for a total of approximately 5.17 mgd.

4. Preliminary planning for the next increment of the Honouliuli WWTP indicated that a capacity of 35.42 mgd will be required by the year 2005, the end of the planning period.

This capacity was derived from a review of existing and proposed approved developments in the tributary areas of the treatment plant including a newly formed tributary area for Waiawa. Because of population constraints imposed by the General Plan and the Development Plans within the tributary areas to the year 2005, we have tentatively allocated a wastewater flow of 0.12 mgd for the entire Waiawa tributary area.

The next increment of the Honouliuli WWTP will increase the plant capacity from 25 mgd to 37.5 mgd or to the ultimate capacity of 51 mgd. A 37.5 mgd capacity will be sufficient to accommodate the flow generated by a General Plan population projected for the year 2005. A tentative date when the next increment may be constructed is 1993. This project is not eligible for Federal funding under the 201 Construction Grant Program.

Alfred J. Thiede

ALFRED J. THIEDE
Director and Chief Engineer

cc: Environmental Communications, Inc.

FEB 24 1987

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ,
PRESIDENT

March 23, 1987

Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

We are in receipt of your comments dated February 20, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. The civil engineering consultant, Community Planning, Inc. provided the technical portion of the responses provided as follows:

1. The Drainage Master Plan will be included with the Gentry Walawa Master Plan since the sites for the major portions of the planned improvements will take place on the larger Walawa site.

   The concept is to retain the increase in urban storm runoff in available open space areas (golf courses) and retard the floodwater flow to Walawa Stream. Design of a retention berm with minimum sized culverts to convey only normal low flow storms (say 10-year storms) would limit passage of runoff from higher peak storms (50- to 100-year storms) and, therefore, flood the open area mauka of the berm. However, during and after the storm, the ponded waters would continually discharge at a rate controlled by the size of the culverts.

   The increase in storm runoff volume due to urbanization of the project area (excluding the open space) for a 24-hour 100-year storm is estimated to be 400-acre-feet. Therefore, if flooding depth was limited to an average of 4 feet, then, only 100 acres of the golf course area would be required for floodwater retention.

   During retention, potential of ground water percolation for basin recharge would increase. Additionally, major project desilting will occur in the ponded golf course area rather than carried to Pearl Harbor.

   The DPW letter notes that the existing and approved projects (under present population restraints to year 2005) will require a total capacity of 35.42 mgd at the Honouliuli WWTP whose present capacity is 25 mgd. If so, the WWTP capacity should not be increased to 37.5 mgd but to its ultimate capacity of 51 mgd and, therefore, provide for Walawa development and other future projects within the tributary area.

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Since many of the approved and planned projects will not be implemented completely for about 20 years, another alternative is to increase the WWTP capacity to 37.5 mgd by 1993 and plan another expansion to 51 mgd in about ten years thereafter.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodrigues

FJR:ls

DGP 2/87 582

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 S. BERETANIA STREET, ROOM 308
HONOLULU, HAWAII 96814

FRANK F. FASI
MAYOR

FRANK K. KAHOOHANOHANO
FIRE CHIEF

LIONEL E. CAMARA
DEPUTY FIRE CHIEF

March 11, 1987

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: FRANK K. KAHOOHANOHANO, FIRE CHIEF

SUBJECT: GENTRY 515, ENVIRONMENTAL IMPACT STATEMENT

We have reviewed the subject EIS and have no additional comments at this time.

Should you have any questions, please contact Battalion Chief Kenneth Word at local 3838.

FRANK K. KAHOOHANOHANO
Fire Chief

FKK:KAW:lm
cc: Mr. F. J. Rodriguez

NO RESPONSE NEEDED

MAR 16 1987

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 • AREA CODE (808) 943-3111

FRANK F. FASI
MAYOR

DOUGLAS G. GIBB
CHIEF

WARREN FERREIRA
DEPUTY CHIEF

OUR REFERENCE SS-LK

February 19, 1987

RECEIVED
'87 FEB 20 AM 11:14
DEPT. OF GENERAL PLANNING
C & C HONOLULU

TO: DONALD CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR GENTRY 515, WAIAWA, CENTRAL OAHU, HAWAII

Thank you for providing us with a copy of the Draft Environmental Impact Statement, dated February, 1987, for the above proposed project.

Our prior response clearly outlines the position of the Honolulu Police Department. We have no additional comments to make in regards to this project.

DOUGLAS G. GIBB
Chief of Police

By
WARREN FERREIRA
Deputy Chief of Police

NO RESPONSE NEEDED

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

IN REPLY REFER TO
5090
Ser 002(09P2)/391

26 FEB 1987

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

Dear Mr. Clegg:

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
GENTRY 515, WAIAWA, CENTRAL OAHU DISTRICT
ISLAND OF OAHU, HAWAII - FEBRUARY 1987

The subject Draft EIS provided by transmittal of the State of Hawaii Office of Environmental Quality Control on February 6, 1987 has been reviewed, and we have no additional comments to make at this time.

We look forward to receiving a copy of the final EIS. Mr. Bill Liu of this command is the U. S. Navy point of contact and can be reached at 471-3703.

Sincerely,

T. C. CRANE
Captain, CEC, U.S. Navy
Facilities Engineer
By direction of the Commander

Copy to:
Mr. F. J. Rodriguez, President
Environmental Communications, Inc.
P. O. Box 536
Honolulu, HI 96809

Office of Environmental Quality Control

NO RESPONSE NEEDED

FEB 27 1987

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P. O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
ES
Room 6307

FEB 19 1987

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

Re: Draft Environmental Impact Statement, Gentry 515, Waiawa, Oahu

Dear Mr. Clegg:

We have reviewed the Draft Environmental Impact Statement and have no additional comments to offer at this time.

We appreciate the opportunity to comment.

Sincerely,

Ernest Kosaka
Project Leader
Office of Environmental Services

✓ cc: P.J. Rodriguez

NO RESPONSE NEEDED

CONSERVE AMERICA'S ENERGY

FEB 20 1987

Save Energy and You Serve America!

cc: F. J. Rodriguez

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. BOX 50004
HONOLULU, HAWAII
96850

March 6, 1987

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

Dear Mr. Clegg:

Subject: Draft EIS - Gentry 515 - Waiawa, Oahu, Hawaii

We reviewed the subject environmental impact statement and offer the following comments:

Page I-3, 3rd par. - We do not agree with the statement:

> "...The active agricultural use alternative was dismissed since the permanent removal of the project lands would not have any significant impact on the State agricultural lands inventory."

This development, by itself, may not have a significant impact, but if you combine all the individual proposed projects, it becomes a different matter.

Page IV-1, last par. - We have the same comment as above.

Pages V-1 and V-2 - The description of the soils in the project area does not identify which areas are Prime and Unique Agricultural Lands. Eva and Wahiawa soils are both classified as such.

Thank you for the opportunity to review the document.

Sincerely,

RICHARD N. DUNCAN
State Conservationist

cc:
✓ Mr. F. J. Rodriguez
Environmental Communications, Inc.
P.O. Box 536
Honolulu, HI 96809

MAR 13 1987

RECEIVED AFTER DEADLINE DATE

ENVIRONMENTAL COMMUNICATIONS INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

Mr. Richard N. Duncan
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Duncan:

We are in receipt of your agency's comments dated March 6, 1987 on the Draft Environmental Impact Statement (DEIS) prepared for the Gentry 515 project. These comments were received after the stated deadline of March 10, 1987. They have been reviewed by the applicant and we respond as follows:

1. Page I-3, 3rd Para.

   The statement discusses only the acreage under review in the DEIS; the cumulative impacts of removing this acreage from the total Oahu acreage is less than 3% of the total Oahu "Prime" acreage and less than 1% of the total "Prime" statewide acreage (page 3 & 4, Appendix I). The statement was made in the context of total acreage Oahu and Statewide.

2. Page IV-1, Last Para.

   Response as provided for #1.

3. Pages V-1 and V-2

   The soils description provided on these pages refer to capacity of the soils for all uses including urban uses such as development. The Prime and Unique Classifications are listed in Appendix I, page 2 and 3.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 Fort St. Mall . Suite 200 • P. O. BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8391

DGP 2/87 547

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

REPLY TO ATTENTION OF:

February 12, 1987

RECEIVED
'87 FEB 18 PM 1:40
DEPT. OF GENERAL PLANNING C & C HONOLULU

Mr. Donald A. Clegg, Director
Department of General Planning
City and County of Honolulu
650 S. King St.
Honolulu, HI 96813

Dear Mr. Clegg:

Thank you for the opportunity to review and comment on the EIS for Gentry 515, Waiawa, Oahu. We have no additional comments to add to our letter dated 23 January 1987.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

NO RESPONSE NEEDED

HAWAIIAN ELECTRIC COMPANY, INC. • PO BOX 2750 • HONOLULU HI 96840 0001

ENV 2-1
JA/G

HEI

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

March 9, 1987

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

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement (DEIS) for Proposed Gentry 515 Development

We have reviewed the above DEIS and have the following comments:

1. We have previously responded on January 27, 1987 to an Environmental Impact Statement Preparation Notice (EISPN) on this proposed development. Our comments in that EISPN addressed inclusion of construction notes in the final construction plans. Those same comments should be included in the subject DEIS.

2. In our previous EISPN response, we indicated that 138kv transmission lines cross and/or are in close proximity to this development. The existence of these 138kv circuits should also be addressed on pages V-10 and V-11 of this DEIS.

3. The paragraph pertaining to electrical service on page VII-17 should include additional discussion to emphasize the following.

   * Adequate underground electrical service can be provided by HECO providing the developer pays the difference in cost.

   * Relocations of existing HECO electrical facilities currently located on perpetual easements will be done at the developer's cost, and

   * The need for a substation as addressed in our prior response should be mentioned.

Sincerely,

Brenner Munger

cc: F. J. Rodriguez, President
Environmental Communications, Inc.

MAR 1 1 1987

HEI

ENVIRONMENTAL
COMMUNICATIONS
INC.

F. J. RODRIGUEZ
PRESIDENT

March 23, 1987

Dr. Brenner Munger, Manager
Environmental Department
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Dr. Munger:

We are in receipt of the HEI comments dated March 9, 1987 on the Draft Environmental Impact Statement prepared for the Gentry 515 project. The comments have been provided to the applicant and we respond as follows:

1. The final construction plans for this project will be processed in a similar manner as the Waiawa by Gentry project. All construction notes will be included.

2. Page V-10 will be revised to reflect the 138kv lines as part of HEI's system.

3. All additional discussions on page VII-17 have been revised to reflect the long range future planning perspective that will need to be reviewed and planned prior to commitments by the applicant to HEI.

Thank you for your comments and continuing concern.

Very truly yours,

F. J. Rodriguez

FJR:ls

1146 Fort St. Mall . Suite 207 P O BOX 536 • HONOLULU, HAWAII 96809 • TELEPHONE (808) 521-8391

APPENDIX A

ENVIRONMENTAL ASPECTS OF STORM WATER RUNOFF

Gentry 515 Project - Waiawa Development Addition
Southern Oahu, Hawaii

December, 1987

by

Gordon L. Dugan, Ph.D.
Environmental Consultant

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INTRODUCTION

The proposed Gentry 515 Project is a addition to and contingent upon the establishment at the proposed Waiawa Development Project, located in southern Oahu, as shown in Figure 1. Although this report deals primarily with the Gentry 515 Project, and the various applications and acceptances necessary for the two projects were submitted independently, the composite environmental aspects of storm water runoff for the two projects will be evaluated in this report.

The project is situated in the 26.4 sq. mi. Waiawa watershed, which extends from the Middle Loch of Pearl Harbor to the crest of the Koolau Mountain Range. This watershed is one of the largest on Oahu and is the major portion of the nearly 90 sq. mi. area that drains into Pearl Harbor. Several streams drain the watershed, however, they all converge at several points into Waiawa Stream before it flows under Kamehameha Highway and into the Middle Loch of Pearl Harbor.

A USGS stream gaging station (#16216000) located on Waiawa Stream near the intersection of Farrington and Kamehameha Highways has been in operation since June 1952. Waiawa Stream follows a course slightly to the east of the proposed project.

The proposed project's designated land use areas of approximately 500 acres is presented in Table 1. The 168 acres of residential area abuts the northern boundary of the Waiawa Development Project while the remaining Gentry 515 area is situated along the south-southeastern portion of the development. The elevations range from nearly 15 ft at the project's flood plain area to approxiamtely 775 ft above mean sea level at it's northern portion.

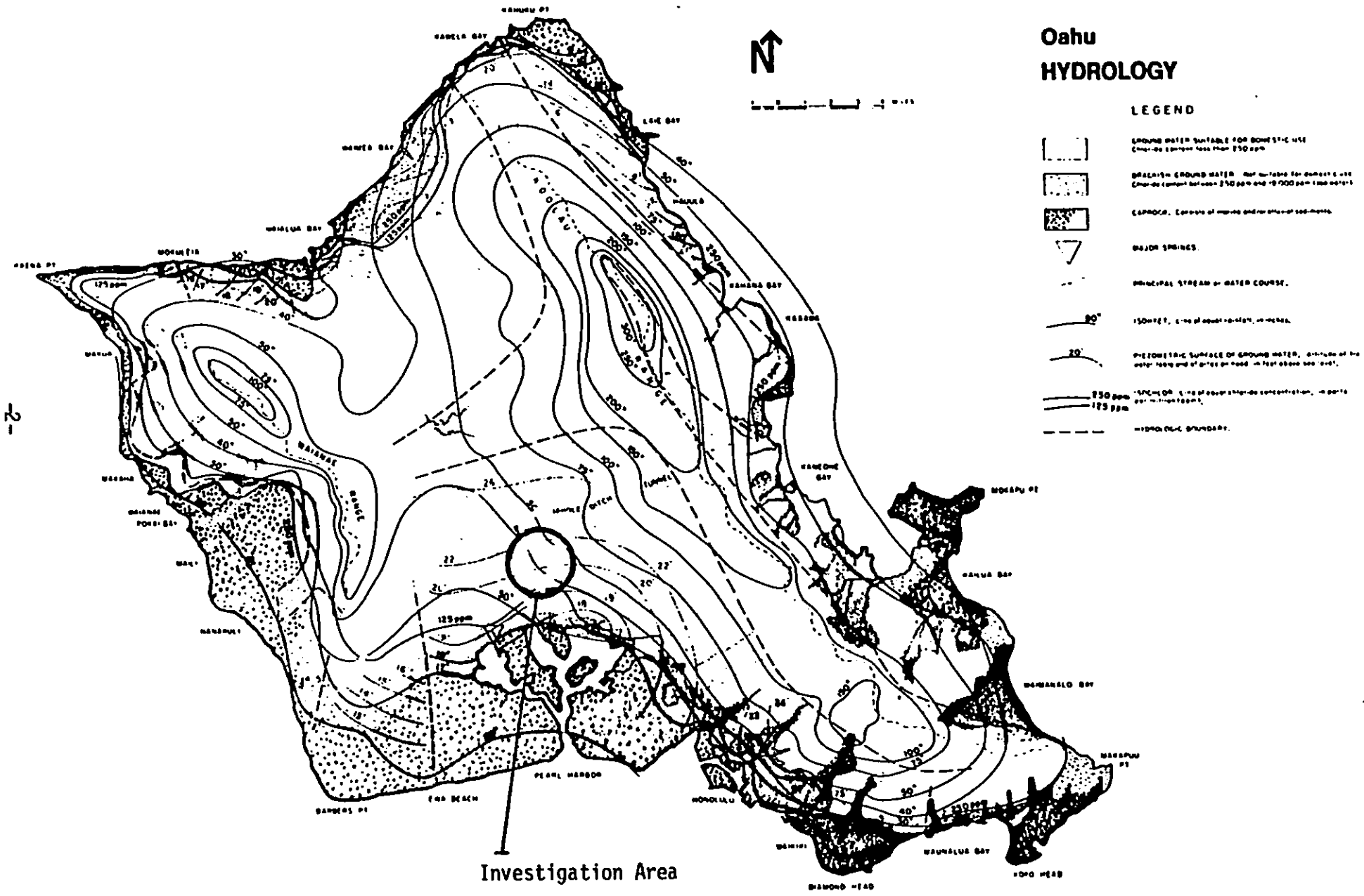

Figure 1. Hydrologic and Geologic Characteristics of Oahu
(source: "2020 Plan," Board of Water Supply, City and County of Honolulu, pg 13, 1971)

TABLE 1

Land Use Designation for the Proposed Gentry 515 Project-Addition to the Waiawa Development Project, Southern Oahu, Hawaii

Land Use	Total Area -acres-
Residential	168
Apartments-Low density	156
Apartments-Medium density	26
Commercial/Industrial	83
Open Space	13
Flood Plain	58
Total	504

The average annual rainfall around the project area ranges from about 33 in. to approximately 60 in. (Division of Water and Land Development, 1982). The project borders Pearl City to the east and the communities of Waipio and Crestview to the west. The Middle Loch of Pearl Harbor is about 0.8 of a mile to the south of the project and the nearby Kamehameha Highway and H-2 Freeway could provide easy access to the proposed project. The basis infrastructure and recreation facilities for the Gentry 515 Project is included in the "parent" Waiawa Development Project.

The property is presently designated as Agricultural on both the Development Plan for the City and County of Honolulu and the State Land Use Map. A major portion of the Gentry 515 and Waiawa Development Project's designated areas were being cultivated for sugarcane by Oahu Sugar Company, however, because of economic reasons the fields have been pulled out of production with the last harvest completed in 1983. Presently these fields are overgrown with sugarcane stalks and California grass, with the remainder of the site, which was not conducive to sugarcane culturing (generally too steep) being characterized by ridges and gulches with vegetation consisting primarily of scrub growth and koa haole. The gulches are within the Waiawa Development Project and are planned to be incorporated into golf courses.

The natural drainage patterns around and within the project's area have been changed somewhat by various irrigation facilities; however, the majority of these were abandoned when sugarcane cultivation in the area ceased in 1983.

Three out of the four major soil associations in the Waiawa watershed are located within the Gentry 515/Waiawa Development Project's boundaries, although the lower one, Lualualei-Fill Land-Ewa Association, is only included in a small portion of the project. Although there are several soil series

in the area, in general, the lower half of the Gentry 515 Project is characterized by Lahaina and Molokai soil series while the northern residential portion is mainly composed of Manana and Waiawa soil series. All three Associations are known as being "well-drained" soils (Foote et al., 1972). The individual soil series within the project and their relationship to storm-water runoff will be discussed in a subsequent section of the report.

Associated with a development project such as is being herein proposed are alterations in surface water runoff resulting from modifying the existing ground conditions. Interest in these runoff changes is generally a result of concern over two factors--one, public safety, and two, environmental impact. The first factor requires the identification of changes in peak discharge rates, the magnitudes of which are necessary for designing adequate drainage structures to prevent flooding, while the second concern requires identification of changed in total runoff volume, as well as sediment, nutrient, and other constituent loads, and the effects these will have on the ecosystem of the natural resource serving as the "sink". It is this second concern, environmental impact resulting from increased runoff volume and sediment and nutrient loads, and its probable effect on subsequent receiving waters (Waiawa Stream which discharges into the Middle Loch of Pearl Harbor) that is under study in the present investigation as herein reported.

PURPOSE AND SCOPE

The purpose of this study is to evaluate the environmental impact of the proposed Gentry 515 Project-addition to the Waiawa Development Project as it relates to surface water runoff. From and assembledge of baseline hydrologic and water quality data, an estimate of the existing and projected volume and quality characteristics of surface water runoff will be made, along with an assessment of the environmental impact resulting from this runoff, in the form of written comments. Determination, extent, and alleviation recommendations of potential flood plain considerations are not included in this section of the report. No development is anticipated in the project's open space and flood plain areas, thus their areas will not be considered in the evaluation of environmental aspects of storm water runoff process.

METHODOLOGY

The methodology used in this study consisted of assembling, analyzing, and interpreting existing data from federal, state, and county agencies, as well as from on-site surveys of field conditions.

Inasmuch as the scope of work consisted of estimating the alterations in volume and quality of surface water runoff resulting from the proposed project, it was necessary to identify those factors that affect runoff generation and runoff quality for both pre-and post-development conditions.

Methods currently available to estimate the surface water runoff volume from a specific storm event requires the determination of reasonable rainfall-runoff coefficients for varying magnitude and duration storms, and for different land management, vegetation, soil, and soil moisture conditions, to name but a few hydrologic factors. In most practical situations, it is not considered feasible, due to the numerous influencing factors, to determine varying rainfall-runoff coefficients; rather, it is more practical for design and evaluation purposes to use a single coefficient for a particular land-use over a given rainfall-intensity range. However, in order to circumvent a major portion of the unavoidable error created by using a constant rainfall-runoff coefficient, a method developed by the Hawaii Environmental Simulation Laboratory (HESL) of the University of Hawaii, was utilized to determine representative storm water volumes under varying conditions (Lopez, 1974; Lopez and Dugan, 1978).

The HESL method is based on an incorporation of U.S. Soil Conservation Service (SCS) data and U.S. Weather Bureau data from the "Rainfall-Frequency Atlas of the Hawaiian Islands" (1962). The SCS data involves the use of soil maps (Foote et al., 1972) and SCS-derived curve numbers

obtained from empirical data, including precipitation, soil and changing soil moisture conditions, and vegetative cover information from the classification of thousands of soils throughout the nation. These soils were classified into four groups, labeled A, B, C, and D, with Class A having the highest water intake rates and Class D soils the lowest. These curve numbers, modified for Hawaiian conditions, pertain only to non-urban conditions. For urban conditions, the HESL method utilized information published by Miller and Viessman (1973).

Once the increase in surface water runoff volume had been established, it was necessary to determine the runoff quality for pre- and post-development conditions.

The quality parameters of stormwater runoff considered the most representative to identify potential changes under different land management practices (i.e. pre-and-post development conditions) are: total nitrogen; total phosphorus; and suspended solids (sediments).

The U.S. Geological Survey (USGS) in conjunction with its national stream flow gaging program periodically collects and analyzes samples from selected stream; Waiawa Stream, of which has been included (USGS, 1960-1984). Unfortunately, for the present study, the USGS program only analyzes for nitrate-nitrogen (rather than for total nitrogen which also includes organic, ammonia, and the nitrite forms) and does not conduct analyses for phosphorus.

To circumvent the problem of determining representative nitrogen and phosphorus values in surface runoff from Waiawa Watershed, for comparative purposes, nitrogen and phosphorus values of 3.0 and 0.3 lb/acre-yr, respectively, were selected to represent pre-project (1985) development conditions. These values were derived from a compilation of data relating to nutrient outputs from rural and agricultural lands

throughout the nation that was reported by Loehr (1972). To convert the output loads to concentration values for the Waiawa Watershed, the average annual flow rate up through 1984 of 33.3 cfs (24,130 acre-ft/yr) (USGS, 1984), together with the selected nitrogen and phosphorus outputs over the 26.4 sq. mi. watershed, produced average annual concentration values of 0.77 mg/L and 0.08 mg/L respectively (rounding-off to the nearest one-hundredth).

Suspended solids data has been collected and reported by USGS through its suspended sediment sampling program (USGS, 1971), which includes Waiawa Stream. A portion of this data in addition to what was then reported as unpublished USGS suspended sediment data was statistically analyzed by the Oahu Water Quality Program (OWQP) Study (Dept. of Public Works, 1971) and reported in 1971 that an output value of 23,200 ton/yr represented the best estimate of the suspended sediment output from Waiawa Watershed.

As would be expected it was also reported by the OWQP that suspended sediment output tended to increase with increasing flow. This adds credence to the theory that runoff from a few major storms contain the major portion of the suspended sediment from watersheds on Oahu. In addition to suspended sediment being carried by the stream a smaller portion is carried by bed load; however, the estimated quantity has received only a limited amount of attention on Oahu, thus, an estimate of its quantity is not practical at this time. The best estimate of 23,200 tons/yr of suspended sediment from Waiawa Watershed at an average annual flow of 33.3 cfs would produce a suspended solids concentration of nearly 700 mg/L. Therefore 700 mg/L was selected as representing pre-project development conditions.

Quality data for stormwater runoff from developed areas are sparce, both locally and nationally. Loehr (1974) compiled urban stormwater runoff quality data collected from throughout the United States, as well as from a few international locations. As expected, the data are diverse. Locally, Fujiwara (1973) reported urban water quality data collected from storm drains in different land use drainage areas of Honolulu (residential, commercial and industrial), as shown in Table 2. These values compare favorably with similar situations from the continental U.S.

For the present study, the results of the Honolulu residential area for nitrogen, phosphorus, and suspended solids of 0.60, 0.57, and 250 mg/L, respectively, were used for the proposed project's residential and low and medium density apartment areas; and respectively 0.32, 0.53, and 145 mg/L, from the Honolulu commercial area of Table 2, were used for the project's Commercial and Industrial designation. Attention is likewise drawn to the heavy metal content of residential and commercial areas, presented in Table 2, especially with respect to iron, chromium, copper, lead, and zinc.

The aforementioned stormwater runoff constituent concentrations for nitrogen, phosphorus, and suspended solids for pre-development (1987) and the various land uses of post-development are presented in Table 3. The suspended solids concentration values of Table 3 were rounded-off to the nearest 5 mg/L. Applying these concentrations to the pre-and-post runoff volumes, the projected sediment and nutrient loads from the project site could then be estimated.

Table 2

Representative Storm Water Quality Data for Honolulu[a] (Fujiwara, 1973)

	Residential[b]	Commercial[c]	Industrial[d]
Total Solids	511	278	246
Suspended Solids	252	142	12
COD	142	209	40
BOD	10	19	7
Dissolved Oxygen	7.1	5.7	6.7
NO_3-N	0.211	0.045	1.1
TKN	0.381	0.272	2.70
Total P	0.57	0.53	2.17
Ortho P	0.27	0.19	1.27
Grease	2.8	1919	2.2
Lead	0.407	0.987	1.657
Chromium	0.013	0.021	0.013
Zinc	0.512	0.792	0.729
Copper	0.036	0.036	0.021
Iron	0.377	0.295	0.049
Total Coliform	83,300	33,500	11,500
Fecal Coliform	1,965	463	580
Fecal Strep	6,393	7,900	7,350

[a] All units in mg/l except total coliform, fecal coliform, and fecal strep which are listed as No./100 ml

[b] Storm water samples collected on Aupuni Street near Nuhelewai Stream

[c] Storm water samples collected at Beretania Street between Maunakea and River Streets

[d] Storm water samples collected near Iwilei and Pacific Streets

TABLE 3

Quality Constituent Values of Storm Water Runoff
for Pre-and-Post Development Conditions,
Gentry 515 - Addition to the
Waiawa Development Project, Southern Oahu

Land Use	Area* -acres-	Nitrogen mg/L	Phosphorus mg/L	Suspended Solids mg/L
PRE-DEVELOPMENT (1985)				
Brush[a]	433	0.77[b]	0.08[c]	700[d]
POST-DEVELOPMENT				
Residential[e]	1252	0.60	0.57	250
Apartments[e]	301	0.60	0.57	250
Commercial[f]	44	0.32	0.53	145
Total Area	433			

* Not including the project's open space and flood plain areas.

a) Primarily abandoned sugarcane fields, scrub brush, and koa haole.

b) Based on an average annual flow rate of 33.3 cfs (24,130 acre-ft/yr) for Waiawa Stream --1952 to 1984-- (USGS, 1984) from its 26.4 sq mi watershed and average nitrogen outputs of 3.0 lb/acre-yr (Loehr, 1972).

c) Based on 10% of the nitrogen value.

d) Based on the reported average suspended sediment output of 23,200 ton/yr (Dept. of Public Works, 1971) from Waiawa Watershed, and the average annual flow of Waiawa Stream --1952 to 1984--(USGS, 1984) of 33.3 cfs.

e) Constituent values of storm water from Honolulu residential area (Fujiwara, 197

SURFACE WATER RUNOFF ALTERATIONS

Quantity

The estimated storm water runoff and constituent changes due to the proposed Gentry 515 Project are shown in Table 4. The values presented, it must be emphasized, are for comparative purposes only, and are not intended to be representative of the accuracy implied by the practice of reporting results to one decimal place. This was done primarily for convience of calculations and balancing.

The changes shown in Table 4 are those occurring only within the separate 433 acre Gentry 515 Project and composite Gentry 515 and the 1395 acre Waiawa Development Projects areas. No attempt was made to compare these changes with contributions from the entire 26.4 sq. mi. Waiawa watershed area which would significantly negate apparent changes caused by the land use change within the project site.

Over the 433 acres of Gentry 515 Project that are planned to be developed, 6 separate soil series are encountered, each of which has additional subclassifications. Also included are a few acres of soil designated as "fill", which were placed in the previously discussed Class B soils. The soils of the property were segregated according to the procedure discussed in the Methodology section into 96% being Class "B" and 4% being Class "C". There were no Class A or D soils indicated on the soil maps (Foote et al., 1972). The storm water runoffs for various designated intensity and duration storms along with different curve numbers for the separate land use and soil classification were determined according to the procedures outlined in the Methodology section.

TABLE 4

Estimated Storm Water Runoff and Constituent Changes due to the Proposed Gentry 515 Project - Addition to the Proposed Waiawa Development Project, Southern Oahu, Hawaii

Gentry 515 Project

Storm[a]			Storm Water Runoff												
			Hydraulic			Nitrogen[b]			Phosphorus[b]			Suspended Solids[b]			
			Development			Development			Development			Development			
Duration	Recurrence Interval	Quantity	1987	Full	△	1987	Full	△	1987	Full	△	1987	Full	△	
hr	yr	in.	AF event	AF event	AF event	lb event	lb event	lb event	lb event	lb event	lb event	ton event	ton event	ton event	
1	1	1.45	0.2	31.2	+ 31.0	0.4	44.9	+ 44.5	0.1	34.7	+ 34.6	0.18	5.99	+ 5.81	
1	5	2.2	3.5	55.7	+ 52.2	7.4	81.0	+ 73.6	0.8	63.6	+ 62.8	3.37	11.10	+ 7.73	
1	10	2.5	6.1	65.8	+ 59.7	12.8	96.1	+ 83.3	1.3	75.8	+ 74.5	5.84	13.25	+ 7.41	
1	25	3.0	11.8	83.0	+ 71.2	24.7	121.5	+ 96.8	2.6	96.3	+ 93.7	11.21	16.88	+ 5.67	
1	50	3.3	15.8	93.4	+ 77.6	33.1	136.8	+ 103.7	3.4	108.7	+ 105.3	15.05	19.09	+ 4.04	
1	100	3.7	21.9	107.3	+ 85.4	45.9	157.4	+ 111.7	4.8	125.5	+ 120.7	20.85	22.05	+ 1.20	
24	1	3.6	20.3	103.9	+ 83.6	42.5	152.4	+ 109.9	4.4	121.4	+ 117.0	19.33	21.32	+ 1.99	
24	5	7.1	94.8	228.1	+ 133.3	198.5	336.7	+ 138.2	20.6	270.8	+ 250.2	90.22	47.86	- 42.36	
24	10	9.7	116.0	321.2	+ 152.2	347.7	474.9	+ 127.2	36.1	383.0	+ 346.9	158.06	67.81	- 90.25	
24	25	11.0	204.2	368.0	+ 163.8	427.7	544.5	+ 116.8	44.4	439.4	+ 395.0	194.39	77.84	-116.55	
24	50	12.0	234.4	403.9	+ 169.5	491.0	597.9	+ 106.9	51.0	482.8	+ 413.8	223.18	85.55	-137.63	
24	100	14.0	296.7	475.8	+ 179.1	621.4	704.6	+ 83.2	64.6	569.5	+ 504.9	282.47	100.96	-181.51	
			Composite Gentry 515 Project and Waiawa Development Project												
1	1	1.45	2.2	104.4	+ 102.2	3.8	168.7	+ 164.9	0.4	140.5	+ 140.1	1.70	28.08	+ 26.38	
1	5	2.2	17.8	194.3	+ 176.5	37.3	323.9	+ 286.6	3.9	266.4	+ 262.5	16.94	53.72	+ 36.78	
1	10	2.5	29.5	232.7	+ 203.2	61.7	391.3	+ 329.6	6.4	320.4	+ 314.0	28.09	64.78	+ 36.69	
1	25	3.0	54.5	298.5	+ 244.0	114.1	507.4	+ 593.3	11.9	413.2	+ 401.3	51.86	83.76	+ 31.90	
1	50	3.3	72.3	338.7	+ 266.4	151.3	578.7	+ 427.4	15.7	469.9	+ 454.2	68.80	95.38	+ 26.58	
1	100	3.7	98.9	393.3	+ 294.4	207.1	676.7	+ 469.6	21.6	547.3	+ 525.7	94.14	111.26	+ 17.12	
24	1	3.6	91.9	654.9	+ 563.0	192.5	652.2	+ 459.7	20.0	528.3	+ 508.3	87.52	107.35	+ 19.83	
24	5	7.1	410.7	879.0	+ 468.3	860.1	1563.4	+ 703.3	89.3	1237.1	+1147.8	390.95	253.14	-137.81	
24	10	9.7	716.6	1262.0	+ 545.4	1501.0	2273.7	+ 772.7	155.9	1782.5	+1626.6	682.27	365.50	-316.77	
24	25	11.0	879.1	1455.4	+ 576.3	1841.2	2634.2	+ 793.0	191.3	2058.1	+1866.8	836.88	422.32	-414.56	
24	50	12.0	1007.6	1604.4	+ 596.8	2110.3	2912.6	+ 802.3	219.2	2270.6	+2051.4	959.25	466.14	-493.11	
24	100	14.0	1272.0	1904.0	+ 632.0	2664.1	3473.0	+ 808.9	276.8	2697.7	+2420.9	1210.98	554.23	-656.75	

a) From U.S. Weather Bureau "Rainfall Frequency Atlas of the Hawaiian Islands" (1962).
b) Refer to Table No.3.

As can be readily observed in Table 4, the storm water runoff volume for the Gentry 515 Project for the 1 yr, 1-hr duration storm for post (full) development conditions is about two magnitudes greater than pre-developed (1987) conditions; however, as the storm duration and recurrence interval increases, this difference reduces down to approximately 1.6 times greater for the 100-yr 24-hr storm, whereas for the composite conditions (including the Waiawa Development Project) the ratio difference wasn't as great. At higher rainfall intensities and durations, soil saturation increases, thus more runoff occurs. The relatively large discrepancy between the pre-and-post storm water runoff condition is because the soils within the project area are notably "well-drained" types. The increased runoff from the project area(s) will correspondingly result in less groundwater recharge within the sites of the project; however, sedimentation basins are planned to be incorporated within the project's boundaries which should, if properly designed and maintained, enhance groundwater recharge as well as intercepting the constituents, especially suspended solids in the runoff.

As would be generally expected, the greatest calculated incremental storm runoff volume resulted from the 100-year storms with a 24-hour duration, both individual and composite conditions, as shown in Table 4. These values (acre-ft/event) represent a volume of water and should not be confused with peak discharge rates which represent the maximum volume of storm water runoff discharged per unit of time (e.g., cfs). Peak discharge rates are required for engineering design or proposed drainage facilities and ascertaining the capacity of existing facilities, while total runoff volume provides a more realistic estimate of impact on water quality. Calculated peak discharge rates and the resulting flooded area for the streams within the project boundaries are usually determined from the City and County

of Honolulu's Drainage Standards procedure.

Quality

Besides the changes in volume of storm water runoff, the quality of the various constituents being transported is of equal, if not more importance. However, estimates of water quality constituents resulting from significant storm water runoff that occurs at the most, only a few times a year, is very perplexing, especially since information on this subject essentially only became available at both the local and national level in the 1970's.

The summation of nitrogen, phosphorus, and suspended solids loads from both present 1987 and projected (full) residential development for storms of 1- and 24-hr duration at recurrent intervals of 1-, 5-, 10-, 25-, 50-, and 100-years are shown in Table 4 for both individual and composite conditions. The incremental changes per storm event for the present and projected development conditions for the various duration and recurrence interval storms indicate that from the least to the greatest amount of rainfall: nitrogen and phosphorus increases and suspended solids increases for the low intensity and duration storms and decrease at the higher intensity and duration storms.

The seemingly high nitrogen and phosphorus values of Table 4 have to be compared with the previous land use of the area, sugarcane, which typically received for a two-year cycle, 300 to 500 lbs each of nitrogen and phosphorus over the first 8 months of the culture cycle. Storm runoff during or shortly after fertilization events undoubtedly had a high concentration of both nitrogen and phosphorus.

It must be emphasized that the constituent values are only for comparative purposes, and should not be taken as absolute values.

The hydrologic and water quality aspects of the surface water runoff were only considered for the present and projected conditions. However, increases in constituent loads will undoubtedly result from construction activities, especially if a significant storm occurs during the interim period between earth moving operations and soil stabilization completion. The impact of construction activities can be minimized by adhering to strict erosion control measures.

Other water quality constituents of general concern include biocides and heavy metals. Typically, the biocides in general use tend to break down more readily in comparison to the more long lasting types of a few years ago; consequently, except for agricultural runoff, the types and concentrations are usually considered insignificant.

Heavy metals, on the other hand, do apparently increase somewhat as a result of urbanization. The possible long-term effect, if any, that the apparent slightly increased heavy metals have upon the biological life of the receiving waters (Waiawa Stream and the Middle Loch of Pearl Harbor) at the concentrations expected is not presently well defined. However,a biological study of Pearl Harbor, conducted by the U.S. Navy in the early 1970's concluded that the heavy metal burden in Pearl Harbor was below the level of concern (even though several heavy metal sources discharged to Pearl Harbor-since eliminated-existed at that time) and that the major detriment to marine environment appeared to be silt (Evans et al., 1972). As can be noted in Table 4, the suspended solids load for the heavy storm events are calculated to decrease, and the sedimentation basins being planned should significantly decrease the suspended solids (sediment) load from the lower level, although relatively infrequent storm events.

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APPENDIX B

GENTRY 504 PROJECT, O'AHU

FLORA STUDY

by

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Prepared for: ENVIRONMENTAL COMMUNICATIONS, INC.
December 1986

GENTRY 504 PROJECT

FLORA STUDY

INTRODUCTION

This flora discussion supplements the earlier Waiawa by Gentry flora survey which was conducted in December 1985 for Environmental Communications, Inc. The proposed Waiawa by Gentry project represents the first increment of the total masterplanned Waiawa community. This first increment, which is the subject of the City and County of Honolulu Development Plan Review, will consist of approximately 1,395 acres. The City Department of General Planning has asked that the Gentry Companies increase the Development Plan Amendment request to include the additional ± 504 acres that are adjacent to the Waiawa by Gentry project.

The ± 504 acres consists of 11 parcels, areas A through L. Land uses proposed are residential, commercial/industrial, commercial, low to medium density apartment, open space, and flood plain. The majority of the vegetation on the parcels consists of fallowed cane fields now dominated by introduced weedy species, largely Guinea grass (*Panicum maximum*).

DESCRIPTION OF VEGETATION

The following vegetation description is drawn largely from

the earlier flora survey by Char (1985).of the adjacent Waiawa by Gentry project area. During that survey observations were also made on the vegetation of some of the Gentry 504 parcels. In addition, a map of the cane lands formerly cultivated by Oahu Sugar Company and black and white aerial photegraphs of the project area were also examined. A checklist of the plants found on the project area can be found in the Char (1985) flora survey.

The majority of the Gentry 504 project area is covered by abandoned cane lands. The more recently abandoned fields (parcels A & B), are still dominated largely by sugar cane (Saccharum officinarum). Species such as Spanish clover (Desmodium canum), pluchea (Pluchea odorata), Guinea grass, indigo (Indigofera suffruticosa), and pua-lele (Emilia fosbergii) are the most frequently observed weedy invaders. However, on most of the project area (parcels C through J) the cane lands now support a grassland composed of Guinea grass with scattered shrubs, largely koa-haole (Leucaena leucocephala). Other woody to semi-woody species include pluchea, indigo, butterfly bush (Buddleja asiatica), Java plum (Syzygium cumini), silk oak (Grevillea robusta), albizia (Albizia falcataria), and guava (Psidium guajava).

Adjacent to the perimeter of the cane lands is usually a scrubby growth which was infrequently maintained by the sugar company. Weedy shrubs such as pluchea, guava, Christmas berry (Schinus terebinthifolious), indigo, various species of vervain (Stachytarpheta spp.), and strawberry guava (Psidium cattleianum) are found here. Dense mats of grasses which include Californiagrass (Brachiaria mutica), Guinea grass, molassesgrass (Melinis minutiflora), and Natal redtop (Rhynchelytrum repens) are found between the scattered shrubs. Forestry plantings of albizia, and various Eucalyptus and Casuarina species are also found in these areas.

The vegetation of the gulch areas, including the steep gulch slopes, usually consists of forestry plantings interspersed among dense thickets of Christmas berry, guava, and strawberry guava. In some areas, especially on the broader slopes, the vegetation may be composed of an open scrub. Here broomsedge (Andropogon virginicus) grasslands with scattered shrubs are frequently encountered.

The parcels located next to Waiawa Stream (parcels K & L) are dominated by Californiagrass and scattered shrubs, again largely koa-haole. Lining the stream banks are dense thickets of koa-haole; a few Java plum trees and saplings are also found here. A large clump of mango trees (Mangifera indica), which marks a house site, is also found

in this area.

DISCUSSION AND RECOMMENDATIONS

The vegetation on the Gentry 504 project site is dominated by introduced plant species. The few native species on the site, such as 'uhaloa (*Waltheria indica* var. *americana*) and yellow wood sorrel (*Oxalis corniculata*), are considered hardy, "weedy" natives and are widespread throughout the islands in similiar environmental conditions.

As the proposed project will impact principally lands now occupied by fallowed cane fields, development will not have a significant impact on the native species. No plants considered rare, threatened or endangered (Fosberg and Herbst 1975; U. S. Fish and Wildlife Service 1980) were found on the project site. Flora surveys of adjacent or nearby areas (Hawaiian Agronomics 1986; Department of Public Works 1972) have also reported no rare, threatened or endangered plant species. These surveys have also noted that the vegetation is composed primarily of introduced species.

Char (1985) expressed some concern over soil loss due to vegetation removal on sloping areas. It is therefore recommended that such areas be grassed over as soon as possible to prevent soil loss through wind and water erosion.

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APPENDIX C

TERRESTRIAL VERTEBRATE ANIMALS

Of Waiawa Ridge--300 Acre Addition, 1987

By Andrew J. Berger

This report results from agreement of January 5, 1987, with F. J. Rodriguez, President of Environmental Communications Inc. Field studies were made on November 20, and 21, 1985, and January 9, 1987.

The Habitat

The entire region has been drastically disturbed for more than 100 years. There is no semblance of any endemic ecosystem in the vicinity of the area. As pointed out in the "Property and Land Use concept" statement: "Of the 1,500 acres within this property, approximately 1,350 acres, formerly in cane, has topography with grades less than a ten percent." The fallow cane fields have a number of introduced grasses and weeds. The ridges and gulches support a generally dense vegetation of such exotic plants as ironwood, eucalyptus, octopus tree, and Christmas berry trees.

Amphibians and Reptiles

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

I. Amphibians

Four species of frogs have been introduced to the island of Oahu: the green and black poison-arrow frog (Dendrobates auratus), the bullfrog (Rana catesbeiana), the wrinkled frog (Rana rugosa), and the giant neotropical toad (Bufo marinus). The four species generally occupy different habitats, and none are of any concern in an environmental impact assessment (Hunsaker and Breese, 1967).

II. Reptiles

1. Blind Snake, Typhlina bramina

"This small, secretive snake was apparently introduced from the Philippines in the dirt surrounding plants that were brought in for landscaping the campus of the Kamehemeha Boys School in Honolulu. It was first found there in January 1930" (Oliver and Shaw, 1933). These blind worm-like snakes are rarely seen until they are flooded from underground burrows by heavy rains or unless one looks for them under branches and other debris on the ground. These harmless snakes are of no significance for an environmental impact assessment. They now are found on all of the main islands (McKeown, 1978)."

2. Skinks and Geckos

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

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 no place else in the world. Many of these endemic birds are classified as endangered or threatened with extinction by the U.S. Fish and 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 Oahu, and there is no suitable habitat 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'O (Fulica americana alai), and the Hawaiian stilt or Ae'O (Himantopus mexicanus knudseni). There is, however, no suitable habitat for these waterbirds on the project area (see, Shallengerger, 1977; Walker et al., 1978).

There is one endangered Hawaiian bird that could occur in the general region of the project site: the Hawaiian owl or Pueo (Asio flammeus sandwichensis). This subspecies of the North American short-eared owl is considered to be endangered on Oahu by the State Division of Forestry and Wildlife, although not by the U.S. Fish and Wildlife Service.

This owl differs from most other owls in its diurnal habitats, so that, where present, it frequently is seen soaring during daylight hours. I did not see any Pueo during my three days of field work, nor could I find any published records of the owls' occurrence in this area.

II. Indigenous Birds

These are species that occur naturally in Hawaii but whose total range includes other parts of the Pacific Basin. These birds are native to the Hawaiian Islands but are not unique to them. In this category are 22 species of sea birds, the Hawaiian Black-crowned night heron (Nycticorax n. hoactli), and a number of migratory species that spend their winter or non-breeding period in the islands. I did not see any night herons and there is no suitable habitat for them on the project site.

The only winter resident that one would expect to find in this habitat is the golden plover (Pluvialis dominica fulva), and I saw several in the old cane-haul roads. In Hawaii these "shorebirds" winter from sea level to elevations as great as 10,000 feet on the island of Hawaii. The birds frequent lawns in residential area, golf courses, weedy pastures, open areas in the

mountains, and mud flats along the coasts. The project site does not provide habitat for the other winter residents.

III. Introduced Birds

More than 170 species of alien birds have been intentionally released in the Hawaiian Islands since about 1800 (Berger, 1981). Approximately 50 species have established breeding populations in the islands. Several species have proven to be highly detrimental to agriculture. The following species occur on and adjacent to the Waiawa land.

I. Order Ciconiiformes

A. Family Ardeidae, herons and egrets

1. Cattle Egret, Bubulcus ibis

This egret 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 in 1961. Thistle (1962) reported that the population of cattle egrets exceeded 150 birds by July of 1962. Some 700 egrets were counted on Oahu during July 1983 by personnel of the State Division of Forestry and Wildlife. I saw a half dozen egrets in flight over the fallow cane fields.

II. Order Galliformes

B. Family Phasianidae, pheasants, quail, and partridges

2. Ring-necked Pheasant, Phasianus colchicus

According to Caum (1933), this Asian pheasant probably was introduced to the islands in 1965 "probably by Dr. Hillebrand." It also has been imported a number of times since "through dealers in the United States as well as from the territorial game farm on Oahu" (Schwartz and Schwartz, 1949). It now is not a very successful species on Oahu. Hunters killed 235 birds during the 1960-1961 hunting season, but only one bird was reported during the 1983-1984 season (Saito, 1984). I heard one bird call from the power line area near the fence for the Waiawa Correctional Facility.

III. Order Columbiformes

C. Family Columbidae, pigeons and doves

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

This Asian dove was introduced to the Hawaiian Islands at an early date; the exact date is unrecorded, but the birds are said to have been common on Oahu by 1879 (Caum, 1933). It is now common to abundant on all of the main islands in the chain, and is classified as a gamebird in Hawaii. It occurs in areas

where the rainfall exceeds 100 inches a year, but the highest densities are found in drier areas where the alien kiawe and koa haole are dominant plants. Schwartz and Schwartz (1949), for example, found densities as great as 200 birds per square mile in dry areas on Molokai. The diet was found to consist of 77 percent weed seeds and about 23 percent fruits; animal matter was "almost negligible." Tapeworm parasitism, however, was heavy, thus, indicating that the small amount of animal material eaten by the doves was important in contracting the worm parasites. The spotted dove is common in residential and open areas throughout the Waiawa region.

4. Barred Dove or Zebra Dove, Geopelia striata

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

IV. Order Strigiformes

D. Family Tytonidae, Barn Owls.

5. Barn Owl, Tyto alba pratincola

Barn Owls differ from other owls in that they have a heart-shaped facial disc of feathers, hence the name of "monkey-faced owl." Barn Owls were first released on Oahu in 1959. Like the mongoose much earlier, the owls were introduced with the hope that they would prey upon rats in the sugar-cane fields of the islands. Few studies of the food habits of the Barn Owl have been conducted in Hawaii, but 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 Kaula islands. These owls are nocturnal in habits and I did not see any during my daytime field work. However, a guard at the entrance to the Waiawa Correctional Facility told me that he had seen "whitish" owls perched on the fence at dusk. These light-breasted birds certainly were Barn Owls.

V. Order Passeriformes

E. Family Alaudidae, Larks

6. Skylark, Alauda arvensis

The first Skylarks were brought to Hawaii from England in 1865; other birds were brought to Hawaii from New Zealand (where they had been introduced from England in 1864) in 1870. Henshaw (1904) wrote that the introduction of the Skylark to Oahu had been "a great success," and that some

birds had been released on the windward side of Hawaii. Skylarks were fairly common in suitable habitat on Oahu 20 years ago, but have become increasingly uncommon as the years have passed. Robert L. Pyle saw two skylarks on the Waipio Peninsula and two others near Walker Bay during 1976 (Elepaio, 37:9); six birds were counted during the 1984 Honolulu Christmas Bird Count of the Hawaii Audubon Society (Pyle, 1985). I was pleasantly surprised to find several birds in their flight song in the "pasture land" during the morning of November 21, 1985.

F. Family Timaliidae, babblers and laughing-thrushes

7. Melodious Laughing-thrush, Garrulax canorus

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

G. Family Pycnonotidae, Bulbuls

8. Red-vented Bulbul, Pycnonotus cafer

Although all members of this Old-world family are listed as "prohibited entry" by the State Quarantine Division of the Department of Agriculture, two species are now well established on Oahu.

The history of the spread of this species since the mid-1960s has been discussed by Berger (1975a, 1981). Bulbuls are a scourge to both fruit and flower growers. The birds eat buds, flowers, and ripe fruits of all kinds. I saw several flocks of 15 to 20 bulbuls in the fallow cane fields and the dirt roads in the project area.

H. Family Turdidae, Thrushes and Bluebirds

9. Shama, Copsychus malabarica

Shama is the Indian name for this thrush, which is native to India, Nepal, Burma, Malaysia, and throughout Indochina. The Hui Manu imported Shamas in 1940 and released them in Nuuanu Valley "and at some homes in the 2400 block on Makiki Heights road" (Harpham, 1953). The Shama is now common on both the windward and leeward slopes of the Koolau mountains. The birds prefer lush vegetation and inhabit the gulches of the region.

I. Family Sylviidae, Old-world Warblers

10. Japanese Bush Warbler, Cettia diphone cantans

This species was introduced to Oahu by the Territorial Board of Agriculture and Forestry in 1929 and "several times after that by the Hui Manu and by private individuals" (Caum, 1933). The Japanese name is Uguisu. These are shy and secretive birds, typically inhabiting areas with dense undergrowth. In the project area, however, the birds were singing throughout the fallow sugarcane fields. Berger (1975b) summarized the history and distribution of this species on Oahu. The song period apparently lasts from November through mid-July, and the birds were in full song on November 20 and 21, 1985, and January 9, 1987.

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

11. Japanese White-eye, Zosterops japonicus

Long a favorite cage bird in the Orient, this species was first imported for release from Japan by the Territorial Board of Agriculture and Forestry in 1929 (Caum, 1933). Later importations were made by the Hui Manu. The Japanese name is Mejiro, and Mejiro clubs held singing competitions with these birds. The white-eye has been a remarkably successful introduction and this species undoubtedly is the most abundant song bird in the Hawaiian Islands. It occurs from sea level to 10,000 feet elevation on Hawaii, and it occupies near-desert areas (e.g., Kawaihae) and those with an annual rainfall of more than 300 inches. The white-eye is an abundant species throughout the Waiawa region.

K. Family Sturnidae, Mynas and Starlings

12. Common Indian Myna, Acridotheres tristis

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

L. Family Ploceidae, Weaverbirds and their Allies

13. Spotted Munia or Ricebird, Lonchura punctulata

This munia has a wide distribution in Sri Lanka, India, Nepal, Burma, and southward into Malaysia and the Indo-Chinese subregion, and

in the Philippines. The species was introduced to Oahu by Dr. Hillebrand about 1865. Caum wrote that this species feeds "on the seeds of weeds and grasses and does considerable damage to green rice." Although rice is no longer grown in Hawaii this munia continues to be a pest for certain agricultural crops (see explanation under House Finch). Ricebirds are highly gregarious and flocks of 75 or more birds are not uncommon. They are a prolific species and I have found nests throughout the year. Rice birds are not inhabitants of forests or dense thickets but are found wherever there are weed seeds in open spaces: for example, pastures, golf courses, along dirt roads and cane haul roads, weedy fields, and fallow sugarcane fields. Therefore, the Ricebird is an abundant species in the project area.

14. Black-headed Munia, Lonchura malacca atricapilla

This race of the Black-headed Munia is native to northeastern India, Burma, and northwestern Yunnan. There are nine other races that range from the Philippines to Java. This species also is known in the pet-store trade as the Chestnut Mannikin, Black-headed Nun, Black-hooded Nun, and Black-headed Mannikin. Birds apparently were first imported as cage birds from Asia between 1936 and 1941. The species was first reported breeding in the wild by Udvardy (1960), who observed 10 adults and 15 juvenile birds near West Loch, Pearl Harbor, on April 26, 1959. Ord (1967) reported that the species was abundant "in open grassy areas around Middle and West Lochs of Pearl Harbor." I observed flocks of this munia along the edges of cane fields in the West Beach area during November 1973, and flocks were observed in Mililani Town in February 1977. The species has continued to expand its range on Oahu and I saw several small flocks in the fallow cane fields.

15. House Sparrow, Passer domesticus

Incorrectly called the English Sparrow (it has a wide distribution in Europe and Asia as well as in Britain), this sparrow was first imported to Oahu in 1871, when nine birds were brought in from New Zealand (where they had previously been introduced from England). Caum (1933) wrote that "the species was reported to be numerous in Honolulu in 1879." The House Sparrow became a serious pest in North America and many thousands of dollars were spent in attempts to control the population. This sparrow apparently never became a pest in Hawaii. The birds eat grain, seeds, and insects and their larvae. The House Sparrow typically is found in the vicinity of man and his buildings but they also forage in outlying areas, and I found them along the dirt roads throughout the fallow cane fields.

M. Family Fringillidae

16. Yellow-faced Grassquit, Tiaris olivacea

This finch is native to the Atlantic slope of Mexico southward through Central America to western Columbia and Venezuela, and Puerto Rico, Cuba, Hispaniola, Jamaica, and other islands. We have no information on the introduction of this species to Oahu. It was first reported by Douglas Roselle,

who found several birds at Pacific Palisades during August 1974 (Elepaio, 35:65). "At least 40 birds" were seen in this area on October 29, 1978 (Elepaio, 38:106). By 1979 this grassquit had spread to the Kipapa trail (Stemmerman, 1981). Although I did not happen to see this species, it undoubtedly occurs in the region of the project site.

17. Red-crested Cardinal, Paroaria coronata

This species has long been clled the Brazilian Cardinal in Hawaii, but its native range also includes Paraguay, Uruguay, and parts of Bolivia and Argentina. The species was released several times between 1928 and 1931 (Caum, 1933). The Red-crested Cardinal is very common on Oahu and I found several flocks of between 15 and 20 birds along the edges of the fallow cane fields.

18. Cardinal, Cardinalis cardinalis

This North American bird also is called the Kentucky Cardinal, Virginia Cardinal, and the Redbird. Its native range is the eastern part of North America east of the plains and northward into Ontario. The Cardinal was released on several occasions between 1929 and 1931 (Caum, 1933). It now is common in residential and rural areas but is uncommon in the fallow cane fields.

19. House Finch, Carpodacus mexicanus frontalis

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

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 the islands of Kauai and Hawaii (Tomich, 1969; Kramer, 1971; Ten Bruggencate, 1983). I know of no evidence that there is a resident population on the island of Oahu.

II. Introduced Mammals

All of the introduced species of mammals in Hawaii have proven highly detrimental to man, his buildings, products, and agricultural crops and/or to the native forests and their animal life. None is an endangered species and none is of concern as far as detrimental effects resulting from the proposed project. It would, in fact, 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 alien mammals prey on birds, their, eggs, or young. These small mammals include the roof rat (Rattus rattus), Polynesian rat (Rattus exulans), Norway rat (Rattus norvegicus), and the small Indian mongoose (Herpestes auropunctatus), as well as the 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 sample the nocturnal rodents. It is reasonable to assume that all of these rodents occur in the project area (Tomich, 1969; Kramer, 1971).

The feral pig (Sus scrofa) inhabits the valleys and gulches in the general Waiawa region, but is of no significance for an impact statement because of the serious destruction that they cause to the Hawaiian forests (Mueller-Dombois et al., 1981).

Summary of Possible Impacts on the Fauna

1. A substantial portion of the project site consists of former sugarcane land, now fallow and heavily overgrown with alien weed plants. The gulches support a dense growth of exotic trees, shrubs, and vines. In its present condition, the area properly can be called a "waste land" as far as endemic or native Hawaiian vegetation and animals is concerned.

2. There are no endemic forest birds in the project area or anywhere near it.

3. There is no suitable habitat for any of the endangered Hawaiian waterbirds.

4. None of the 19 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 Ricebird and the house finch already has been mentioned. The doves and myna have been implicated in spreading the seeds of such noxious plants as Lantana camera. 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 birds on Kauai (Byrd and Telfer, 1980). Some of the introduced birds apparently cause no damage to crops or to the endemic forest birds, and they do provide pleasure for many people. However, development, including landscaping, actually would provide habitat for many of the introduced bird species. Therefore, it seems reasonable to conclude that the presence of these alien birds is irrelevant to an environmental impact assessment.

5. All of the mammals, land reptiles, and amphibians that occur in the project area are introduced or alien animals. Many 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 animals is of any significance in this environmental impact assessment.

6. Because the vegetation in the project area is virtually all introduced or exotic and because all of the terrestrial vertebrate animals in the region are alien to the islands, there can be no sound biological reason that the proposed project would have any adverse effect on any endemic Hawaiian animal or ecosystem.

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APPENDIX D

WAIAWA RIDGE, OAHU:
ARCHAEOLOGICAL SURVEY OF GENTRY 515 PROJECT AREA

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JANUARY 1987

I. INTRODUCTION

On January 29 and 30, 1987, an archaeological survey was conducted on a 515 acre parcel at Waiawa Ridge, central Oahu. The purpose of the survey was to provide information to be included in a supplemental review of the property. The fieldwork consisted of pedestrian sweeps of the survey area by one person looking for evidence of past utilization [stone walls, midden remains, artifacts, etc.]. Complete coverage was not possible because of the presence of thick grass and haole koa [Leucaena glauca] in those areas which had previously been cultivated in sugarcane. Because of the extensive ground disturbance associated with this sugarcane cultivation, the primary efforts of the survey were directed to the gulches.

II. BACKGROUND

The survey area is to be part of a proposed residential development bounded by Pearl City, the Waipio subdivision and the Crestview subdivision. The following physical description of the proposed development area is from materials supplied by the client:

> "The land area is composed of a series of gently sloping plateaus, with slopes of 5 to 10 percent. Tributaries of Panakauahi and Waiawa Gulch meander through the site, generally on a north-south axis, and divide the plateaus into several smaller areas. These gulches provide a natural drainage system through the site and transport storm water runoff from the Koolau Mountains to the Middle Loch of Pearl Harbor. Two major soil associations are found within the project area: the Lualualei-fill land-Ewa association near Pearl Harbor and the Helemano-Wahiawa association. The former association is characterized as deep, nearly level to moderately sloping, well-drained soils that have a fine textured or moderately fine textured subsoil and is primarily located on the coastal plains. The Helemano-Wahiawa association includes the major portion of the site. It is characterized as nearly level to moderately sloping, well-drained soils that have a fine-textured subsoil and is mainly situated on upland areas.

"The average annual precipitation ranges between 25 inches at the lower elevations to about 40 inches in the mauka areas. The elevation ranges between 150 to 885 feet above sea level. Winds are predominantly from the northeast, and the median annual temperature is 82 deg. F. Vegetation on the site consists primarily of scrub growth and koa haole. Approximately 1,860 acres of the site were previously cultivated for sugarcane by Oahu Sugar Company. However, the lands are now fallow since active cultivation ceased after the last harvest in 1983."

In addition to the above-described areas, part of the present survey included the floodplain of Waiawa Stream.

III. PREVIOUS RESEARCH

Published information on the area is scarce. McAllister [1933:105] mentions only one site in the vicinity, and that was in Waiawa Gulch outside the project area approximately one-half mile to the northeast:

"Site 121. Puoiki heiau, at the juncture of Manana and Waiawa gulches.

"The heiau crowned the top of a small oval knoll which is about 50 feet high by 100 feet wide and 200 feet long. The sides of the knoll are perpendicular except for a steep and narrow neck on the mountain side. During the ceremonies the people are said to have been at the foot of the knoll and surrounding the heiau. There are no remains."

Handy [1940:81] refers briefly to taro cultivation in Manana gulch:

"This narrow Gahupua'aH was called Manana-iki in its lower portion and Manana-nui in the mountains where it broadens and includes Manana Stream, which flows into Waiawa. There were a few terraces seaward, irrigated by Waiawa Stream."

A reconnaissance survey of the larger project area was conducted by the author in February, 1986. Exposures of partially-buried terrace retaining walls were found in the bottoms of three gulches, and a basalt adze was found on the surface of one of the adjacent slopes. During a subsequent intensive survey of two proposed

golf courses, four sites were recorded. These included boulder alignments, a historic trash dump, the former location of a cannery and the former location of plantation housing [Barrera 1986].

IV. SURVEY RESULTS

No significant archaeological or historic sites were found. This lack is primarily the result of the extensive ground disturbance caused by sugarcane cultivation and other more recent earthmoving activities, but the possibility that agricultural sites have been buried by flood deposits in Waiawa Stream is a real one, especially in light of Handy's remarks [quoted above].

VI. RECOMMENDATIONS

It is recommended that the developer retain an archaeologist to monitor construction and grading activities so that any sites and their associated scientific information that may have been obscured by sugar cultivation or stream flooding may be identified, assessed and protected.

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APPENDIX E

T R A F F I C I M P A C T R E P O R T

W A I A W A 5 1 5 P R O J E C T

M a r c h 1 9 8 7

Prepared For: The Gentry Companies

Prepared By: Parsons Brinckerhoff Quade & Douglas, Inc.
Honolulu, Hawaii

WAIAWA 515 PROJECT

TRAFFIC IMPACT REPORT

INTRODUCTION

A development plan has been proposed by The Gentry Companies for approximately 2,500 acres on Waiawa Ridge in Central Oahu. The plan includes a retirement community, other residential development, commercial areas, a business park, and several golf courses. The first ten years of development (1990-2000) will include approximately 1,395 acres; traffic impacts of this project in year 2002 were discussed in the Traffic Impact Assessment Report[1] for the "Waiawa By Gentry" development.

Development of the project is expected to continue over the next ten years, with nearly 5,000 additional dwelling units on a total site of approximately 1,900 acres. This report summarizes the evaluation of Year 2010 traffic conditions with and without the proposed Waiawa project (the entire 20-year development). The project's effect on the regional traffic demands and the transportation improvements needed to support the proposed project are discussed herein.

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[1] Parsons Brinckerhoff Quade & Douglas, Inc., Traffic Impact Assessment Report, Waiawa By Gentry, January 1987.

EXISTING CONDITIONS

Existing conditions in the area are discussed in the traffic report for the first ten years of development.

FUTURE CONDITIONS WITHOUT PROJECT

The evaluation of future conditions without the project assumes that no portion of the proposed Waiawa project is developed. Future traffic demands (Figure 1) in the area are based on the State Highways Division's projections[2] for Waipio and Waiawa Interchanges. Other proposed developments in the area will contribute to the expected increase in traffic demands; the State's projection of the future traffic demand on the H-1 Freeway on the Honolulu side of Waiawa Interchange was accepted as a baseline for the evaluations.

The new Waipio Interchange at the existing Mililani Memorial Park Access Road overpass of the H-2 Freeway is expected to be completed in mid-1989 and was assumed to be in place for this evaluation. This interchange would be connected to Kamehameha Highway via an extension of Ka Uka Boulevard. A new interchange at Paiwa Street on H-1 is also assumed to be operational. Other roadway improvements which will be necessary include:

- Signalization of the Ka Uka Boulevard intersections with Kamehameha Highway and with the off-ramp from Honolulu at the Waipio Interchange. A two-lane off-ramp would also be necessary.

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[2] State of Hawaii, Department of Transportation, Highways Division, Traffic Assignment TA 85-17.

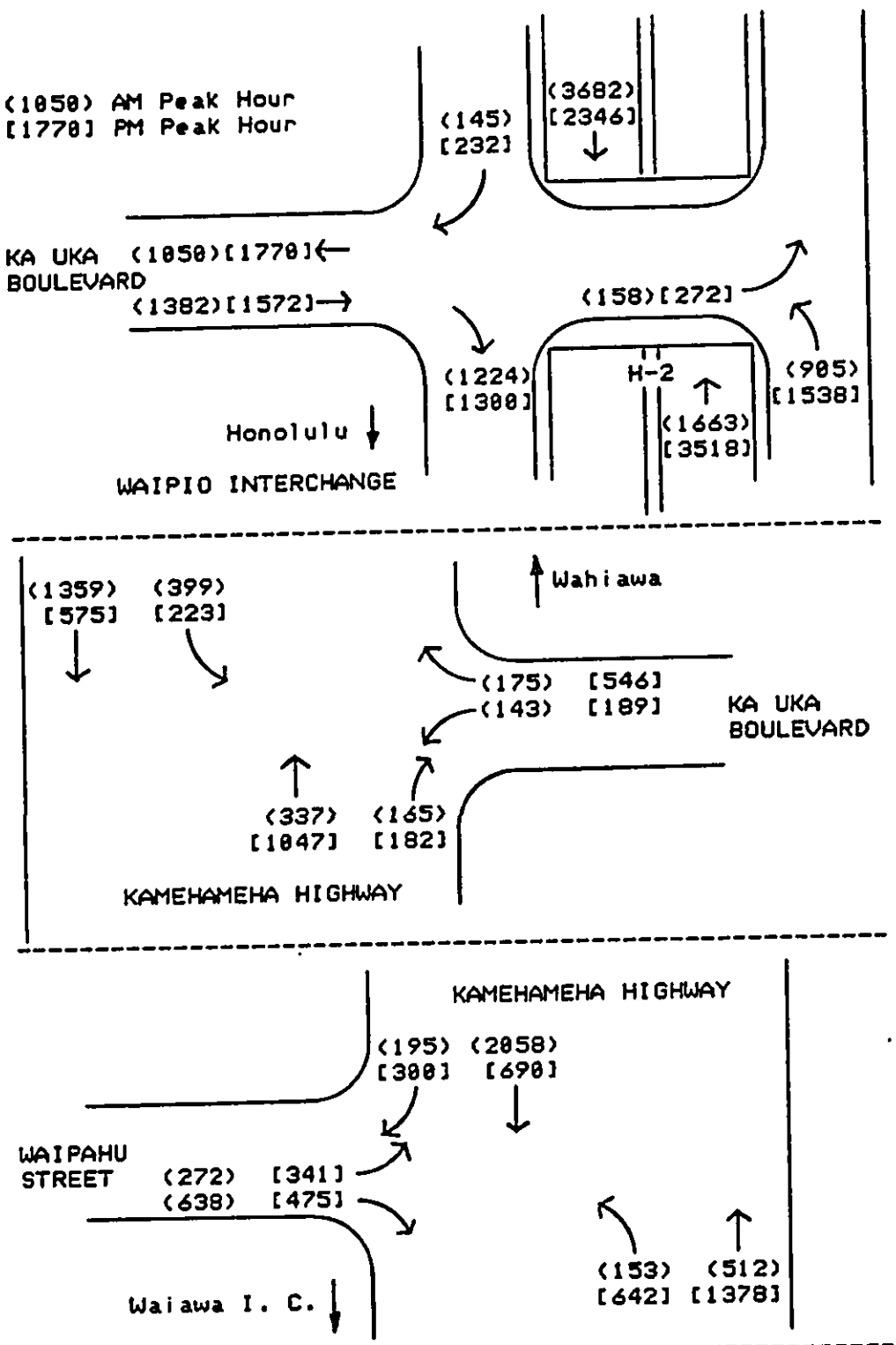

FIGURE 1
TRAFFIC ASSIGNMENT
WITHOUT PROJECT - YEAR 2010

- A two-lane on-ramp toward Honolulu at Waipio Interchange.

- Separate approach lanes on Waipahu Street (eastbound) at Kamehameha Highway for traffic desiring to turn right and to turn left.

- Signalization of the intersection of Kamehameha Highway and Waihona Street.

These improvements will be necessary to provide sufficient capacities in the roadway system to accommodate the projected future traffic volumes without the proposed Waiawa development. Traffic, however, will operate at near-capacity conditions along H-2 south of Waipio Interchange and at the intersection of Kamehameha Highway and Waipahu Street. The Kamehameha Highway intersections with Ka Uka Boulevard and with Waihona Street are expected to operate at under-capacity conditions.

TRAFFIC GENERATION

The traffic impact of the proposed project is determined by evaluating the number of vehicles generated by the project. This traffic is assigned onto the future base condition, after which the impacts at affected locations can then be examined. The expected start of development (Waiawa By Gentry) is in 1990; the impact of the total development at the end of the second ten-year period, which includes the Waiawa 515 project, is addressed in this report for year 2010.

Trip Generation

The number of trip ends generated by the proposed project depends on its land uses. The proposed project has several types of land uses which have been categorized in Table 1 along with the corresponding vehicular trip generation rates and parameters.

Table 1

TRIP GENERATION RATES

Land Use & (Parameter)	Daily (vpd) Enter & Exit	AM Pk Hr (vph) Enter	AM Pk Hr (vph) Exit	PM Pk Hr (vph) Enter	PM Pk Hr (vph) Exit
Residential (dwelling unit)					
Single Family	10.0	0.21	0.55	0.63	0.37
Low Density Apt.	6.1	0.1	0.4	0.47	0.23
Leisure Village - net traffic (dwelling unit)	3.3	0.05	0.22	0.25	0.12
Commercial/Industrial (acre)*	189	10.7	3.5	6.4	12.0
Golf Course (acre)	6.9	0.22	0.05	0.08	0.31

Notes: vpd = vehicles per day vph = vehicles per hour
* weighted average of light industrial, industrial park, warehousing, general office building, and retail.

Source: Institute of Transportation Engineers, Trip Generation, Third Edition.

Table 2 summarizes the trip generation with the projected twenty-year development, which includes both the Waiawa By Gentry and the Waiawa 515 projects. The size of the development and its mixed uses are expected to allow the satisfaction of many trip demands within the project site. Internal trips, i.e. trips which have both origin and destination within the project limits, have been estimated to be 30% of the total generated in the AM Peak Hour and 50% in the PM Peak Hour, based on evaluations of other large areas on Oahu. The net vehicle trips, or external trips, shown in Table 2 account for these internal trips and represent the traffic volumes expected across the project boundaries.

Trip Distribution

The external trips will access the roadway system at two locations: the Ka Uka Boulevard extension and a new road between Waipahu and Waihona Streets. The external trips will have origins or destinations in six general directions from the project: Wahiawa, Crestview/Waipio, Waipahu, Ewa/Waianae, Pearl City, and Honolulu. Estimates of trip distribution were made for five different land uses within the project, as shown in Table 3.

Traffic Assignment

The traffic demands from the project were assigned to the roadway system using the trip distribution estimates and the most direct connection available on the network (Figure 2).

Table 2
TRIP GENERATION
Year 2010

Land Use	Daily(vph) Enter&Exit	AM Pk Hr(vph) Enter	AM Pk Hr(vph) Exit	PM Pk Hr(vph) Enter	PM Pk Hr(vph) Exit
Total Trip Ends - Waiawa By Gentry					
Residential Units					
3,216 single-family	32,160	675	1,769	2,026	1,190
540 apartments	3,290	54	216	254	124
Leisure Village					
4,150 units	13,700	208	913	1,038	498
Commercial/Industrial					
110 acres	20,790	1,177	385	704	1,320
Golf Course					
355 acres	2,450	78	18	28	110
TOTAL (W. By Gentry)	72,390	2,192	3,301	4,050	3,242
Total Trip Ends - Waiawa 515					
Residential Units					
1,090 single family	10,900	229	599	687	403
Leisure Village					
3,900 units	12,870	195	858	975	468
Commercial/Industrial					
83 acres	15,690	888	291	531	996
TOTAL (Waiawa 515)	39,460	1,312	1,748	2,193	1,867
TOTAL DEVELOPMENT	111,850	3,504	5,049	6,243	5,109
NET TRIP ENDS		2,221	3,766	3,405	2,271

Table 3

TRIP DISTRIBUTION

	Residential S. Fam.	Residential Apt.	Leisure Village	Comm./ Indus.	Golf Course
Access Point					
Ka Uka Boulevard	95 %	95 %	60 %	80 %	90 %
Waipahu/Waihona Sts.	5 %	5 %	40 %	20 %	10 %
Origin/Destination					
Wahiawa	2 %	3 %	5 %	10 %	5 %
Crestview/Waipio	3 %	5 %	10 %	15 %	5 %
Waipahu	3 %	5 %	10 %	10 %	5 %
Ewa/Waianae	7 %	10 %	10 %	5 %	15 %
Pearl City	5 %	7 %	15 %	10 %	6 %
Honolulu	80 %	70 %	50 %	50 %	64 %

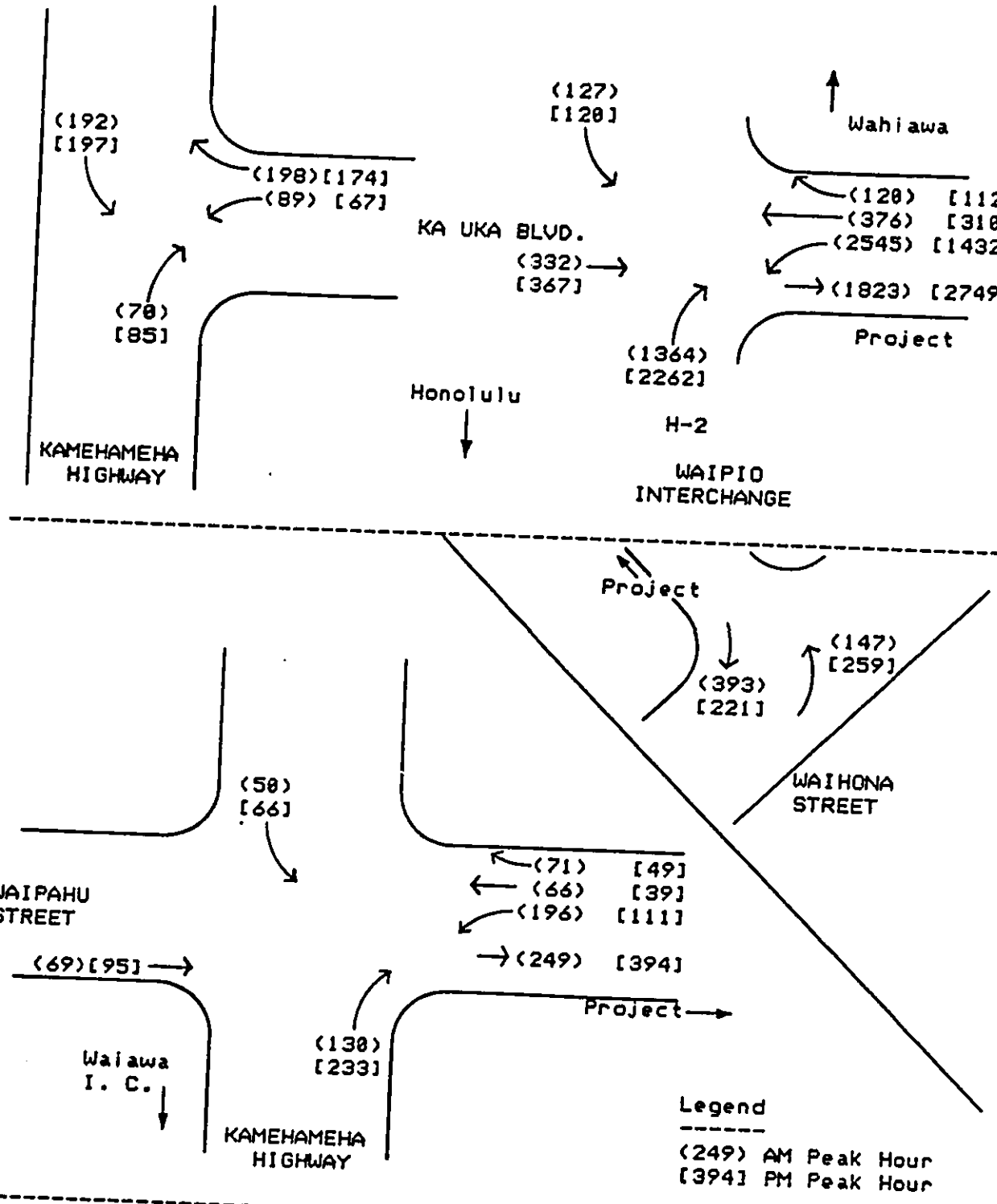

FIGURE 2
PROJECT TRAFFIC ASSIGNMENT
YEAR 2010 (NO MITIGATION)

PROJECT IMPACTS AND RECOMMENDED IMPROVEMENTS

The proposed Waiawa project is expected to affect traffic conditions in the region by redistibuting travel demands. The State's traffic assignment, while made without consideration of development at Waiawa, was based on a rate of development in the area north and west of the Waiawa Interchange consistent with growth expectations and population projections. The State's traffic assignment was therefore adjusted to reflect the inclusion of development at Waiawa in the area.

The proposed rate of development of the Waiawa projects, if realized, would account for much of the increase in traffic wishing to commute from Central and Leeward Oahu into downtown Honolulu. To maintain consistency with the State Highways Division's estimate of traffic volumes east of Waiawa Interchange, traffic to and from Ewa or Mililani would have to be less than previously projected. This analysis would identify worst-case conditions at the project access points.

The State's estimates for years 1998 and 2008 were extrapolated to determine year 2010 volumes. Future with-project traffic assignments at Waipio Interchange, the Kamehameha Highway intersections with Ka Uka Boulevard and Waipahu Streets, and on Waihona Street are shown in Figures 3, 4, and 5.

The analyses of freeway conditions, ramp termini levels of service, and intersection adequacy followed procedures described in the Highway Capacity Manual[3]. These calculations provide an

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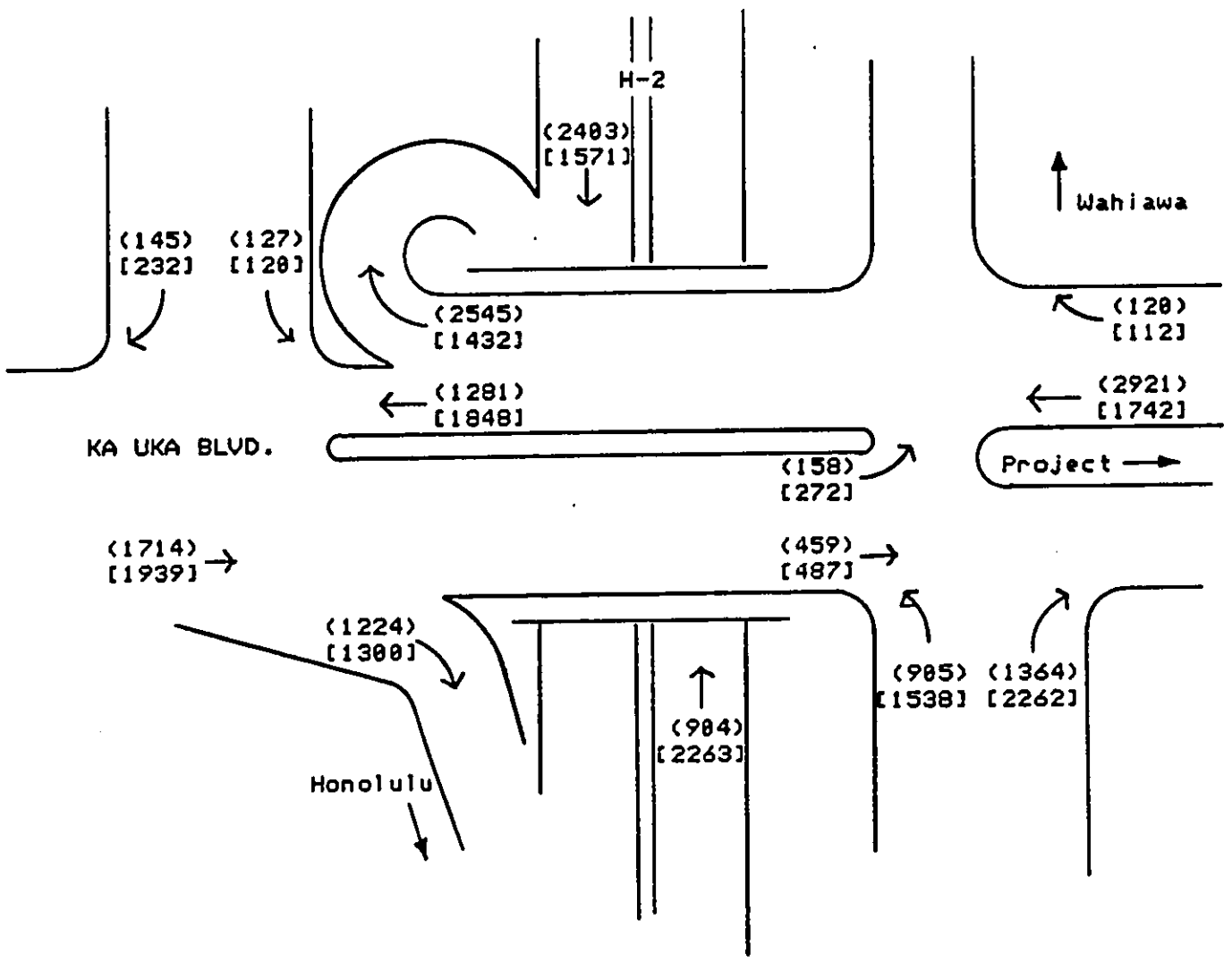
[3] Transportation Research Board, National Research Council, Special Report 209, Highway Capacity Manual, Washington, D. C., 1985.



Legend

(1224) AM Peak Hour
[1300] PM Peak Hour

FIGURE 3
TRAFFIC ASSIGNMENT (WAIPIO INTERCHANGE)
WITH PROJECT - YEAR 2010

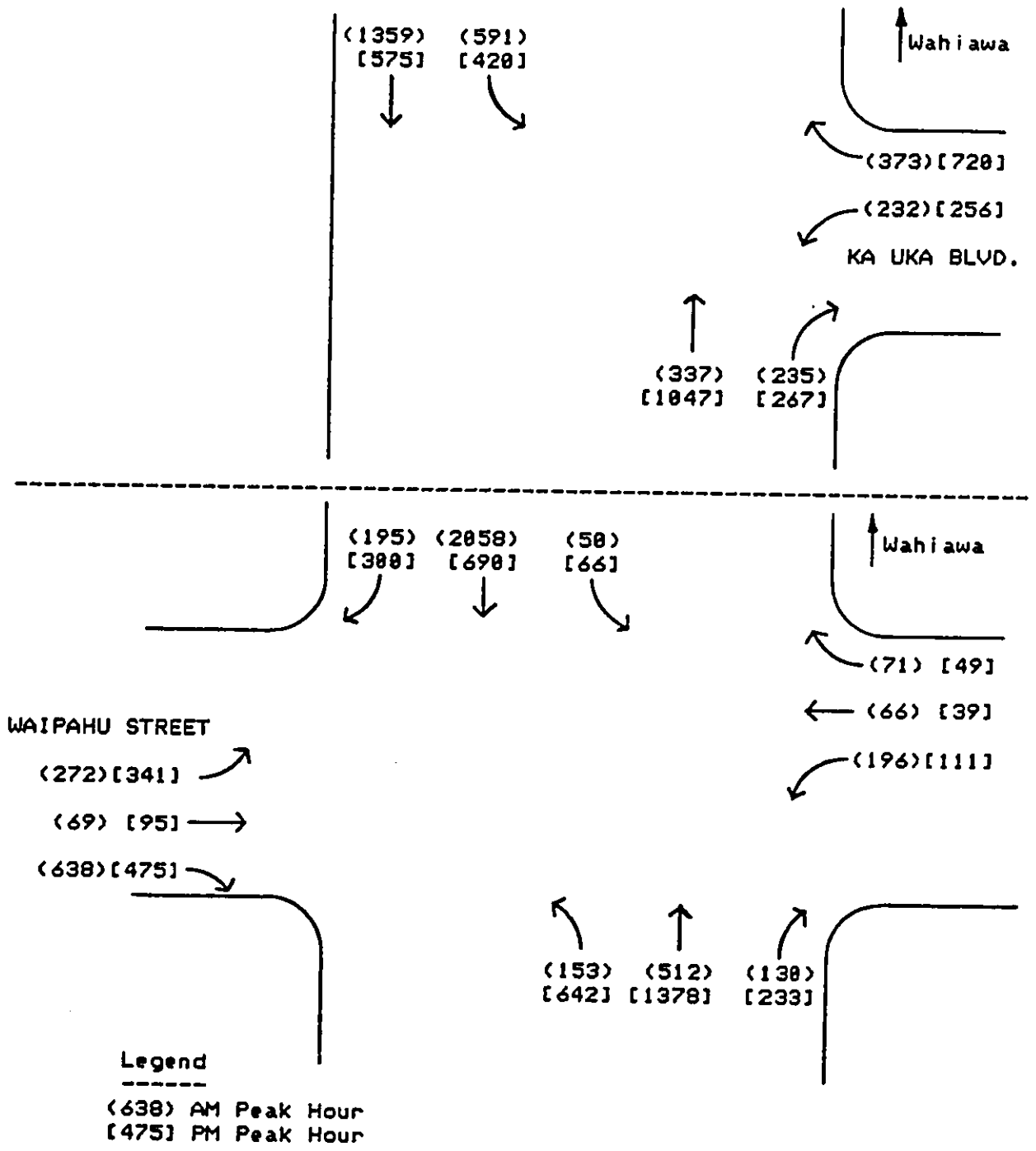
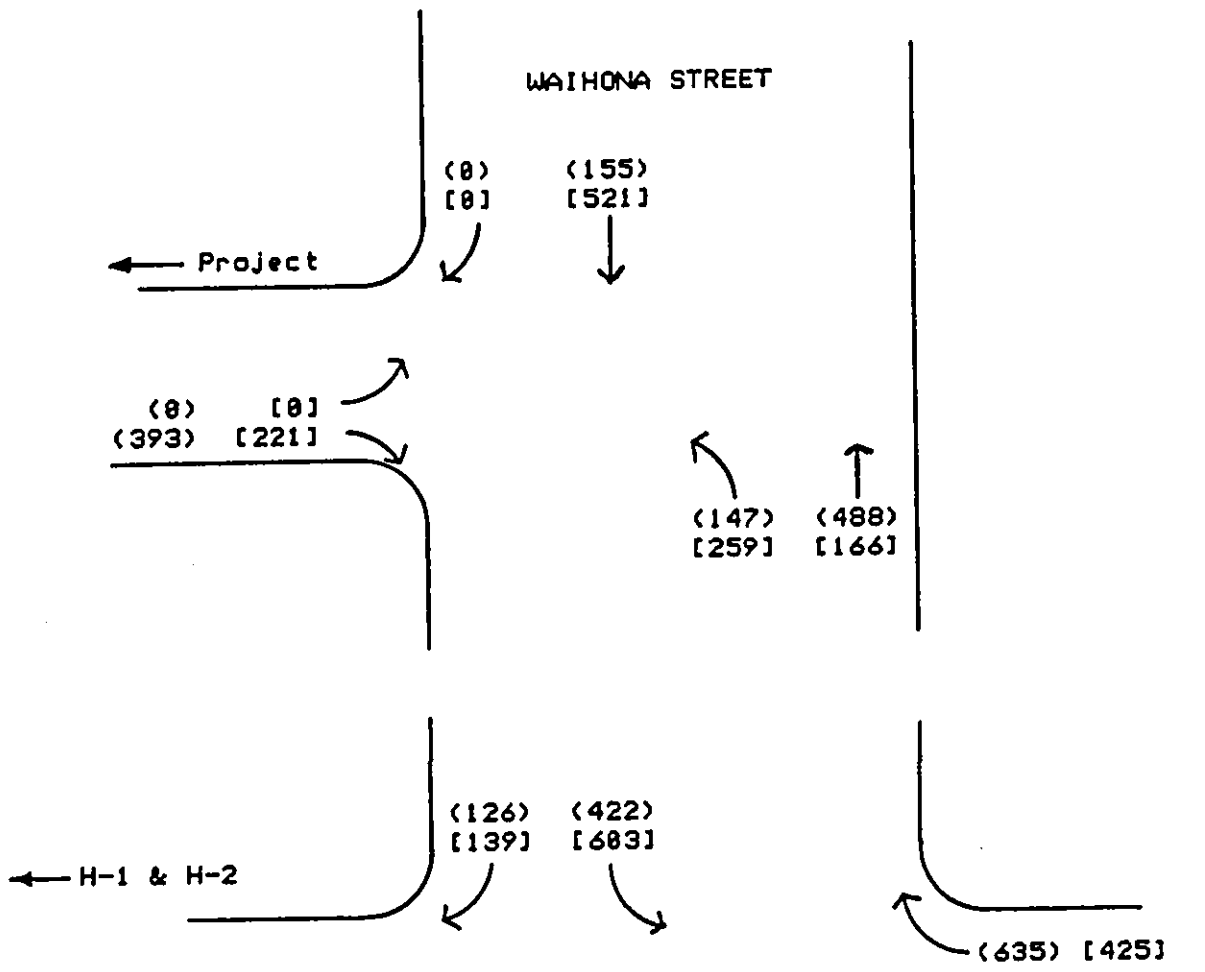
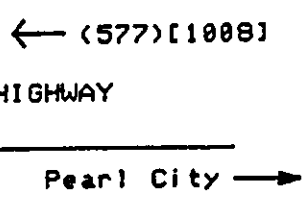


FIGURE 4
TRAFFIC ASSIGNMENT (KAMEHAMEHA HIGHWAY)
WITH PROJECT - YEAR 2010





Legend

(635) AM Peak Hour
[425] PM Peak Hour

FIGURE 5
TRAFFIC ASSIGNMENT (WAIHONA STREET & KAMEHAMEHA HIGHWAY)
WITH PROJECT - YEAR 2010

indication of the number of lanes required to serve the projected traffic demands, but do not indicate the design of needed improvements, such as length of on-ramp or storage requirements.

Waipio Interchange

A loop on-ramp will be needed to serve traffic from the proposed Waiawa development toward Honolulu on H-2 at the Waipio Interchange. The ramp capacity analyses indicate that the critical demand volumes in year 2010 will exceed the capacity of the interchange, even with the loop on-ramp. A reduction of demand from the Waiawa project of 42.5 % or approximately 1,100 vehicles in the AM Peak Hour would be necessary. Traffic demands from Honolulu on H-2 at Waipio Interchange in the PM Peak Hour will also exceed the capacity of the two-lane off-ramp; a reduction of 30 % or about 660 vehicles will be necessary. The following section on "Mitigation Measures" discusses changes in travel characteristics which could achieve these reductions.

The single-lane ramps on the north side of Waipio Interchange will provide adequate service for the projected demand volumes. Tables 4 and 5 summarize the findings of the analyses of freeway and ramp conditions.

While the capacity analyses indicate that two-lane ramps and the six-lane H-2 Freeway can serve future traffic (assuming mitigation measures effectively reduce the project's vehicular demand), good freeway design includes certain relationships between the number of lanes at ramp termini and desirable ramp lengths and separations. While the desirable design will require additional improvements, including widening of the freeway, the traffic demand volumes projected for this location indicate that the existing rural conditions will no longer prevail, and the

Table 4
H-2 FREEWAY CONDITIONS

Condition (Waiawa):	Without Project		With Project	
Direction:	SB	NB	SB	NB
AM Peak Hour				
North of Waipio I.C.				
Level of Service	C	B	B	B
Approx. V/C Ratio	0.65	0.31	0.46	0.20
South of Waipio I.C.				
Level of Service	E	B	F*	C
Approx. V/C Ratio	0.84	0.44	1.06	0.54
PM Peak Hour				
North of Waipio I.C.				
Level of Service	B	C	B	B
Approx. V/C Ratio	0.44	0.65	0.33	0.45
South of Waipio I.C.				
Level of Service	C	E	D	F*
Approx. V/C Ratio	0.62	0.86	0.74	1.04

Notes: 1) SB = Southboun, NB = Northbound

2) * See section "Mitigation Measures" and Table 8.

Table 5
RAMP LEVELS OF SERVICE
Waipio Interchange

(Year 2010 - No Mitigation)	AM Peak Hour		PM Peak Hour	
	SB	NB	SB	NB
Without Waiawa Development				
Single-lane Ramps				
North (SB=off, NB=on)	C	A	B	C
South (SB=on, NB=off)	F	C	E	F
With Waiawa Development				
Single-lane Ramps				
North (SB=off, NB=on)	B	A	B	B
South (SB=on, NB=off)	F	E	F	F
Double-lane Ramps (NB=off)	-	C	-	F*
With Loop Ramp (SB=on)				
Loop Ramp (WB-to-SB)	F*	-	D	-
Diamond 2-lane (EB-to-SB)	E	-	D	-

Notes: 1) SB = Southbound, NB = Northbound, WB = Westbound, EB = Eastbound

2) * See section "Mitigation Measures" and Table 8.

segment of H-2 between Waipio and Waiawa Interchanges would experience congested conditions typical of urbanized areas.

Kamehameha Highway Intersections

The Waiawa development will increase turn volumes at three intersections with Kamehameha Highway: Ka Uka Boulevard, Waipahu Street, and Waihona Street. Improvements at each intersection beyond those identified for traffic demands without the project will be necessary to accommodate project traffic. With these improvements, conditions at each intersection will be similar to conditions without the development.

An additional westbound lane on Ka Uka Boulevard approaching Kamehameha Highway will be needed (this analysis assumes a "T"-intersection without development of the proposed Waiola Estates project). The added lane would be used as an option lane for right or left turns; however, to maximize utilization of the lane, turn restrictions during peak periods are indicated. The analysis was based on using the added lane as a left turn only lane into southbound Kamehameha Highway during the AM Peak Period, and as a right turn only lane to northbound Kamehameha Highway in the PM Peak Period. The intersection would operate under-capacity with or without the Waiawa project.

The intersection of Kamehameha Highway and Waipahu Street would be changed from the existing "T"-intersection to a cross-intersection. New turn lanes from Kamehameha Highway into the new road would be needed. The analyses evaluated various phasing schemes and found that the most efficient signal operation would be six-phase, with separate phases for the westbound and eastbound approaches. The new westbound connection from the project would need to have three approach lanes: a right turn only lane, a left turn/straight option lane, and a third lane exclusively for left

turns. Widening of the eastbound approach (existing Waipahu Street) would be needed, with the third (middle) approach lane serving traffic wishing to cross Kamehameha Highway to proceed into the Waiawa development. As is the case at Ka Uka Boulevard, special use of the middle lane, as an optional right turn lane in the AM Peak Period and an optional left turn lane in the PM Peak Period, would maximize utilization of the intersection.

Signalization is needed at the Kamehameha Highway and Waihona Street intersection to provide adequate capacity for projected Waihona Street traffic in the PM Peak Hour, with or without the Waiawa project. With the project's traffic, two left turn lanes out of Waihona Street would be needed to maintain under-capacity conditions. Table 6 summarizes the signalized intersection findings.

Waihona Street

The unsignalized intersection formed at the project's access road with Waihona Street will have adequate capacity to serve projected traffic volumes. Table 7 shows the level of service findings of the unsignalized intersection analysis.

MITIGATION MEASURES

The traffic generated by the proposed project will require multiple-lane ramps at Waipio Interchange and other improvements at the Kamehameha Highway intersections. At Waipio Interchange, however, projected demand volumes would still exceed capacities.

A program to reduce traffic by encouraging high occupancy vehicle (HOV) use during peak periods has the potential to reduce

Table 6

KAMEHAMEHA HIGHWAY INTERSECTIONS

Signalized Intersections

	Sum of Critical Movements	
	AM Peak Hour	PM Peak Hour
Without Project (year 2010)		
Ka Uka Boulevard	1,046	1,161
Waipahu Street	1,389	1,313
Waihona Street	665	1,030
With Project (year 2010)		
Ka Uka Boulevard	993	1,017
Waipahu Street	1,389	1,388
Waihona Street	817	1,088

Notes: 1) Critical Movement Analysis Planning Application (Levels of Service are not assigned):

Sum of Critical Movements	Condition
0 to 1,200	Under Capacity
1,200 to 1,400	Near Capacity
1,400 or higher	Over Capacity

2) Improvements as discussed in text are included for with-project conditions.

traffic demands. The project traffic demand forecast was developed using observed existing travel patterns; if a change in the pattern of use can be achieved, a reduction in traffic demand would follow. Table 8 shows what an HOV program would need to achieve to reduce the project's traffic generation to a level which can be served by the proposed roadway improvements.

Table 7
WAIHONA STREET CONNECTION
Unsignalized Intersection

	Level of Service	
	AM Peak Hour	PM Peak Hour
Left turn from Waihona Street	A	A
Left turn into Waihona Street	C	D
Right turn into Waihona Street	A	B

Table 8

TRAFFIC DEMAND REDUCTION PROGRAM

	AM Peak Hour	PM Peak Hour
Critical Volume (vehicles/hour)	2,545	2,262
Location	SB on-ramp (loop)	NB off-ramp
Level of Service	F	F
Base vehicle occupancy (estimated)	1.2	1.2
Person trip demand	3,054	2,714
Desired modal use pattern:		
A) No change	45 %	65 %
Person trips	1,374	1,764
Vehicle occupancy	1.2	1.2
Vehicle trips	1,145	1,470
B) Shift to car pools	35 %	15 %
Person trips	1,069	407
Vehicle occupancy	3.5	3.5
Vehicle trips	305	116
C) Shift to Express Bus	20 %	20 %
Person trips	611	543
Vehicle occupancy	48	48
Vehicle trips	13	12
Total vehicle trips	1,463	1,598
Reduction in Critical Volume	42.5 %	29.4 %
Ramp Level of Service	E	E

CONCLUSIONS AND RECOMMENDATIONS

The proposed development of Waiawa Ridge will affect traffic conditions in the area. Modifications to the Waipio Interchange would be needed to accommodate the traffic demands of the proposed project. Overall growth due to all projects in the area, including the Waiawa development, will cause increased traffic demands on the roadways. The establishment of ridesharing programs and the provision of facilities to encourage increased use of high occupancy vehicles should be instituted to help mitigate adverse traffic impacts of this growth.

Specific recommendations from this evaluation identify improvements which should be made between years 2000 and 2010:

- Provide improved signalization and institute lane use restrictions during peak periods to increase efficiency at the Kamehameha Highway intersections with Ka Uka Boulevard and Waipahu Street.

- Monitor traffic volumes at Waihona Street and provide signalization and restriping as necessary.

- Establish and continue a program to encourage the use of high occupancy vehicles as a means to reducing traffic demand.

APPENDIX F

AIR QUALITY STUDY

FOR THE

PROPOSED GENTRY 515 PROJECT

OAHU, HAWAII

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January 12, 1987

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SUMMARY

1. The proposed Waiwa Development involves site preparation and construction of a residential/commercial community on a large parcel of former sugar cane lands east of the H-2 Freeway between the existing Waiawa Interchange and the proposed Waipio Interchange. The Gentry 515 project is the 5,000 residential unit increment of this development slated to occur between the year 2000 and 2010.

2. Present air quality in the project area is estimated to be good since nearby long term monitoring stations have consistently been recording airborne particulate and sulfur dioxide levels that are well within allowable State of Hawaii Air Quality Standards, but particulate and carbon monoxide emissions from nearby sugar cane or pineapple fires do present some potential to degrade air quality in the project area for short periods of time and vehicular emissions during peak period traffic conditions may be creating "hot spots" near congested downstream intersections where carbon monoxide levels could exceed allowable air quality standards under especially unfavorable meteorological dispersion conditions.

3. Except for short term dust emissions during the construction phase of the development, no significant direct air quality impacts are expected. Adequate control measures exist to limit the scope of this impact, but special care will have to be exerted to insure that previously developed residential areas are not subjected to excessive levels of particulate pollution from construction activities.

4. Indirect air quality impacts are expected to result from new demands for electrical energy. This impact is most likely to occur in the vicinity of existing power plants such as the Kahe Plant on the Waianae coast where increased levels of particulates and sulfur dioxide can be expected. Maximum use of solar energy designs in project development can at least partially mitigate the magnitude of this impact. New methods of generating electrical power such as wind or ocean thermal energy conversion may eventually also play a mitigative role in this regard.

5. Increased traffic generated by the proposed Waiawa Development will increase emissions of carbon monoxide and nitrogen dioxide in the project area and along routes leading to urban Honolulu. Detailed carbon monoxide modeling carried out as a part of this study indicates that allowable State of Hawaii standards can be met at the proposed Waipio Interchange, but that these standards are not likely to be met at other critical receptor sites in the vicinity of Waipahu Street and Kamehameha Highway and along the H-1 Freeway between the Waiawa Interchange and the Halawa Interchange.

6. While modeling indicates that future levels of carbon monoxide at these locations are likely to be lower than present values whether traffic from the proposed development is included or not, it is still likely that State of Hawaii standards will be exceeded at these sites unless regional measures to mitigate traffic congestion are employed.

1. PROJECT DESCRIPTION

The proposed Gentry 515 project covers development of the Gentry-Waiawa complex slated to occur between the years 2000 and 2010. A previous study has been carried out covering development of 1395 acres of the site prior to the year 2000. This project will involve site preparation and construction of approximately 5,000 additional residential dwellings on about 515 acres of the total 2500 acre parcel of land located on the east side of the H-2 Freeway in Central Oahu as shown in Figure 1. The existing site was formerly used for sugar cane growing, but it has been taken out of agricultural use by Oahu Sugar Company and is currently fallow with some ground cover for erosion control. The property is dissected in places by steep ridges and gulches which are not suitable for development and will be preserved as green space. The general land use plan for the portion of the property to be developed is also shown in Figure 1.

Previous project development, up to the year 2000, includes 115 acres of commercial and industrial property, 3,216 single family detached dwellings and 540 multi-family units, two golf courses with associated club houses, and a retirement-oriented Leisure Village consisting of 4150 units.

Major access points from the project to the existing roadway system are expected to be constructed at the proposed Waipio Interchange to the H-2 Freeway and at the intersection of Waipahu Street and Kamehameha Highway.

The purpose of this study is to describe existing ambient air quality in the project area and to estimate the magnitude of any increase in air pollutant concentrations resulting from actions related to the proposed project.

2. AIR QUALITY STANDARDS

State of Hawaii and National Ambient Air Quality Standards (AQS) have been established for six classes of pollutants as shown in Table 1. An AQS is a pollutant concentration not to be exceeded over a specified sampling period which varies for each pollutant depending upon the type of exposure necessary to cause adverse effects. Each of the regulated pollutants has the potential to cause some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration.

National AQS have been divided into primary and secondary levels. Primary AQS are designed to prevent adverse health impacts while secondary AQS refer to welfare impacts such as decreased visibility, diminished comfort levels, damage to vegetation, animals or property, or a reduction in the overall aesthetic quality of the atmosphere. State of Hawaii AQS have been set at a single level which is in most cases significantly more stringent than the lowest comparable national limit. In particular, the State of Hawaii one hour standard for carbon monoxide is four times more stringent than the National standard.

National AQS are based *on 40 CFR* Part 50, while State of Hawaii AQS are set in Chapter 11-59, Hawaii Administrative Rules. This chapter was recently amended (March 25, 1986) to make Hawaii AQS for particulates and sulfur dioxide essentially the same as the most stringent National limits.

3. PRESENT AIR QUALITY

A summary of air pollutant measurements from State of Hawaii long term monitoring stations located nearest to the project is presented in Table 2. Data from several different sampling stations are included in the tabulation.

The sampling station for particulates and sulfur dioxide is located in Pearl City, about two miles east southeast of the project area. The monitoring of sulfur dioxide in Pearl City was discontinued in 1984 and 1985 measurements are from the Barbers Point station located about six miles southwest of the project.

Until September 1979, and after June 1983, carbon monoxide monitoring was conducted at the Department of Health building at Punchbowl and Beretania Streets in urban Honolulu. This site is about 12 miles southeast of the project. During 1981 carbon monoxide was measured at Fort DeRussy in Waikiki (13 miles southeast of the project), and in 1982 carbon monoxide was monitored at Leahi Hospital in Kaimuki, about 15 miles southeast of the project.

Ozone levels were also measured at the Department of Health building in urban Honolulu until December 1980, when the monitor was relocated to Sand Island (about 10 miles southeast of the project site). During 1981 nitrogen dioxide was also monitored at the Sand Island location, but all nitrogen dioxide monitoring has since been discontinued. Lead measurements are from Liliha Street in Kalihi, about 11 miles southeast of the project site.

From the data presented in Table 2 it appears that State of Hawaii ambient air quality standards for particulates, sulfur dioxide, nitrogen dioxide, and lead are currently being met at nearest monitoring stations to the project area.

On the other hand, carbon monoxide and ozone readings from urban Honolulu indicate that allowable State of Hawaii standards for these vehicle-related air pollutants are being violated at a rate of about once or twice a year. Ozone is an indicator of the formation of photochemical pollutants in the air, a condition which tends to develop if the air mass over the islands has been fairly stable with little wind flow for a period stretching over several days.

Concentrations of carbon monoxide are more directly related to vehicluar emissions and tend to be highest during periods of rush hour traffic. Carbon monoxide would thus be the pollutant most likely to cause difficulty in meeting allowable State of Hawaii AQS as a result of new residential development on Oahu.

There are power plants and other potential sources of industrial pollutants along the central portion of the leeward coast in the vicinity of the project site, but the generally low readings of particulates and sulfur dioxide at the Pearl City monitoring station just to the east of the project indicate that these sources are not likely to cause any air pollution problems at Waiawa. Likewise sugar cane cultivation to the north and west could generate some particulates and carbon monoxide when fields are burned at harvest (about once every two years for any given field), but the consistently low readings of particulates at Pearl City indicate that this source is not likely to present any significant air pollution problems at Waiawa either.

Finally, natural air pollutant producers which could affect air quality in the Waiawa project area include the ocean (sea spray), plants (aero-allergens), dust, and perhaps a distant volcanic eruption on the Island of Hawaii. Concentrations of air pollutants from these kinds of sources should be fairly uniform for most Oahu locations.

4. DIRECT AIR QUALITY IMPACT OF PROJECT CONSTRUCTION

During the site preparation and construction phases of this project it is inevitable that a certain amount of fugitive dust will be generated. Field measurements of such emissions from apartment and shopping center construction projects has yielded an estimated emission rate of 1.2 tons of dust per acre of construction per month of activity. This figure assumes medium level activity in a semi-arid climate with a moderate soil silt content. Actual emissions of fugitive dust from this project can be expected to vary daily depending upon the amount of activity and the moisture content of exposed soil in work areas.

One major generator of fugitive dust is heavy construction equipment moving over unpaved roadways. This problem can be substantially mitigated by completing and paving roadways and parking areas as early in the development process as possible. Because of the relatively long construction period, some construction will eventually be taking place in close proximity to existing residential areas. Dust control will have to be an item of special concern in all instances where residential areas are downwind from construction sites.

Heavy equipment at construction sites will also emit some air pollutants in the form of engine exhausts. The largest equipment is usually diesel-powered. Carbon monoxide emissions from large diesel engines are generally about equal to those from a single automobile, but nitrogen dioxide emissions from this type of engine can be quite high. Fortunately, nitrogen dioxide emissions from other sources in the area should be relatively low and the overall impact of pollutant emissions from construction equipment should be minor compared to levels generated on major roadways nearby.

5. AIR QUALITY IMPACT OF INCREASED ENERGY UTILIZATION

Estimating about 1,500 square feet average size for the 5,000 planned residential units yields a total additional floor space of about 7.5 million square feet to that previously estimated for the initial phase of project development. Energy consumption rates at the power plant for single family residential units with all-electric kitchens and water heaters are about 55,000 BTU per square foot, which would add a requirement for over 400 billioon more BTU to the previous total of about 530 billion BTU computed for residential units to be constructed in the project prior to the year 2000. For residential use alone the total project could thus require more than 900 billion BTU of energy per year at the power plant, or about 160,000 barrels of oil if the demand were to be met totally by burning fuel oil. Energy use for commercial and industrial purposes would add substantially to this total.

The major impact of burning fuel oil to meet this new energy demand will be increased levels of sulfur dioxide and particulates in the vicinity of existing power plants, primarily the Kahe Power Plant on the Waianae coast.

New energy requirements could be reduced substantially by the installation of solar water heating on all units at the time of construction. It is also possible that the new demand could be met by means other than burning fuel oil. Generation of electrical energy by wind power and by using ocean thermal energy conversion are two such possibilities.

6. INDIRECT AIR QUALITY IMPACT OF INCREASED TRAFFIC

Once construction is completed the proposed project will not in itself constitute a major direct source of air pollutants. By serving as an attraction for increased motor vehicle traffic in the area, however, the project must be considered to be a significant indirect air pollution source.

Motor vehicles, especially those with gasoline-powered engines, are prodigious emitters of carbon monoxide. Motor vehicles also emit some nitrogen dioxide and those burning fuel which contains lead as an additive contribute some lead particles to the atmosphere as well. The major control measure designed to limit lead emissions is a Federal law requiring the use of unleaded fuel in most new automobiles. As older cars are removed from the vehicle fleet lead emissions should continue to fall. In fact, effective January 1, 1986, the Federal Environmental Protection Agency has revised the allowable lead amount in gasoline to 0.1 gram per gallon. At the beginning of 1985 the standard was 1.1 grams per gallon. The EPA is also advocating a total ban on lead in gasoline to take effect as early as 1988.

Federal control regulations also call for increased efficiency in removing carbon monoxide and nitrogen dioxide from vehicle exhausts. By the year 2000 carbon monoxide emissions from the Oahu vehicle fleet then operating should be little more than half the amounts now emitted. At present, however, no further reductions in vehicular emissions have been mandated for years following 2000, and increases in traffic levels after 2000 will result in directly proportional increases in vehicle-related pollutant emissions.

7. CARBON MONOXIDE DIFFUSION MODELING

In order to evaluate the air quality impact of projected increases in traffic associated with the proposed project a detailed carbon monoxide modeling study was carried out. The study was designed to yield carbon monoxide concentration values which could be compared directly to allowable State and National Ambient Air Quality Standards.

Three critical receptor sites were selected for analysis. Site 1, on the west side of the H-2 Freeway near the proposed new Waipio Interchange was selected for analysis because this interchange is expected to be the main entry/exit point to the completed Waiawa Development. The particular position of site 1 with respect to the freeway was selected because that spot would be most likely to show the greatest level of impact from project-related automobile-generated air pollutants, specifically carbon monoxide, under worst case morning peak hour traffic and meteorological diffusion conditions. The site is at the edge of the freeway right-of-way because the diffusion model used is not recommended for use within a freeway right-of-way and there should be no reason for the general public to spend as long as an hour at any particular spot within this right-of-way.

Site 2, on the west side of Kamehameha Highway near the existing intersection with Waipahu Street, was selected because a new segment of Waipahu Street would be created to provide access to the Waiawa Development at this intersection.

Site 3, on the south side of the H-1 Freeway between the Waiawa and Halawa Interchanges, was selected in order to evaluate the long term cumulative impact of project-related traffic along the main commuter route between Waiawa and urban Honolulu.

The general locations of all three receptor sites are shown in Figure 1. Expected worst case morning peak hour carbon monoxide concentrations at these receptor sites were computed for study years 1986 and 2010. Computations were made for traffic conditions with and without the proposed Waiawa Development (including the Gentry 515 portion) using traffic volume predictions for the project.

For site 1, 1986 carbon monoxide estimates are for a point along the H-2 right of way near where the Waipio Interchange would be constructed. For the year 2010, computations for the scenario without Waiwa Developement assume that the Waipio Interchange will have a full diamond configuration, while computations for the scenario with Wiawa Development assume a loop ramp configuration as shown in Figure 2.

Since the traffic study for the project did not include volume estimates for the H-1 Freeway, the following volumes were assumed for carbon monoxide modeling: for 1986 - 2250 vehicles per lane in the peak direction and 850 vehicles per lane in the off peak direction with four lanes in each direction; for 2010 - 2000 vehicles per lane in the peak direction and 680 in the off peak direction with five lanes in each direction. Waiawa Development contributions for the year 2010 add 489 vehicles per lane in the peak direction and 258 vehicles per lane in the off peak direction. These values deliberately overstate the Waiawa contributions by assuming that all Waiawa peak hour morning traffic to and from Honolulu will use the H-1 Freeway.

Using 1986 vehicle registration figures for Oahu, the existing peak hour vehicle mix in the project area is estimated to be 91.9% light duty gasoline-powered vehicles, 4.2% light duty gasoline-powered trucks and vans between 6000 and 8500 pounds, 0.5% heavy duty gasoline-powered vehicles, 0.5% diesel-powered automobiles, 0.1% diesel-powered light duty trucks, 1% diesel-powered trucks and buses, and 1% motorcycles. The same vehicle mix was assumed for 1986 and 2010 emission rate calculations.

At site 1, traffic on the H-2 Freeway was assumed to move at 25 mph in the peak direction and 35 mph in the off-peak direction while on-ramp and off-ramp traffic at the Waipio Interchange moved at 5 mph. At site 2, where a signal light would control traffic flow, average vehicle speeds were assumed to be 1 mph upstream from red signals and 15 mph downstream from signals or turns. On the H-1 Freeway average vehicle speeds were assumed to be 10 mph in the peak direction and 35 mph in the off-peak direction. An ambient temperature of 55 degrees F was assumed to simulate a cold winter morning with 20.6 percent of vehicles equipped with catalytic converters and 20.6 percent of vehicles without catalytic converters operating in the "cold start" mode and 27.3 percent of all vehicles operationg in the hot start mode. The EPA computer model MOBILE3 was run using the above parameters to produce vehicular carbon monoxide emission estimates for each of the years studied.

The EPA computer model HIWAY 2 was used to calculate carbon monoxide concentrations at each of the selected critical receptor sites for each scenario studied. Stability category 5 was used for determining diffusion coefficients for sites 1 and 2, while stability category 4 was used for site 3. These stability categories represent the most stable (least favorable) atmospheric conditions that would be likely to occur on a cold, clear, nearly calm winter morning at each of the sites studied.

To simulate worst case wind conditions a uniform wind speed of one meter per second was assumed with the worst case wind direction for sites 1 and 2 from the southeast, and for site 3 from the northeast. For each receptor site concentrations were computed at a height of 1.5 meters to simulate levels that would exist within the normal human breathing zone. For site 1, calculations are for the edge of the H-2 right of way; for sites 2 and 3, computations were performed for a receptor located 10 meters from the edge of the roadway.

Background contributions of carbon monoxide from sources or distant roadways not directly considered in the analysis were assumed to be zero in order to more clearly indicate the impact of project-related traffic at these locations. At site 1, this background contribution should be near zero for 1986 and on the order of 1 milligram per cubic meter for the year 2002; for site 2 the background contribution could be as high as 2 or 3 milligrams per cubic meter for both scenario years because of the complicated profusion of on and off ramps to the H-1 Freeway to the south of the receptor site, and for site 3 morning peak hour concentrations of carbon monoxide at congested intersections along the H-1 corridor are likely to be of the same order of magnitude as those levels estimated for the higher volume, but somewhat more freely flowing traffic on the Freeway.

Results of the peak hour carbon monoxide study are presented in Table 3. At sites 2 and 3 existing carbon monoxide concentrations under the worst case conditions studied here are estimated to be substantially in excess of the allowable State of Hawaii one hour carbon monoxide standard.

For site 1, both current and expected worst case carbon monoxide levels with or without the proposed project are within acceptable standards. For sites 2 and 3, all projected concentrations are in excess of the allowable State of Hawaii one hour limit with or without the proposed project. The traffic study for the project indicates that substantial mitigative measures might be required in order for projected traffic volumes from the project to meet critical volume limitations on the loop on-ramp to the H-2 Freeway at the proposed Waipio Interchange. Specifically a decrease in morning peak hour vehicle volume by about 35.9% would be required to achieve an acceptable volume. This would require that about 25% of the projected person trips be shifted to car pools and 20% to express bus service. The effect of this reduction on projected carbon monoxide levels at sites 1 and 3 is shown in Table 3.

For sites 2 and 3, projected peak hour values for the year 2010 are better than current levels with or without the proposed project.

All of the computed worst case carbon monoxide concentrations are within the National one hour carbon monoxide limit and it is reasonable to conclude that this standard can be met by the proposed project.

Eight hour carbon monoxide levels are estimated by multiplying the peak hour values by a "meteorological persistence factor" of 0.6 which is recommended in EPA modeling guidelines to account for the fact that average one hour traffic volumes over an eight hour period are lower than peak hour volume and the fact that meteorological dispersion conditions are more variable (and hence more favorable) over an eight hour period than they are for a one hour period. Multiplying projected peak hour carbon monoxide levels by this factor yields the values that are shown in Table 4.

For site 1, projected eight hour values are within allowable State and National limits. For site 2, the Hawaii standard is exceeded with or without the proposed project, but the National standard is met for both cases. For site 3, both State and National eight hour limits are estimated to be exceeded under worst case conditions for all scenarios.

It is important to note that the worst case conditions studied here have a relatively low probability of occurrence. The wind directions used in the computations occur fairly often, but the wind usually blows from these directions at much higher speeds than one meter per second. With windspeeds of two meters per second, for example, computed carbon monoxide concentrations would be half the values shown in Table 3. Furthermore, the light wind speeds needed to produce the worst case values shown here would be most likely to occur in conjunction with highly variable wind directions rather than the steady conditions assumed here. Prevailing temperatures are generally much warmer than the 55 degrees F used for emission computations. Emissions would be about 10 percent lower for a temperature of 65 degrees F.

The meteorological conditions used in this analysis do have a small probability of occurring, but to put the computations into perspective, this probability is on the order of 0.3 to 1.0 percent (somewhere between one and four morinings a year). Nonetheless, both State of Hawaii and National Ambient Air Quality Standards are values not to be exceeded more than once per year. Comparisons between the values presented in this study and allowable air quality standards are thus considered to be valid.

8. MITIGATIVE MEASURES

A. SHORT TERM

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

B. LONG TERM

Once completed, the proposed Waiawa Development is expected to have little direct impact on the air quality of the surrounding region. Indirect long term impacts in the form of increased air pollutant emissions from power plants serving new residences in the project area can be mitigated somewhat by planning and implementing solar energy design features to the maximum extent possible.

Other indirect long term air quality impacts are expected in those areas where traffic congestion can potentially be worsened by the addition of vehicles traveling to and from the proposed project. Project planners can do very little to reduce the emission levels of individual vehicles, but the Traffic Impact Report for the project describes several proposed or planned roadway improvements that could significantly increase highway traffic capacity and facilitate entry and exit from the proposed development with a minimum of increased traffic congestion. The key to viable access and acceptable air quality impact regarding this project will be redesign of the planned Waipio Interchange on the H-2 Freeway to accommodate traffic from the Waiawa side of the freeway.

Even with a redesigned interchange which includes a double-lane loop entry from the Waiawa Project to the southbound lanes of H-2, the Traffic Report indicates a need for as much as a 36% percent reduction in morning peak hour vehicle trips to meet critical volume limitations on this ramp. Carbon monoxide modeling conducted at the edge of the right-of-way adjacent to the proposed Waipio Interchange shows that a traffic volume reduction of this magnitude would result in about a 0.5 milligram per cubic meter reduction in the projected worst case carbon monoxide level in the year 2010. However, estimated worst case levels even without such a traffic volume reduction are within allowable State of Hawaii and National limits.

Carbon monoxide modeling at the intersection of Waipahu Street and Kamehameha Highway and along the H-1 corridor between Waiawa and Halawa Interchanges indicates that State of Hawaii Hawaii standards are currently being exceeded at these locations under worst case conditions. While the modeling also predicts that lower levels can be expected at these sites in future years, projected increases in prevailing and project-related traffic will continue to contribute to potential violations of standards at these "hot spots". Congestion at these sites constitutes a regional traffic problem which will require mitigative measures beyond those that a single project developer can be expected to provide. In the case of this particular project the developer might be required to provide "park and ride" facilities for carpooling or mass transit systems as a part of regional transportation control plans.

Because the stringent national vehicular emissions reduction program now being pursued is entirely the product of ever changing government regulations, it is always possible that economic conditions or other factors could lead to an early abandonment of this program. If that were to occur, then the projected pollutant levels presented in this study could be too optimistic. On the other hand, this analysis did not consider the possibility that technological innovation may lead to new vehicular power systems that produce few or none of the currently regulated atmospheric pollutants.

For the benefit of future residents of the proposed Waiawa Development it is also noted that tall, dense vegetation can provide some screening of residential areas from larger airborne particulates generated along roadways and near construction areas. It is thus recommended that wherever possible such vegetative cover be included in landscaping plans with plantings occuring as early in the development process as practicable.

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6. PARSONS BRINCKERHOFF, Traffic Impact Report, Waiawa 514 Project, December 30, 1986, draft.

TABLE 1

SUMMARY OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS
(Micrograms per Cubic Meter)

POLLUTANT	SAMPLING PERIOD	AMBIENT AIR QUALITY STANDARDS NATIONAL Primary	NATIONAL Secondary	HAWAII
Particulates	Annual Geometric Mean	75	60	60
	Maximum 24-Hour Average	260	150	150
Sulfur Dioxide	Annual Arithmetic Mean	80	--	80
	Maximum 24-Hour Average	365	--	365
	Maximum 3-Hour Average		1300	1300
Nitrogen Dioxide	Annual Arithmetic Mean		100	70
Ozone	Maximum 1-Hour Average		240	100
Carbon Monoxide	Maximum 8-Hour Average		10	5
	Maximum 1-Hour Average		40	10
Lead	Calendar Quarter		1.5	1.5

Notes: 1. Carbon monoxide standards are in milligrams per cubic meter.
2. National standards based on 40 CFR Part 50; Hawaii standards based on Title 11, Administrative Rules, Chapter 59.

TABLE 2

SUMMARY OF AIR POLLUTANT MEASUREMENTS AT NEAREST MONITORING STATIONS

POLLUTANT	1979	1980	1981	1982	1983	1984	1985
PARTICULATE MATTER							
No. of Samples	58	60	59	53	55	56	47
Range of Values	20-48	22-93	19-71	19-54	17-57	16-45	16-62
Average Value	33	36	34	31	30	28	35
No. of Times State AQS Exceeded	0	0	0	0	0	0	0
SULFUR DIOXIDE							
No. of Samples	56	52	56	43	49	42	50
Range of Values	<5-63	<5-15	<5-<5	<5-10	<5-<5	<5-<5	<5-25
Average Value	10	5	<5	5	<5	<5	<5
No. of Times State AQS Exceeded	0	0	0	0	0	0	0
CARBON MONOXIDE							
No. of Samples	207		286	311	173	318	342
Range of Values	0-17.3		1.2-13.8	0-4.6	0-8.6	.6-10.9	0-10.4
Average Value	2.9		5.1	1.2	2.3	2.4	1.5
No. of Times State AQS Exceeded	10		13	0	0	1	1
OXIDANT (OZONE)							
No. of Samples	338	295	314	335	349	296	341
Range of Values	10-80	10-84	10-104	0-151	0-123	0-104	8-198
Average Value	39	48	37	32	46	44	43
No. of Times State AQS Exceeded	0	0	1	2	2	1	3

OTHERS:	NITROGEN DIOXIDE	LEAD	
No. of Samples	46	52	58
Range of Values	6-77	.5-.8	0-.5
Average Value	25	0.6	0.3
No. of Times State AQS Exceeded	0	0	0

NOTES: See text for locations of monitoring stations. Carbon monoxide reported in milligrams per cubic meter; other pollutants in micrograms per cubic meter. Carbon monoxide and ozone are daily peak one hour values; lead is quarterly; other pollutant values are for a 24 hour sampling period.

SOURCE: State of Hawaii Department of Health

TABLE 3

RESULTS OF PEAK HOUR CARBON MONOXIDE ANALYSIS
(Milligrams Per Cubic Meter)

SITE 1 (H-2 Freeway at proposed Waipio Interchange)		
YEAR	1986	2010
Without Waiawa Development	1.8	6.9
With Waiawa + Gentry 515 Development (no traffic mitigation)		8.3
(with traffic mitigation)		7.9
SITE 2 (Intersection of Waipahu Street and Kamehameha Highway)		
Without Waiawa Development	15.4	10.7
With Waiawa + Gentry 515 Development		14.2
SITE 3 (H-1 Freeway between Waiawa and Halawa Interchanges)		
Without Waiawa Development	35.9	20.8
With Waiawa + Gentry 515 Development (no traffic mitigation)		25.9
(with traffic mitigation)		24.1

STATE OF HAWAII AQS:	10
NATIONAL AQS:	40

Notes: See Figure 1 for location of receptor sites.
See text, Section 7, for models and assumptions used for producing these estimates.

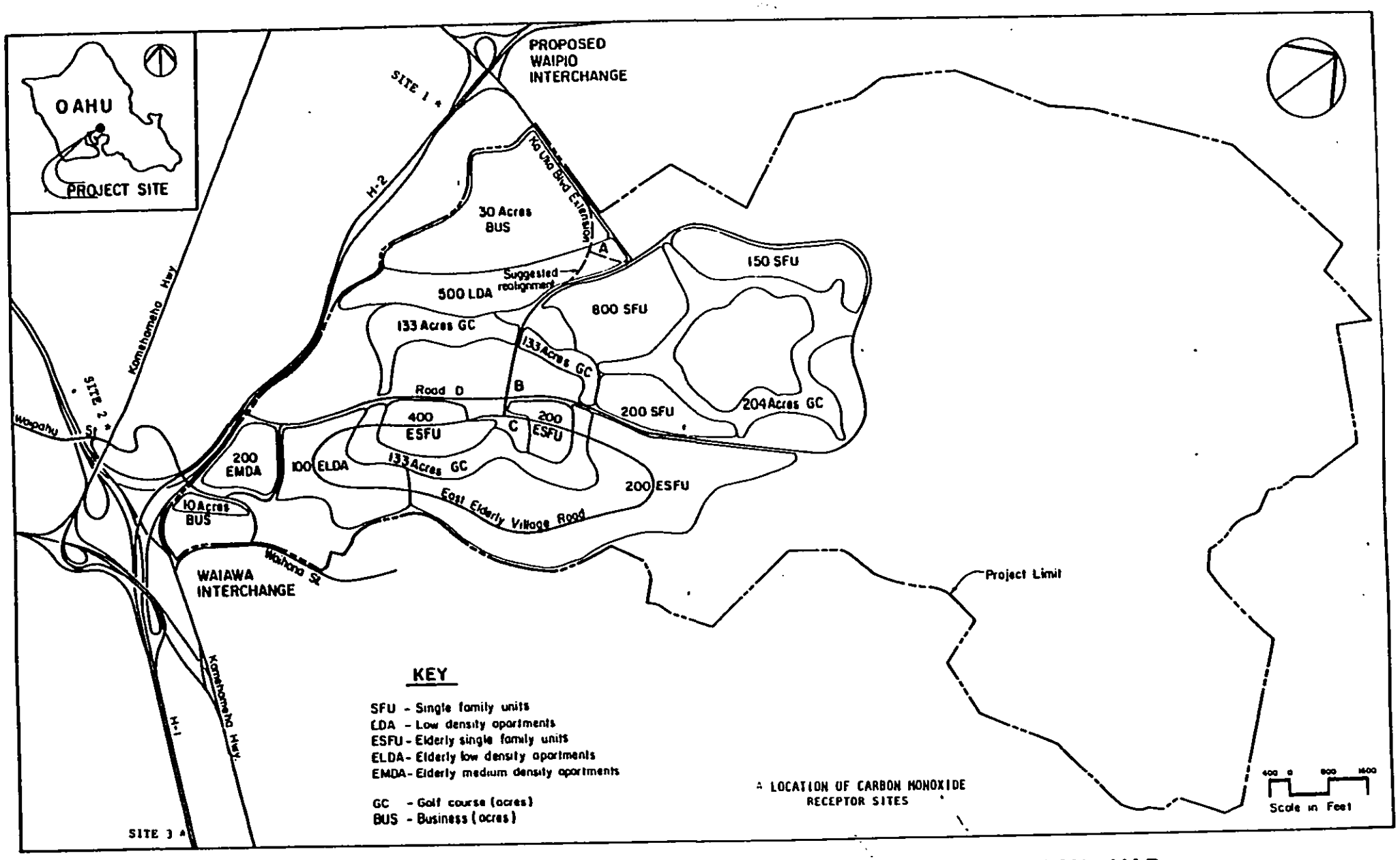
TABLE 4

RESULTS OF EIGHT HOUR CARBON MONOXIDE ANALYSIS
(Milligrams Per Cubic Meter)

SITE 1 (H-2 Freeway at proposed Waipio Interchange)		
YEAR	1986	2010
Without Waiawa Development	1.1	4.1
With Waiawa + Gentry 515 Development (no traffic mitigation)		5.0
(with traffic mitigation)		4.7
SITE 2 (Intersection of Waipahu Street and Kamehameha Highway)		
Without Waiawa Development	9.2	6.4
With Waiawa + Gentry 515 Development		8.5
SITE 3 (H-1 Freeway between Waiawa and Halawa Interchanges)		
Without Waiawa Development	21.5	12.5
With Waiawa + Gentry 515 Development (no traffic mitigation)		15.5
(with traffic mitigation)		14.5

STATE OF HAWAII AQS: 5
NATIONAL AQS: 10

Notes: See Figure 1 for location of receptor sites.
See text, Section 7, for models and assumptions used for producing these estimates.



LOCATION MAP

FIGURE 1

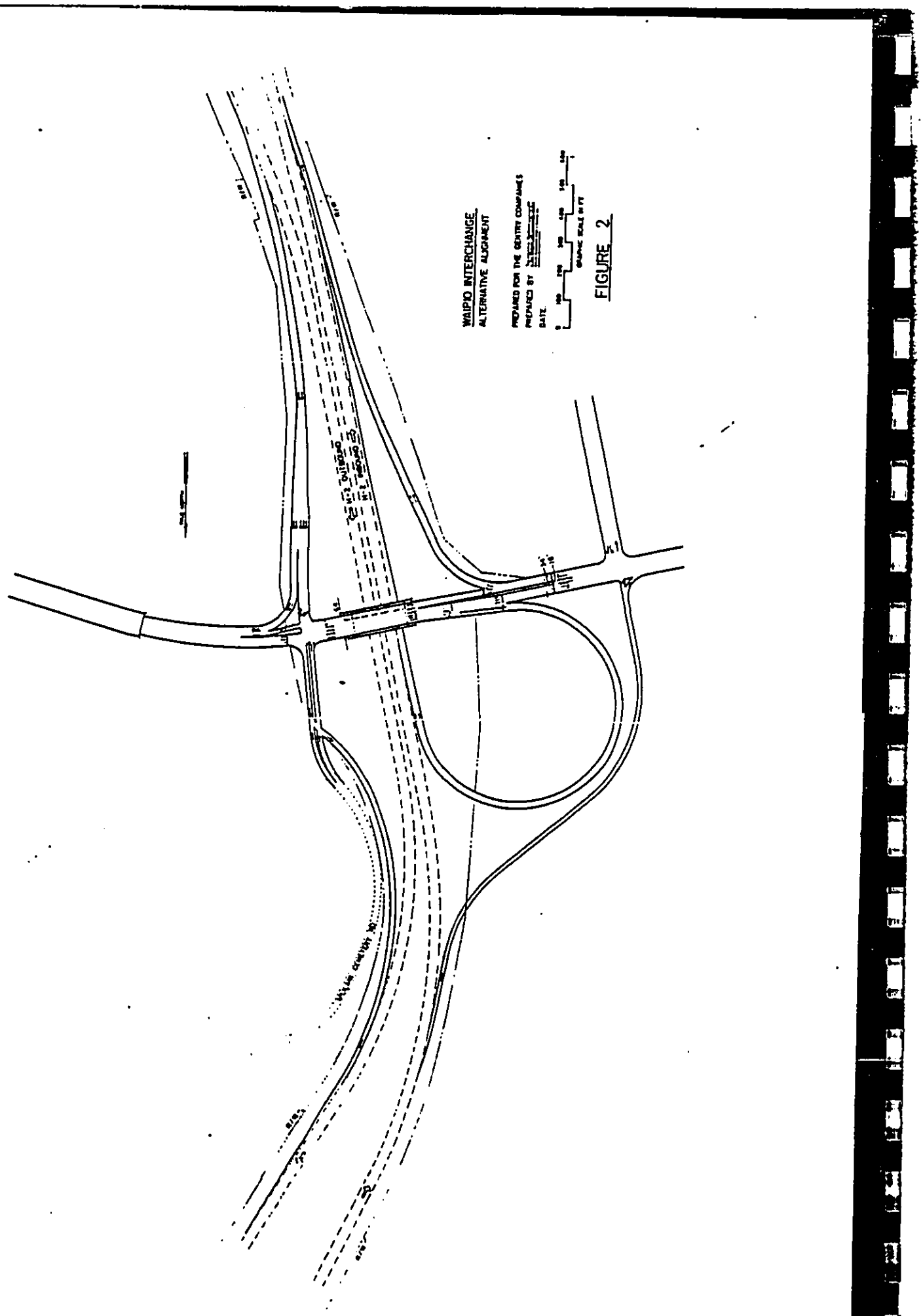

WAIPIO INTERCHANGE
ALTERNATIVE ALIGNMENT
PREPARED FOR THE SENTRY COMPANIES
PREPARED BY
DATE
GRAPHIC SCALE IN FT

FIGURE 2

APPENDIX G

UPDATED TRAFFIC NOISE STUDY
FOR THE PROPOSED
WAIAWA DEVELOPMENT
(YEAR 2010 & 514 PROJECT)

PREPARED FOR
ENVIRONMENTAL COMMUNICATIONS, INC.

BY
Y. EBISU & ASSOCIATES

JANUARY, 1987

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I. SUMMARY

Evaluations of existing, Year 1993, and Year 2002 traffic noise were performed in earlier studies (see References 1 and 2). This current study was performed to supplement the two earlier studies with additional information related to the proposed 504 acre addition to the original Waiawa Development Plan.

The future traffic noise levels in the vicinity of the proposed Waiawa Development for the Year 2010 planning period were reevaluated for their potential impact on present and future residences. The future traffic noise level increases on Kamehameha Highway and H-2 Freeway were calculated for the Year 2010 planning period following full development of the additional 504 acres. Increases in traffic noise ranging from 0 to 3.8 Ldn (or dB) are predicted to occur between now and the 2010 planning period as a result of project plus non-project traffic. Project related traffic noise increases on existing roadways are predicted to be in the order of 0.2 to 1.0 Ldn, which are considered minimal to moderate.

Future traffic noise impacts on Waiawa residents can be minimized by the use of buffer zones of adequate depth on the Waiawa side of H-2 Freeway, and along the internal roadways of the development. In order to not preclude federal (FHA/HUD) assistance on the project, it is suggested that minimum setback distances to the future 65 Ldn noise contours be used in siting future residential and apartment units. If these setback distances are not practical, the use of other noise mitigation measures may be applied as required. Because of possible noise impacts from H-2 Freeway, more detailed analyses of future traffic noise at parcels J, F, and D are recommended following completion of the site grading plans.

Traffic noise impacts on existing residences along Kamehameha Highway are predicted to be insignificant. Along H-2 Freeway, noise impacts are expected to be moderate. Although signifi-

cant increases in traffic noise levels are predicted as a result of primarily non-project traffic, existing residences should remain in the "Acceptable, Moderate Exposure" and "Unconditionally Acceptable, Minimal Exposure" categories.

II. PURPOSE AND METHODOLOGY

The objective of this current study was to update the prior traffic noise studies (References 1 and 2), which were performed for the proposed Waiawa Development Plan during the Year 1993 and 2002 planning periods, respectively. Included in this current study are the potential traffic noise impacts associated with the addition of a 504 acre increment to the earlier Waiawa Development Plan proposals. Additional information is also provided on the potential traffic noise impacts along the internal roadways of the development. The methodology used in the earlier noise studies was repeated for this current study. New traffic assignments representing full project development by the Year 2010 (Reference 3) were used to update the prior traffic noise predictions along H-2 Freeway and Kamehameha Highway, and were also used to develop future traffic noise predictions along the major internal roadways of the development. Tables and figures developed previously to reflect Year 1993 and Year 2002 conditions were repeated to reflect Year 2010 predictions, with the suffix "U-2" added to their original numbers to designate the Year 2010 predictions.

III. YEAR 2010 TRAFFIC NOISE ENVIRONMENT ALONG H-2 FREEWAY

Predictions of Year 2010 traffic noise levels were made using the traffic volume predictions for the period contained in FIGURES 3 and 4 of Reference 3. Future traffic noise levels were calculated with and without the project traffic, with FIGURE 2 of Reference 3 used to estimate non-project traffic by the Year 2010. Traffic noise level increases in the vicinity of the proposed connection with Kamehameha Highway (at Waipahu Street) and attributable to project traffic are anticipated to be less than 0.5 dB, and are predicted to be insignificant by the Year 2010 planning period.

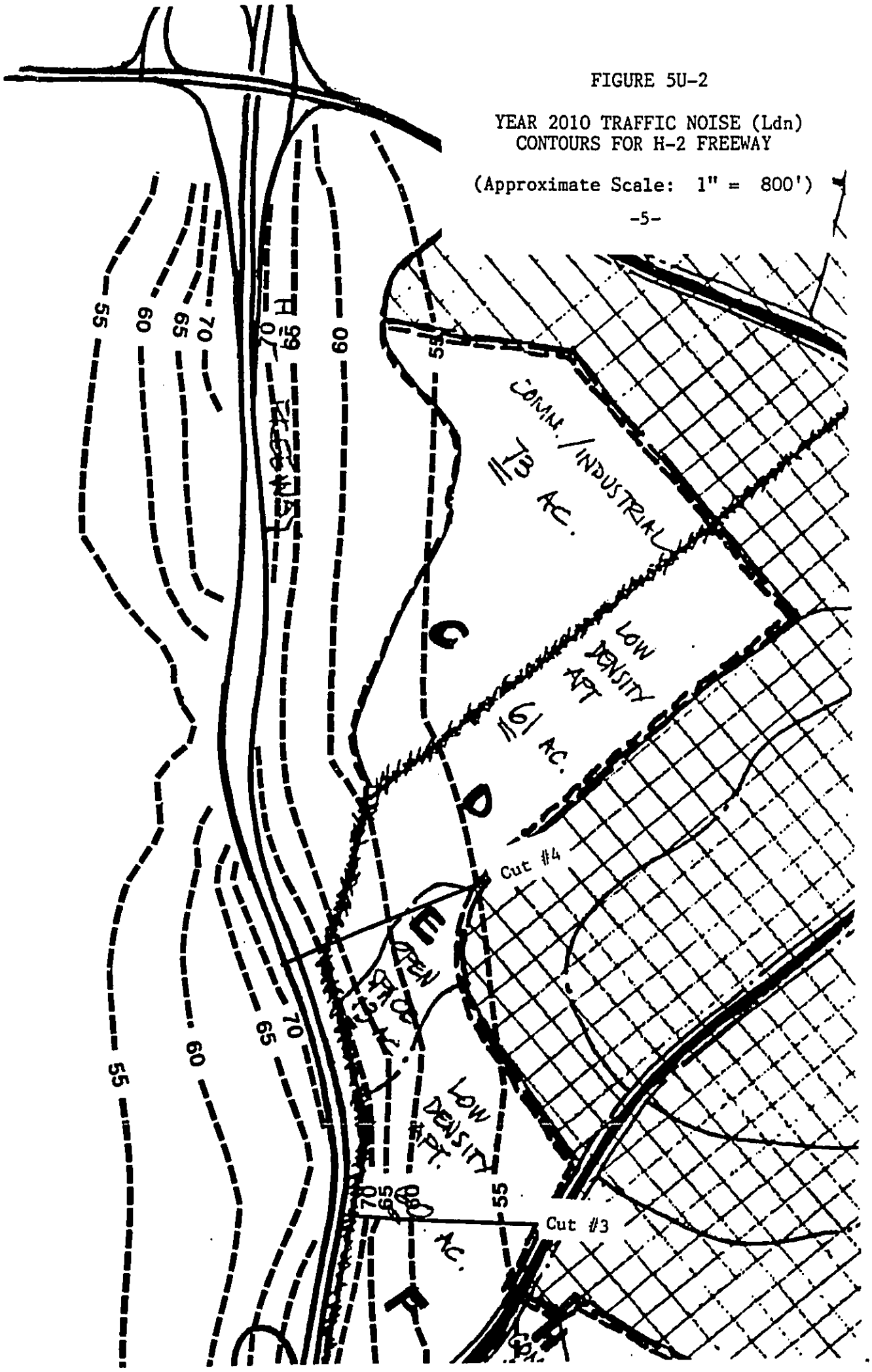
The total (project and non-project) increases in traffic noise levels along H-2 Freeway are predicted to be approximately 3.8 dB (or Ldn unit), with 10 and 90 percent of the increase associated with project and non-project traffic, respectively. The predicted Year 2010 traffic noise contours along H-2 Freeway with the project implemented are shown in FIGURE 5U-2. Updated noise level vs. distance curves were also constructed at sections thru proposed residential areas bordering the freeway. These curves are shown in FIGURES 8U-2, 9U-2, and 10U-2 with the applicable locations of the sections shown in FIGURE 5U-2. Distances indicated along the horizontal axis in FIGURES 8U-2, 9U-2, and 10U-2 apply from the baseline (centerline) of H-2 Freeway. Noise level vs. distance curves for three receptor elevations were computed to depict the dependence on receptor elevations at approximately 5, 10, and 15+ FT above ground level, and to show the effects of shielding from the highway cuts.

TABLE 3U-2 presents the predicted changes in the maximum setback distances to the 60, 65, and 70 Ldn traffic noise contours under worst case sound propagation conditions (180 degree field-of-view to the freeway lanes) as a result of project and non-project traffic on H-2 Freeway at Year 2010. TABLE 4U-2 presents the existing and Year 2010 traffic noise levels at a reference distance of 100 FT from the center of the inbound and outbound

FIGURE 5U-2

YEAR 2010 TRAFFIC NOISE (Ldn)
CONTOURS FOR H-2 FREEWAY

(Approximate Scale: 1" = 800')



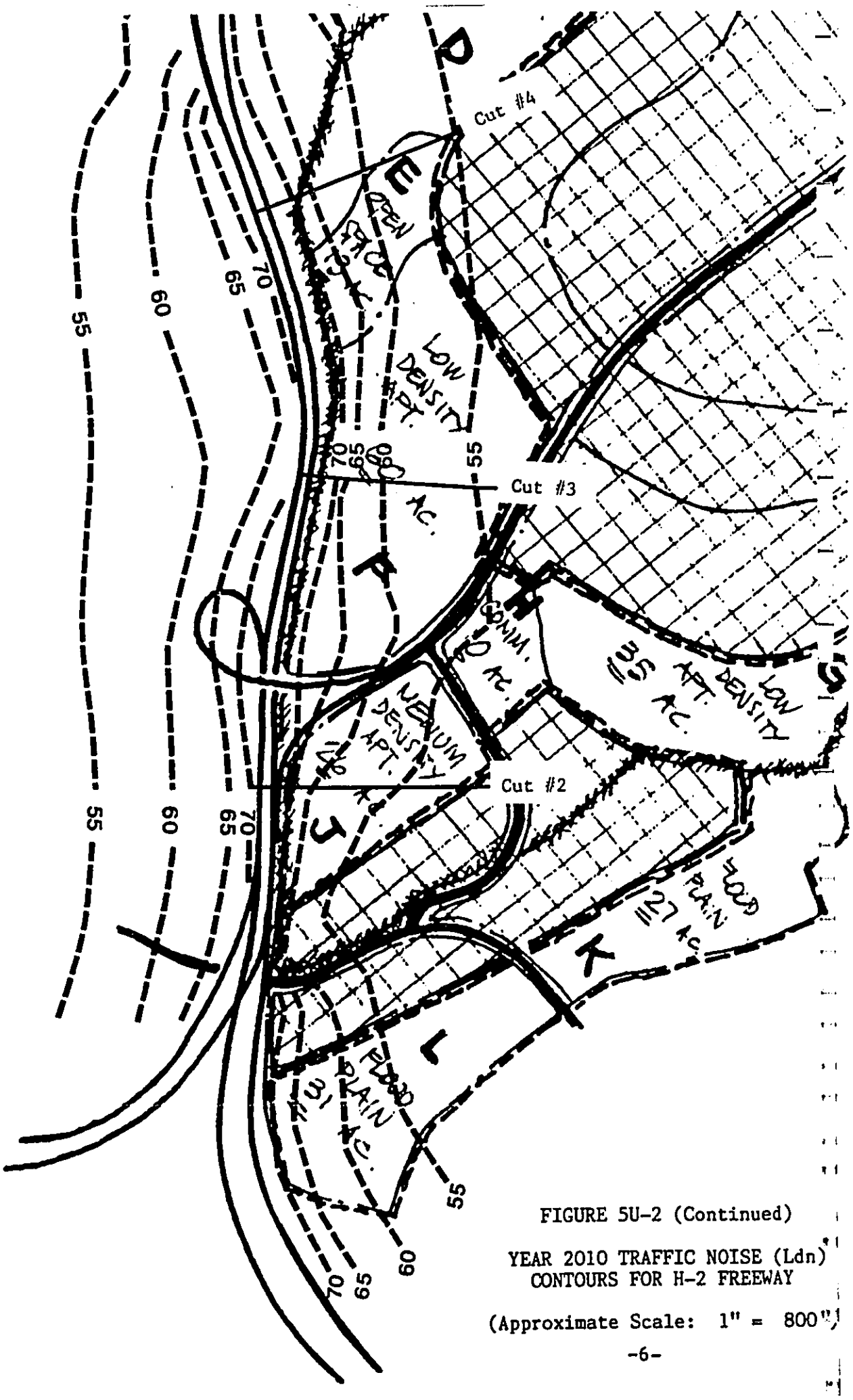


FIGURE 5U-2 (Continued)

YEAR 2010 TRAFFIC NOISE (Ldn) CONTOURS FOR H-2 FREEWAY

(Approximate Scale: 1" = 800')

Y. Ebisu & Associates
Acoustical and Electronic Engineers
1126 12th Avenue
Room 305
Honolulu, Hawaii 96816
(808) 735-1634

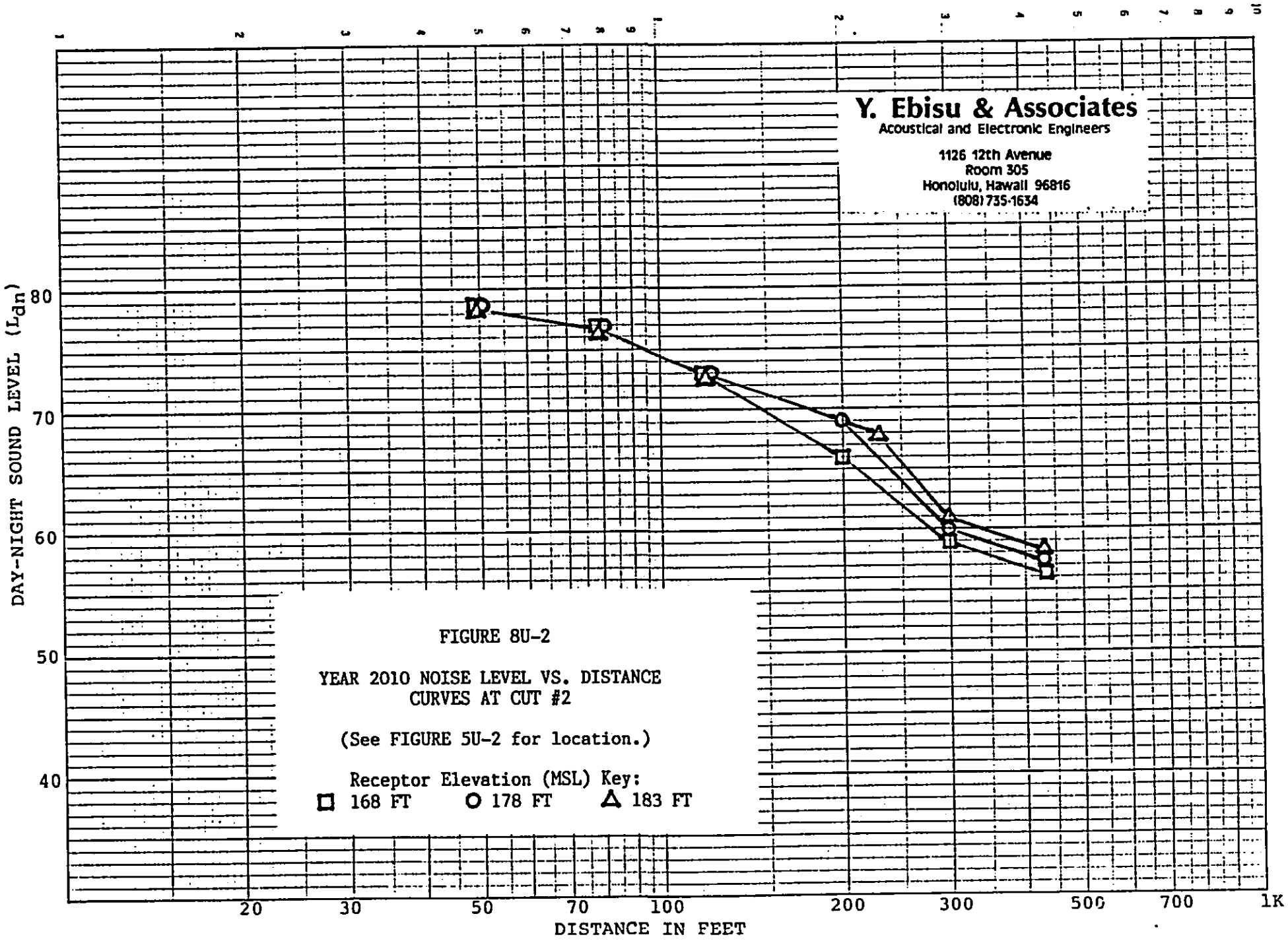
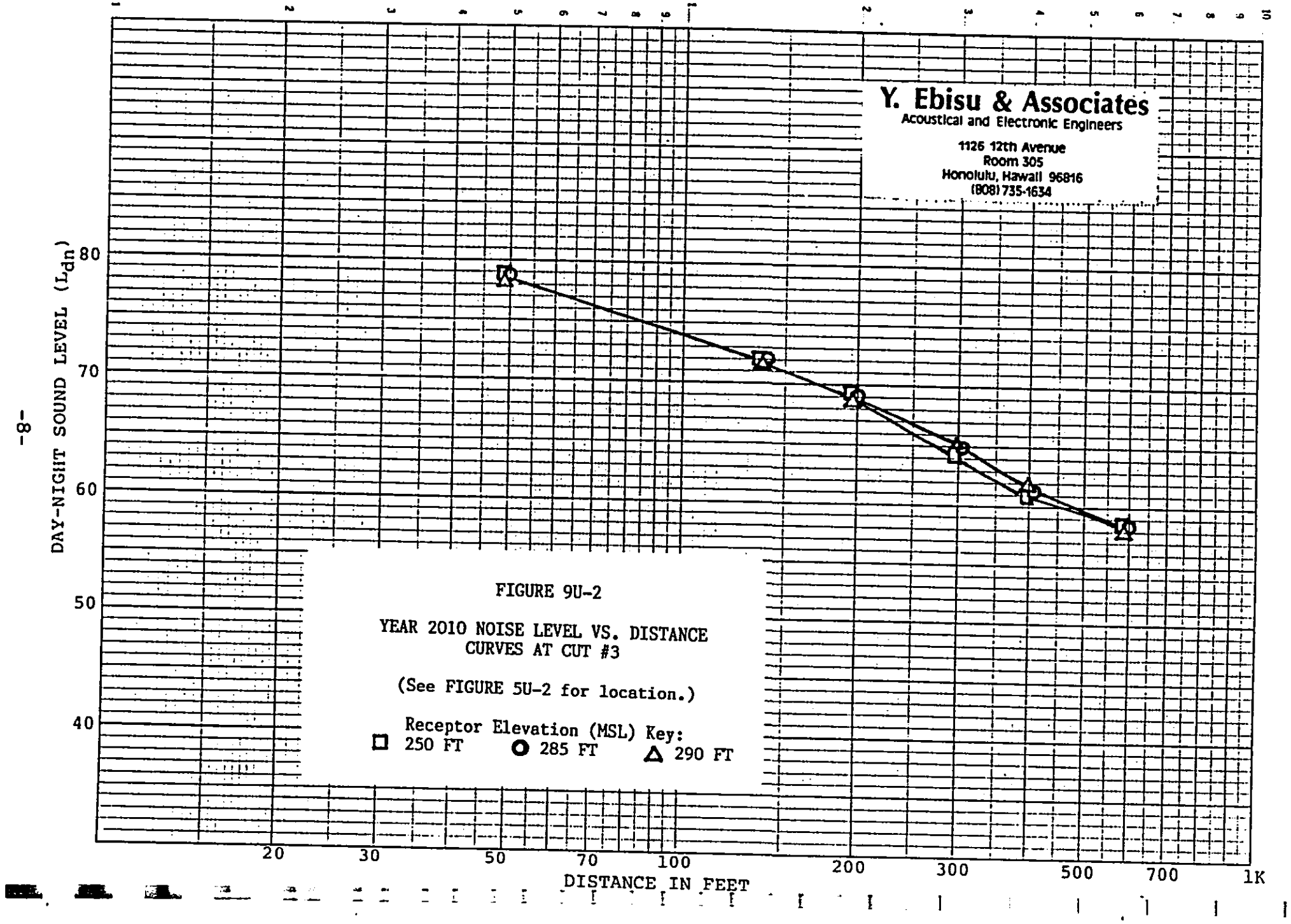


FIGURE 8U-2

YEAR 2010 NOISE LEVEL VS. DISTANCE
CURVES AT CUT #2

(See FIGURE 5U-2 for location.)

Receptor Elevation (MSL) Key:
□ 168 FT ○ 178 FT △ 183 FT



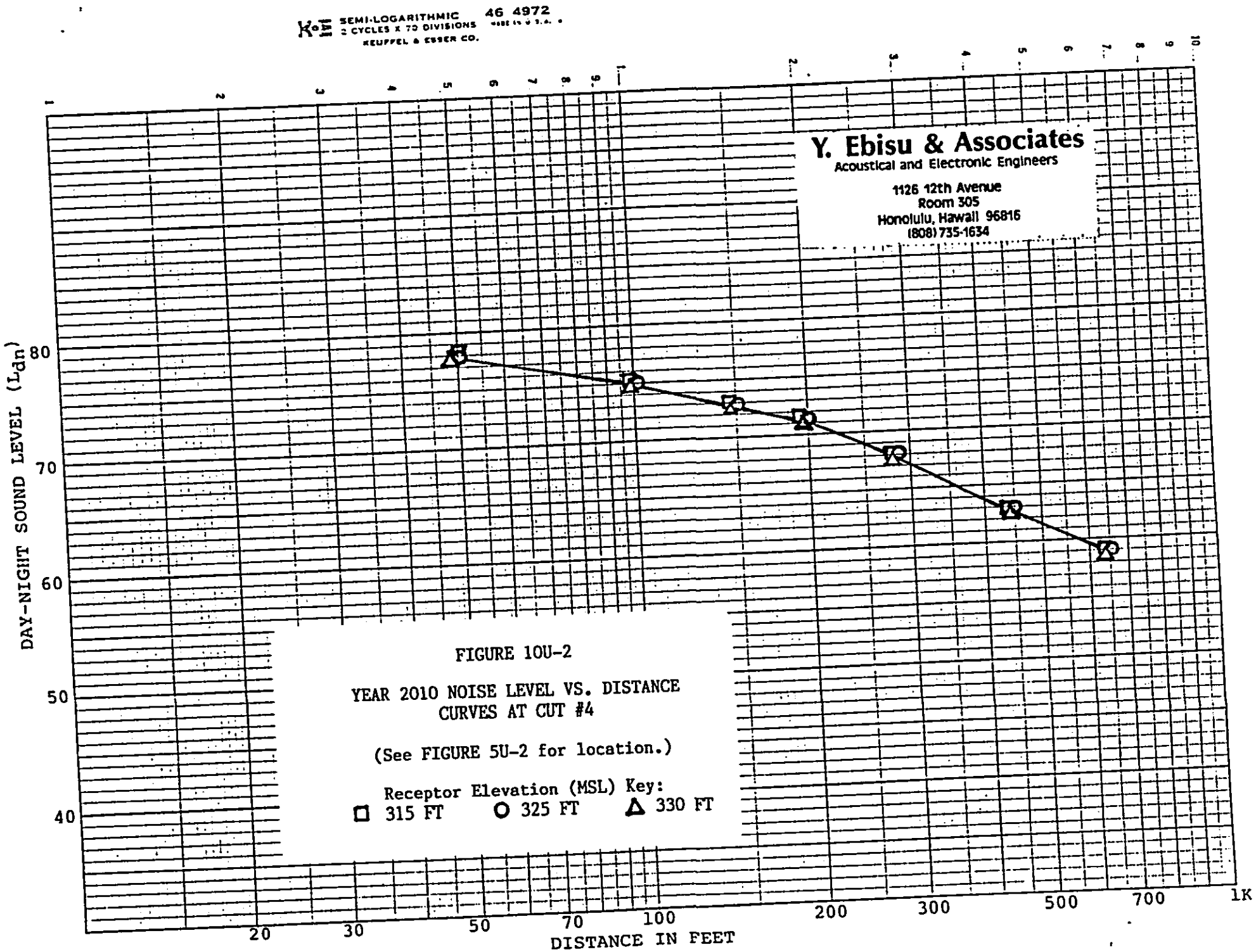

SEMI-LOGARITHMIC
2 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO.
46 4972
Y. Ebisu & Associates
Acoustical and Electronic Engineers
1126 12th Avenue
Room 305
Honolulu, Hawaii 96815
(808) 735-1634
DAY-NIGHT SOUND LEVEL (L_{dn})
80
70
60
50
40
20
30
50
70
100
200
300
500
700
1K
DISTANCE IN FEET
FIGURE 10U-2
YEAR 2010 NOISE LEVEL VS. DISTANCE
CURVES AT CUT #4
(See FIGURE 5U-2 for location.)
Receptor Elevation (MSL) Key:
315 FT
325 FT
330 FT

TABLE 3U-2

EXISTING AND YEAR 2010 DISTANCES TO 60, 65, AND 70 Ldn CONTOURS
(FOR UNOBSTRUCTED LINE-OF-SIGHT CONDITIONS)

STREET SECTION	60 Ldn SETBACK (FT)		65 Ldn SETBACK (FT)		70 Ldn SETBACK(FT)	
	EXISTING	FUTURE	EXISTING	FUTURE	EXISTING	FUTURE
H-2 Frwy. (North of Waipio Interchange)	522	490	242	227	113	106
H-2 Frwy. (South of Waipio Interchange)	522	844	242	391	113	183
Ka Uka Boulevard Extension	N/A	203	N/A	94	N/A	44
4,000 VPH Roadway	N/A	177	N/A	82	N/A	38
3,000 VPH Roadway	N/A	146	N/A	68	N/A	31
2,000 VPH Roadway	N/A	112	N/A	52	N/A	24
1,000 VPH Roadway	N/A	70	N/A	33	N/A	15

Notes:

1. Setback distances are to freeway and roadway centerlines.
2. Assumed traffic mix of 96% autos, 2.5% medium trucks, and 1.5% heavy trucks on H-2 Freeway.
3. Assumed traffic mix of 98% autos, 1% medium trucks, and 1% heavy trucks on internal roadways.
4. Ldn assumed to be 1.4 dB greater than two-way, AM Peak Hour Leq.
5. Setback distances are for unobstructed Line-of-Sight conditions.

TABLE 4U-2

PROJECT AND NON-PROJECT TRAFFIC NOISE INCREASES

LOCATION	1985 LDN	YEAR 2010 LDN W/O PROJECT	YEAR 2010 LDN W PROJECT	PROJECT INCREASE
H-2 Freeway North of Waipio Interchange:				
H-2 (Outbound) to North	67.3	69.0	67.1	(1.9)
H-2 (Inbound) from North	68.6	70.0	68.4	(1.6)
H-2 Freeway South of Waipio Interchange:				
H-2 (Outbound) from South	67.3	70.4	71.4	0.9
H-2 (Inbound) to South	68.6	71.1	72.1	1.0

Note: Ldn values calculated at 100 FT from all roadways' centerlines.

lanes of H-2 Freeway north and south of the proposed Waipio Interchange. Traffic noise levels represent project plus non-project Ldn at the 2010 planning year. As indicated in TABLE 4U-2, minimal changes in project plus non-project traffic noise are predicted to the north of the project. If the project is implemented as proposed, traffic noise levels north of the Waipio Interchange are predicted to decrease slightly. South of the interchange, non-project traffic are predicted to cause significant increases in traffic noise of 2.8 dB by the Year 2010, and project traffic are predicted to add an additional 1.0 dB.

IV. YEAR 2010 TRAFFIC NOISE ENVIRONMENT ALONG INTERIOR ROADWAYS

Future traffic noise levels along the major interior streets of the proposed development were also evaluated for the Year 2010 time period. A worst case traffic volume of approximately 4,902 VPH is projected during the AM peak hour on the Ka Uka Boulevard extension (Reference 3). Under these conditions, and at an anticipated average speed of 35 MPH, traffic noise levels along the boulevard should not exceed 69 Ldn at 50 FT setback distance from the roadway centerline. Future setback distance to the 65 Ldn contour from the centerline of this roadway is predicted to be 94 FT.

For other interior roadways of the project, AM peak hour traffic volumes are expected to be less than 4,902 VPH. Predicted setback distances to the 65 Ldn traffic noise contours for interior roadways with traffic volumes of 4,000, 3,000, 2,000, and 1,000 VPH are also shown in TABLE 3U-2. As indicated in the table, setback distances of 94 to 33 FT from the roadways' centerlines are required to not exceed 65 Ldn for AM peak hour volumes of 4,902 to 1,000 VPH. If these minimum setback distances from the centerlines of the interior roadways are used when siting residential/apartment buildings within the project, the existing FHA/HUD noise standard of 65 Ldn can be met, and traffic noise impacts from interior traffic will be minimized.

V. DISCUSSION OF FUTURE TRAFFIC NOISE IMPACTS

As indicated previously, differential traffic noise impacts along Kamehameha Highway and attributable to the proposed Waiawa Development are predicted to be less than 0.5 Ldn (or dB), and will be difficult to measure. The proposed Waiawa Development, including the additional 504 acre increment, is not anticipated to generate adverse traffic noise impacts along Kamehameha Highway by the Year 2010 planning period.

Because traffic noise along H-2 Freeway to the north of the proposed Waipio Interchange are not expected to increase, adverse traffic noise impacts should not occur in areas to the north of the proposed project.

Along H-2 Freeway between the proposed Waipio Interchange and the existing Waiawa Interchange, significant increases (3.8 Ldn) in total traffic noise levels are predicted by the Year 2010 planning period. Project and non-project traffic will contribute 2.8 and 1.0 Ldn, respectively, to this total increase. Adequate setback distances currently exist to residential areas to the west of H-2 Freeway, and Year 2010 traffic noise levels should remain in the "Acceptable, Moderate Exposure" to "Unconditionally Acceptable, Minimal Exposure" categories.

On the Waiawa Development side of the H-2 Freeway, possible noise impacts may occur at the low and medium density apartments (parcels J, F, and D) located at the southwest end of the development (see FIGURE 5U-2). The extent of the noise impacts will depend upon the setback distances and building elevations planned within these proposed housing areas (see FIGURES 8U-2, 9U-2, and 10U-2). For single story construction, setback distances from the freeway baseline of 210 to 370 FT are required to not exceed the FHA/HUD standard of 65 Ldn. For multistory construction, larger setback distances (applicable to the upper floors) of 260 to 370 FT are required.

Of the six noise sensitive (residential and apartment) parcels included in the Waiwa 514 Project application, three (par-

cels J, F, and D) will probably require more detailed study to insure that traffic noise levels do not exceed the FHA/HUD standard of 65 Ldn. As indicated in the future H-2 noise contours of FIGURE 5U-2, portions of parcel F, which do not have the benefit of highway noise shielding from existing topographic features, will probably be in the "Normally Unacceptable" noise exposure category. The major portion of the highway frontage of parcel J, on the other hand, is predicted to be shielded from highway noise. The southernmost portion of parcel D may be within the 65 Ldn contour. Setback distances and receptor elevations required to not exceed 65 Ldn at locations within these three parcels are provided in FIGURES 8U-2, 9U-2, AND 10U-2. After the site grading plans are developed, the validity of the Year 2010 noise predictions should be checked to identify structures which may require sound attenuation treatment.

VI. POSSIBLE NOISE MITIGATION MEASURES

Possible noise mitigation measures which would minimize noise impacts from roadway traffic noise include measures such as: the use of buffer zones of sufficient depth as indicated in FIGURES 8U-2, 9U-2, and 10U-2, and TABLE 3U-2; construction of sound attenuation berms or walls where adequate setbacks cannot be achieved; incorporating sound attenuating window design features in upper story homes which cannot be shielded by sound attenuating barriers; and air conditioning affected spaces. The applicability of each mitigation measure depends upon other considerations besides noise, such as economic cost, aesthetics, and technical feasibility.

The construction of sound attenuation walls or berms is a standard mitigation measure, particularly for single story homes. However, wall height requirements become excessive (in the order of 10-plus FT) when multistory residences are involved in traffic noise mitigation efforts. For this reason, the use of walls or berms as a traffic noise mitigation measure is generally limited to ground floor residential units.

Where none of the above mitigation measures are feasible, the remaining options are air conditioning the affected residential spaces or sound treating the ventilation openings (windows). The use of air conditioning within residences is not common in Hawaii, and is not generally considered to be a practical option for subdivision residences. The use of sound treated windows has been applied at selected mid-rise structures in Hawaii for the purpose of meeting FHA/HUD noise standards, and is a possible noise mitigation option for any new home of the project.

A. REFERENCES

(1) Y. Ebisu & Associates, "Traffic Noise Study for the Proposed Waiawa Development Plan," January, 1986.

(2) Y. Ebisu & Associates, "Updated Traffic Noise Study for the Proposed Waiawa Development Plan (Year 2002)," July, 1986.

(3) Parsons Brinckerhoff Quade & Douglas, Inc., "Traffic Impact Report, Waiawa 514 Project," December, 1986.

APPENDIX H

SOCIAL IMPACT ANALYSIS
FOR THE PROPOSED
GENTRY 515 PROJECT
WAIAWA, CITY & COUNTY OF HONOLULU, HAWAII
THE GENTRY COMPANIES

January, 1987

Prepared for
Environmental Communications, Inc.
by
Triad Evaluations

I. INTRODUCTION

Identification of social and economic impacts on any given proposed development are subjective at best, however, the need for such analysis are desirable and required under current City planning criteria. In light of such objectives, the identification of potential social impacts of a proposed development upon local residents is best addressed by obtaining a good understanding of the area prior to development. This report is intended to provide objective background data which can serve as a starting point for prognostication of potential social and cultural impacts.

The social impacts of development are listed as demographic, economic, housing, public service, and physical/environmental in Section 10, Social Impacts of Development, in Ordinance 83-6, City and County of Honolulu.

This presentation was developed systematically with the intent of identifying possible impacts based on empirical and quantitative data. Three primary analytical aspects were utilized in formulation of the social impact forecast presented here.

Baseline data for the subject area was recorded through a systematic analysis of available demographic data on socio-economic characteristics in the vicinity. For comparative purposes, Honolulu County statistics were also used as reference mean. From these statistics, conclusions were drawn from the analysis of these findings with respect to demographic concerns outlined in Section 10, Social Impact of Development, Ordinance 83-6, City and County of Honolulu.

The economic aspects of the development were evaluated with respect to the general economic trends which affect the project, as was the housing analysis. Public service evaluation was limited to an overview of existing facilities since public service and facilities planning are usually implemented gradually as needs for specific services arise. Lastly, the physical characteristics of the project were reviewed for any significant impacts resulting from implementation of the project.

II. PROJECT DESCRIPTION

The proposed Gentry 515 project consist of a mixed use development of 515 acres located in Waiawa, Oahu, Hawaii. This development will include mixed residential uses, a neighborhood shopping center and commercial/ industrial areas. The project site is adjacent to the planned Gentry Waiawa community and may share facilities and services with the 1,300 acre project.

The project site, which is currently vacant and fallowed of sugarcane crop, is located mauka of the H-2 Interstate Highway and Kamehameha Highway. The Waiawa Interchange lies at the makai tip of the site while the central Oahu plateau continues beyond the project's uppermost boundaries. The Manana and Pacific Palisades subdivisions and the Pearl City Industrial Park are located directly Diamond Head beyond the Waiawa Gulch and Stream which bounds the eastern side of the site. The Waipio, Seaview, and Crestview subdivisions lie beyond the H-2 to the west. The site is classified for agriculture in the State Land Use and City and County Zoning Maps. The property's Development Plan Designation is also for agriculture.

Land Use	Acreage	Units
Residential	168	1,090
Low Density Apartment	156	3,120
Medium Density Apartment	26	780
Commercial	10	
Commercial/Industrial	73	
Open Space	13	
Flood Plain	58	
Interior Roadways	11	
TOTAL	515	4,990

The low and medium density apartment units are planned for a portion of the development which will be marketed as a retirement community which will serve retirees interested in a leisurely and active lifestyle. Extensive

recreational facilities and activities are proposed which will include golfing, tennis, swimming, exercise rooms, library, game rooms and meeting facilities. Health care facilities will also be planned as an integral part of the community. Residents for this community are expected to be 55 years or older.

Affordable housing is also planned for the project and consultation with the City and County Department of Housing and Community Development will be maintained in developing a program to meet this requirement.

An integral 10-acre shopping center is planned for the retirement community. This neighborhood shopping center will be anchored by a major supermarket chain store and a major discount drug store. A variety of smaller food, service, and retail stores will also be included in the center. The center will be centrally located to afford pedestrian access within the retirement community.

A 73-acre commercial/industrial area is also planned for the development. The commercial/industrial area, which will be located off the H-2 Highway, will allow expansion of the Gentry Waiawa commercial/industrial area which is adjacent to the subject project's business site. The mixed use area is expected to include a wide variety of retail and commercial service establishments, and professional and technical business activities ranging from corporate offices and high technology businesses to appropriate clean light industrial uses.

Both the shopping center and commercial/industrial area will service the project's internal needs for consumer services as well as the creation of new employment centers.

The Gentry 515 Development will be afforded a wealth of recreational opportunities both onsite as well as on the Gentry Waiawa Development. Additionally, in keeping with the active, health oriented theme of the project, an extensive system of bicycle and walking paths are planned for convenient interal access.

Access to the project site would be provided by interchange on Interstate Highway H-2 at the Mililani Memorial Road overpass and by on and off ramps to the project at the Waiawa interchange in the downtown direction. The internal circulation system proposes a parkway roadway system providing direct access to the commercial, commercial/industrial mix areas, and various recreational facilities. Secondary streets will provide access to the different neighborhoods.

III. WAIAWA REGIONAL PROFILE: Socio-Economic Characteristics

A. Demographic: Whether the development will:

- Increase or decrease the residential population.
- Increase or decrease the visitor population.
- Change the character or culture of the neighborhood.

The proposed Gentry 515 project site is contained within the U.S. Bureau of the Census, tract number 89.03. This tract is identified as a split tract with a portion belonging to the Waipahu CDP (census designated place, an area of 10,000 or more). The majority of the tract lies within an area categorized as Remainder of Honolulu.

The census tract containing the Gentry 515 site, 89.03, also includes the Waipiolani Seaview, Crestview and Waipio Gentry developments. A small portion of Waipahu town and the area around Leeward Community College are also included in the tract figures but are also considered a portion of the Waipahu CDP.

For comparative purposes in this report, tracts 89.02, 80.03, 80.06 and 80.05 will be considered as surrounding community areas. These areas contain in part or entirety, Mililani and Waipio, Manana, Pearl City and Pacific Palisades, respectively.

Population:

Population statistics from the Department of Planning and Economic Development for 1984 list Waiawa (tract 89.03) as having a population of 12,783. This represents a 95% increase over the 1980 census figure of 6,566. This increase is primarily attributable to recent development occuring outside of the Waipahu CDP, namely Waipio Gentry. This increase is fairly consistant with the population changes occuring between 1970 and 1980 for the surburban communities in the immediate area.

Table I

Population Growth Within CT 89.03 (Waiawa)

	Waipahu CDP	Remainder in Honolulu County	Total
1970 -	746	1,623	2,369
1980 -	2,382	4,184	6,566 (+177.2%)
1984 -	-	-	12,783* (+94.7%)

* Source: DPED
1970 Census of Housing Block Statistics

These changes are significantly larger than those occuring within Honolulu County which experienced a 20.9% increase between 1970 and 1980 and a subsequent increase of 3.3% between 1980 and 1983.

Table II

Population Growth, Honolulu County and Waiawa

	Honolulu County	Waiawa (CT 89.03)
1970 -	630,528	2,369
1980 -	762,565 (+20.9%)	6,566 (+177.2%)
1983 -	805,300 (+5.6%)	12,783 (+94.7%)

Source: The State of Hawaii Data Book 1985

High growth is not limited to areas within the immediate Waiawa vicinity. Neighboring areas outside of the Waiawa CT are separated by district physical boundaries and are clearly delineated as independent communities, however, they have also exhibited similar growth patterns in some instances.

Table III
Population Growth in Surrounding Areas*

	Manana 80.03	Pearl City 80.05	Pacific Palisades 80.06	Mililani 89.02
1970 -	2,811	7,846	4,349	4,420
1980 -	3,377(+20.1%)	7,465(-5.1%)	5,906(+35.3%)	25,874(+485.4%)
1984 -	6,823(+102%)	7,483(+0.2%)	5,945(+.06%)	30,960(+19.7%)

* Place names are given as area indicators and are not intended to imply totals for the named area or any legal boundaries.

Sources: DPED, The State of Hawaii Data Book 1985

Population increases experienced recently may be attributed to ongoing projects by Lusk Hawaii, Lear Siegler and Mililani Town expansion. Areas within Pearl City and Pacific Palisades experiencing growth stabilization within the past few years are primarily older and more established.

Number of Households

Based on the 1980 census population of 6,566, Waiawa had 1,626 households, with a mean of 4 people per household. This compares to a lower mean of 3.3 people per household in Honolulu County and 3.15 for the State. In 1983 the Hawaii State Department of Health estimated the average Honolulu County household to contain 3.16 persons. The existing Waiawa households can also be separated into sub-catagories part of the Waipahu CDP and those in the northern Honolulu County areas.

Table IV

Number of Households 1980

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County)
Population	762,565	6,566	2,382	4,184
Number of Households	230,214	1,626	485	1,168
Mean per Households	3.3	4.0	5.2	3.6

Projected Population Increase:

1980 census data indicates Waiawa household sizes as being larger than the Honolulu County average, however, no data is currently available for the number of households formed since 1980. Units surveyed in 1980 consisted primarily of single family detached residences while post 1980 construction included a significant number of higher density units targeted at smaller household sizes. These recent developments are generally expected to lower household size averages because of their mixture of single family detached and higher density uses. Similar mixtures may be found in newer developments such as Mililani which has an average household size of 3.3. However, this may still reflect an average higher than the Gentry 515 development will actually contain.

The Gentry 515 Plan, will consist of 4,990 residential units which will consist of a mixture of Residential, Low and Medium density units. Approximately 3,900 of these units will be reserved for the Gentry 515 Leisure Village which is targeted for the retirement community and "empty nesters." These units are expected to contain small household sizes with one or two persons per unit as the norm.

Based upon this information, an average age persons per household figure of 3.3 should be considered a fair coefficient for the conventional units. Analysis of retirement communities suggest that 1.6 members per household is also reasonable regardless of unit type. Similarly, the Department of General Planning utilizes the coefficients of 2.0 for low density apartments, 3.0 for medium density apartments, and 3.3 for residential units. Utilizing all of these ratios, a total population increase of approximately 9,837 persons could be expected from full development of the project.

Table V

Population Projection

Retirement Community		Conventional Housing	
Low Density Apartment			
3,120 @ 1.6 =	4,992		
Medium Density Apartment		Residential	
780 @ 1.6 =	1,248	1,090 @ 3.3 =	3,597
	6,240		3,597

Total - 9,837

Age:

The Waiawa community is primarily composed of detached dwelling units consisting of nuclear or extended families. The age breakdown within the area indicates that the highest percentage of adults fall within the 25 to 44 year age categories. Although the overall distribution is similar to Honolulu County, the Waiawa area does express slightly higher numbers of school age children and teens. A decrease in ages 55 and over is also indicated.

Table VI

Age Groups (1980)

	Honolulu County	Waiawa (89.03)
Under 5	60,154(7.9%)	527(8%)
5-9	56,771(7.4%)	589(9%)
10-14	58,528(7.7%)	684(10.4%)
15-19	69,715(9.1%)	623(9.5%)
20-24	89,371(11.7%)	454(6.9%)
25-34	143,456(18.8%)	1,203(18.3%)
35-44	89,330(11.7%)	1,021(15.5%)
45-54	74,775(9.8%)	720(11%)
55-64	65,097(8.5%)	425(6.5%)
65-74	35,932(4.7%)	198(3%)
75+	19,436(2.5%)	121(1.8%)

Place of Birth:

Waiawa exhibits significant differences in its residents places of birth compared to Honolulu County distributions. As a whole, the Waiawa census tract is predominantly comprised of Hawaii and foreign born people with relatively few mainland born. More descriptively, it should be noted that Honolulu County has half as many foreign born as it does mainland born. The converse is true for Waiawa where foreign born outnumber mainlanders by a ratio of 1.7 to 1.

Further breakdown of the tract into Waipahu CDP and Remainder of Honolulu County sub-tracts indicate clear differences in internal composition. The Waipahu CDP contains a high percentage of foreign born (41.2%) with relatively few mainlanders (6%) which reflects the high percentage of Filipinos residing in Waipahu. The Remainder of Honolulu County sub-tract on the other hand, contains a markedly high percentage of Hawaii born which may indicate the area as a very "local" community.

Table VII

Place of Birth

	Honolulu County	Waiawa CT	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County)
Hawaii	420,120(55%)	4,018(61%)	1,266(52.8%)	2,752(65.6%)
Mainland	229,234(30%)	958(14.5%)	145(6%)	813(19.4%)
Foreign	113,211(14.8%)	1,615(24.5%)	988(41.2%)	627(15%)

Years of School Completed:

Waiawa shares fairly homogeneous educational characteristics with Honolulu County. Overall highschool education percentages are in line with the County average however, a slight increase of persons with some college education is noted for Waiawa.

Table VIII

Education

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County)
% Highschool Graduates	75.6	76.3	62.0	83.3
College 1-3 Years	78,386(18.3%)	868(23.4%)	304(23.8%)	564(23.2%)
College 4 or More Years	93,201(21.7%)	728(19.7%)	171(13.4%)	557(23%)

Labor Force:

The Waiawa population, compared to Honolulu County, has a large percentage of employable age persons. Labor force figures for the whole Waiawa tract show a labor force of 75.8% while the Honolulu County average is held at 69.2%. These figures are also supported by the age characteristics for both study areas (Table VIII).

Waiawa's overall employment rates are comparable with County wide averages, however the split tracts indicate some divergence with the Remainder of Honolulu County area possessing a higher than County average and the Waipahu CDP possessing a lower than County average.

Table IX
Labor Force

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County)
Persons 16 Yrs. & Older	574,903	4,603	1,692	2,911
Total Labor Force	397,889(69.2%)	3,488(75.8%)	1,190(70.3%)	2,298(78.9%)
Civilian Labor Force	339,863	3,264	1,132	2,132
Employed	324,113(95.4%)	3,099(94.9%)	1,037(91.6%)	2,062(96.7%)
Unemployed	15,750(4.6%)	165(5%)	95(8.4%)	70(3.3%)

Occupation:

In comparison with Honolulu County, Waiawa's work force shows strength in service and labor occupations while trade and professional service occupations exhibit some under representation. This would suggest that Waiawa has a higher percentage of wage earners than Honolulu County.

The Waiawa community also contains a high percentage of government workers (26.9%) compared to the Honolulu County (22.5%). Conversely, few workers are self-employed (3%) (Table IX).

Income in 1979:

Waiawa exhibits overall higher-than-average affluence with substantially higher median and mean incomes over County wide figures. The majority of households (46.8%) fell into the $20,000-$34,999 range establishing a solid middle class foundation. Marked differences are noted in the lower income brackets with only 15.5% earning under $20,000 in comparison to Honolulu County's 47.3%. Households with incomes over $35,000 are also notably higher in the Waiawa area. Income distribution within the split Waiawa tracts is homogenous.

Median and mean incomes of owner-occupied Waiawa households are similar to Honolulu County figures, however, Waiawa's renter-occupied households show significantly higher incomes than County figures for the same category.

Comparison within Waiawa's split tracts show similarities in income progression but in light of the marked differences in members per household (CDP 5.2, Remainder 3.6), corresponding economic adjustments are expected in actual disposable income (Table X).

Table X
Occupation and Selected Industries

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County)
Employed -16 Years & Older	324,113	3,099	1,037	2,062
Managerial, Administrative Specialty	79,934(16.4%)	1,216(16.9%)	256(10.8%)	960(19.8%)
Technical, Sales Administrative Support	109,521(22.4%)	2,038(28.3%)	656(27.6%)	1,382(28.5%)
Service Occupations	56,939(11.7%)	1,140(15.8%)	386(16.3%)	754(15.6%)
Farming, Forestry, Fishing	5,838(1.2%)	17(0.2%)	11(0.5%)	6(0.1%)
Precision, Production, Repair	36,546(7.5%)	486(6.7%)	181(7.6%)	305(6.3%)
Operators, Fabricators, Laborers	35,335(7.2%)	798(11.1%)	392(16.5%)	406(8.4%)
Manufacturing	24,982(5.1%)	267(3.7%)	120(5%)	147(3%)
Wholesale, & Retail Trade	79,644(16.3%)	767(10.6%)	264(11.1%)	503(10.4%)
Professional & Related Svcs.	59,927(12.3%)	485(6.7%)	107(4.5%)	378(7.8%)
Private Wage & Salary Workers	231,719(69.4%)	2,141(67.3%)	786(75.2%)	1,355(63.4%)
Government Workers	75,058(22.5%)	857(26.9%)	240(23%)	617(28.9%)
Local Government Workers	10,583(3.2%)	90(2.8%)	8(0.8%)	82(3.8%)
Self-employed Workers	16,312(4.9%)	94(3%)	11(1.1%)	83(3.9%)

Table XI
Income in 1979

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County
Households	230,931	1,651	463	1,188
Less than $10,000	48,065(20.8%)	104(6.3%)	62(13.4%)	42(3.5%)
$10,000-$19,999	61,153(26.5%)	152(9.2%)	36(7.8%)	116(9.8%)
$20,000-$34,999	68,496(29.7%)	772(46.8%)	185(40%)	587(49.4%)
$35,000-$49,999	33,443(14.5%)	419(25.4%)	120(25.9%)	299(25.2%)
$50,000 and More	19,774(8.6%)	204(12.4%)	60(13%)	144(12.1%)
Median Income	$21,077	$31,061	$29,139	$31,495
Mean Income	$25,180	$33,266	$32,319	$33,635
Owner-Occupied Households	115,290	1,392	370	1,022
Median Income	$30,248	$32,386	$32,282	$32,387
Mean Income	$33,693	$34,820	$34,379	$34,980
Renter-Occupied Households	115,641	259	93	166
Median Income	$13,912	$22,932	$20,093	$24,091
Mean Income	$16,693	$24,910	$24,125	$25,350

Housing:

In 1980 1,704 housing units were listed for the Waiawa tract. Since 1980, the area has undergone extensive growth primarily due to development of the Waipio Gentry subdivision. The 1,500 unit development, which is near completion, is the prime factor responsible for population increases between 1980 and 1984 (Table 1). Waipio Gentry, which is comprised of light industrial, commercial, and mixed residential units, is similar to the proposed Waiawa development in character, however, the Waiawa development will also include a golfcourse and luxury homes as well as retirement/leisure village homes.

Home ownership within Waiawa is very high with only 15.7% of 1980's households renting. Compared to Honolulu County's 49.9% home ownership figure, Waiawa's 84.3% appears exceptionally high. It should be noted, however, that Waiawa is comprised primarily of detached single family units with rental apartment units being almost non-existent.

Table XII
Home Ownership and Rental Units

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County)
Total Households	230,931	1,651	463	1,188
Owner-Occupied Households	115,290(49.9%)	1,392(84.3%)	370(79.9%)	1,022(86%)
Renter-Occupied Households	115,641(50.1%)	259(15.7%)	93(20.1%)	166(14%)

If a current unit count of approximately 3,200 dwelling units is utilized as a base figure, the addition of 2,600 units would result in a total of 5,800 units for the area. This total figure would be realized over a 10-year build-out plan and does not account for any other development in the area.

Transportation to Work:

Use of private transportation to work is very high within Waiawa tract with 93.5% of all employees utilizing private vehicles and only 2.9% using public transportation. These figures are noticeably higher than Honolulu County figures of 76.4% and 10% respectively. The mean travel time to work is slightly higher than the County mean with a difference of 4 to 5 minutes.

Table XIII

Transportation to Work

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	(Waiawa Remainder)
Private Vehicle	282,479(76.4%)	3,017(93.5%)	974(91.4%)	2,043(94.6%)
Public Transportation	37,042(10%)	95(2.9%)	51(4.8%)	44(2%)
Other*	43,622(11.8%)	77(2.4%)	41(3.8%)	36(1.7%)
Work at Home	6,380(1.7%)	37(1.1%)	-	37(1.7%)
Mean travel time to work, minutes	22.6	27.3	26.8	27.6

* Includes bicycles, walk to work

Schools:

The project area is currently serviced by three public schools for grade K through 12. These schools are: Kanoelani Elementary for grades K thru 6; Highlands Intermediate for grades 7 thru 9; and Pearl City High School for grade 10 thru 12. Kanoelani was opened within the past 6 years and is located within the Gentry Waipio development while Highlands Intermediate and Pearl City High are both located within Pearl City.

In the Department of Education "Enrollment Projections of the Public Schools in Hawaii 1986-1991" report, a summary of general enrollment trends indicates that State wide enrollment growth has been experienced for the past three years after the extensive decline experienced from 1971 to 1982. The gains were primarily the result of more students entering kindergarten and private school students crossing over to public schools.

Enrollment losses were expected for existing schools within the Leeward District, however, Leeward's gain of 80 students last year ended a string of enrollment losses and is expected to trigger the beginning of an upward trend. Revised projections for the district show a gain of about 1,300 students over the next six years from many developments planned in the district.

Table XIV

Waiawa Area School Projections

	(Actual) 1985	(Projected) 1986	1987	1988	1989	1990	1991
Kanoelani Elementary	665	818	879	929	935	935	935
Highlands Intermediate	1134	1145	975	877	918	889	854
Pearl City High School	2464	2440	2281	2170	1963	1888	1801

These projections do not account for the proposed Gentry 515 development but do consider those projects under construction or within final planning stages. These projections also indicate that enrollment for currrent and recognized future residents can be accommodated within existing facilities due to the significant decline experienced over the past decade.

Table XV

Public and Private School Enrollment

	Honolulu County	Waiawa (CT total)	Waiawa (Waipahu CDP)	Waiawa (Remainder of Honolulu County)
Grades K-8 Public	103,958(56.5%)	1,236(63.3%)	464(63%)	772(63.4%)
Grades K-8 Private	19,229(10.4%)	191(9.8%)	53(7.2%)	138(11.3%)
Grades 9-12 Public	51,521(28%)	508(26%)	208(28.2%)	300(24.7%)
Grades 9-12 Private	9,390(5.1%)	19(1%)	12(1.6%)	7(0.6%)

Table XIV figures indicate that Waiawa's student population is similar to Honolulu County's public and private school mix for grades K thru 8. Waiawa's student population for grades 9 thru 12 displays a strong orientation to public schools with 1% attending private schools while 5.1% of Honolulu County's students are enrolled in private high schools.

B. ECONOMIC: Whether the development will affect:

- The rate and pattern of economic growth and development.
- The diversity of employment.
- The availability of jobs.
- The employment wage rate.
- The principal economic activities on Oahu.

Economic evaluations for specific regional activity is fairly limited, and when available, should be carefully utilized in context. Economic trends, which may have impact on a specific area, are generally addressed on a state-wide level. The economic data discussed in this section will primarily address general trends which may have regional impacts and a more detailed discussion of regional employment.

The Bank of Hawaii Annual Economic Report for 1986 estimates that Hawaii's gross state product increased 2.4% in 1985 and although an official measure of the overall performance of the 1986 GSP is not yet available, it is believed that 1986 may prove to be the best year in Hawaii's economy in almost a decade.

This forecast is representative as to the general trend of the economy, however, it does not analyze the mix of jobs, age groups and household income which determine the economic capacity of various segments of the economy.

An analysis of jobs and employment by the Bank of Hawaii indicates that the statewide total of non-agricultural wage and salary job count increased by 2,700 during the first 9 months of 1986.

> "The gains in the overall economic activity have resulted in gains in employment and income. Non-agricultural wage and salary jobs for the first 9 months of 1986 were reported ahead of the same period of a year ago by 2,700. Most of the gains occurred in trade, services and construction. As of the second quarter of 1986, personal income was higher than in the same period a year earlier by 6.3 percent, or up 3.4 percent after adjustment for inflation. With the rate of general price inflation

remaining below 3 percent, the year as a whole is expected to produce slightly better real personal income gains than in 1985.

While 1986 has turned out to be a year of respectable gain in the overall level of economic activity, the differences of sectoral performance indicated a pronounced unevenness. That disparity alone may prevent a very strong performance of the economy in 1987.

Despite the booming construction industry in 1985 and 1986, weak spots remain. Residential permits for the first half of 1986 were behind the same period of a year ago. It appears that declining interest rates have not been sufficient to stimulate that sector more than they already have. With most of the major resort projects on the outer islands already under way, the construction industry should remain at current levels of activity, but that means that growth is expected to slow significantly in 1987. Likewise, visitor arrivals may stay at current levels but that means that growth could remain at zero.

With two of the major propellants of growth in 1986 slowing in 1987, the overall economy is expected to show similar pattern. As our forecast shows, GSP is expected to increase 6 percent in 1987 as compared to 7.5 percent in 1986. In real terms that will be a growth of about 3 percent compared to close to 5 percent in 1986."

Employment centers within the project will consist of a commercial area and a commercial/industrial area totalling 83 acres.

The primary commercial site would be the centrally located 10 acre shopping center. This center would be anchored by a major supermarket chain and would also contain a major discount drug/sundry store and a variety of retail, food and service stores. The primary target market would be the Gentry 515 and Gentry Waiawa populations. The secondary market would include Waipio by Gentry with access by freeway overpass. The tertiary market would be surrounding residential and commercial/industrial development. Waiawa Center is not viewed as a potential regional center that would capture a significant market share from other areas.

The 73-acre commercial/industrial mix area off Interstate Highway H-2 is intended to accommodate a wide variety of retail and commercial service establishments, and professional and technical business activities ranging from corporate offices to high technology businesses to appropriate clean light industrial uses.

The 20-acre commercial/industrial mix area next to the proposed lake would be developed primarily with a mix of food services, retail shops, and art and craft activities convenient to the proposed retirement community.

The main 73-acre commercial/industrial complex will possibly be developed as a mixed-use business park with a portion of the area consisting of a mix of low-rise and garden-office buildings. A market analysis conducted by real estate consultants Wendell Brooks, Jr., John Zapotocky and Daniel McFadden, indicates:

> "The need for office space in the Waiawa, Pearl City, Waipahu area will become much more apparent during the next five to ten years. At the present time, there is a surplus of office space in the Central Business District of Honolulu and fringe areas. Oahu's office space market has followed the traditional office development cycle (i.e., shortage, development, over supply and absorption).
>
> Oahu is currently in the absorption phase. The rate of absorption has increased with improvement in the economy commencing in 1982 and 1983.
>
> Future office building demands should occur in the Waiawa region to service the population shift towards Pearl City. This will be increasingly necessary as warehousing and proposed clean industry uses grow in the area in response to increased service needs for the population of the island as a whole and increased emphasis on diversification of the economy.
>
> The remaining portion of the mixed use business park would consist of various uses permitted in light industrial areas (e.g., I-1 Permitted Uses).
>
> The demand for an additional area for light industrial uses will also become apparent as existing light industrial areas are absorbed over the next five years."

The project's market analysis and economic impact analysis consultants have projected the creation of 3,415 jobs from the development of the project. This total which is similar to the previous projection is detailed below:

Employment Projections

Use	Area	Employment Ratio	Total
Commercial	110,000 sq. ft.	1/320 sq. ft.	344
Industrial	73 acres	20/acre	1,460
Miscellaneous Employment	4,990 units	1/50 units	100

Source: John Zapotocky, Market Feasibility Analysis of the Proposed Gentry 515 Planned Community, December 1986

This is not intended to suggest that all of these jobs will be held by Gentry 515 or regional residents, however, it reflects the substantial increase in the job market resulting from the project's implementation.

Long term new job opportunities in West and Central Oahu may change the pattern of employment within the region. Several new projects currently underway represent a variety of new and desireable employment sources which should be compatible with the Gentry 515 project. A partial inventory of these new sources, listed below, was conducted by Chaney, Brooks & Company with John Zapotocky in 1986.

Diversified Agriculture

Opportunities for diverified agricultural operations will increase as lands are released from sugar cultivation and decisions on land use issues are finalized.

Campbell Industrial Park

Campbell Industrial Park is preparing for a large expansion and it is expected to generate substantial new employment at the park.

Gentry Park

Increased demand for industrial space in this area is expected to result in the creation of new jobs as the remaining undeveloped areas of the park are developed.

Hawaii High-Tech Park (Mililani)

The new 250 acre high tech park proposed for the Central Oahu area is currently in the zoning process. It is estimated that 600-900 jobs per year could be created over the next 10 to 15 years beginning in 1988.

Local Service Business

All of the master planned communities being proposed in the Ewa and Central Oahu areas plan to provide for the neighborhood shopping requirements of residents. These facilities will offer employment opportunities.

West Beach Resort

The West Beach Resort development which is expected to be under construction in 1986, is estimated to have the potential of providing approximately 6,000 permanent jobs upon its completion in the next 10 to 20 years.

Kuilima

The Kuilima Resort expansion, while not within the Ewa or Central Oahu area is projected to create approximately 3,500 jobs in the next 10 to 15 years. Given the lack of housing in the North Shore and Koolauloa areas, the small population and housing base which currently exists there, and the lack of limited residential development permitted under the existing General Plan and Development Plan policy for the North Shore, a significant portion of the work force will come from Central Oahu.

Construction

(a) Housing - Whether housing development in Central Oahu continues at its present pace or if most of the development takes places in the Ewa area, there is little doubt that the Ewa and Central Oahu areas will become increasingly important suppliers of housing for the Oahu Market. Thus, an increasing number of construction jobs can be forecast in the area.

(b) Industrial/Commercial - The major influx of population and the plans for regional shopping, office and industrial expansion in the area should improve the prospects for this type of construction.

(c) Resort - Large expenditures for construction of infrastructure and facilities at the proposed West Beach Resort can be expected to begin in 1986 and continue for the next 10 to 15 years (see 8 above).

(d) Public Facilities - Large expenditures can be expected in the area of infrastructure for residential developments that are proposed. In addition, highway improvements, service facilities and other public facilities can be expected as population in the area increases, e.g. a garbage to energy facility is to be built in Ewa.

Government Employment

(a) Barbers Point Harbor - By the year 2000, the harbor is expected to generate approximately 600 jobs while indirectly creating another 1,000 jobs at Campbell Industrial Park.

(b) Miscellaneous - Government service jobs in the area such as schools, police, fire, etc., can be expected to expand with the population.

(c) Second City - Assuming that the second city develops as projected, a government center can be expected to develop as part of the city core.

Based on the list of job opportunities, and the multiplier effect, Zapotocky et al estimated that an excess of 30,000 jobs could be created over the next 20 years. They also stated that it is likely that as the secondary growth area matures into the Second Urban Center, a larger and larger proportion of the job inventory will be filled by workers within the study area.

The following is a summary of the potential jobs that could be created in the area between 1986 and 2005.

Cannery	1,050
Hi Tech	10,000
Waikele Office Park	1,500
Mililani Regional Shopping Center	1,600
West Beach	6,000
Construction	500
Harbor	1,600
Kuilima	3,500
Miscellaneous Jobs	4,300
Total	30,050

Source: Consulting report for Department of Housing and Community Development. Chaney, Brooks & Company and John Zapotocky, May 8, 1986.

It is expected that a large percentage of West Oahu residents will continue to work at traditional places of employment because of seniority, vested retirement plans or personal preference. The consultants also suggested that others will choose to work closer to home, and still others living in the Primary Urban Center will choose employment in the Secondary Urban Center. As markets grow, as labor pools grow, and as land cost in the Primary Urban Center increase, decentralization will be increasingly more attractive in much the same way experienced by many mainland cities. This could result in employment patterns changing measurably during the next five to seven years.

C. HOUSING: Whether the development will affect:

- The availability of housing.
- The quality of housing.
- Speculation in land and housing.
- Property values of existing homes.

The Gentry 515 project, as a master planned community, will provide an extensive mix of housing types. This mix will include single family detached dwellings, low density apartments, and medium density apartments, but one unique feature is the planned retirement community. This retirement community will serve as a "community within a community."

An analysis of the housing market should therefore be divided into two parts; the retirement community, and, the conventional community. Each market exhibits characteristics that are different yet complementary to each other.

Retirement Community

A major component of the Gentry 515 project will be it's "Leisure Village." This retirement community is planned as a self-contained neighborhood that would be unique to Hawaii. This community which would consist of 3,120 low density apartments and 780 medium density apartments would serve retirees interested in both a leisurely and active lifestyle with self-contained activities as golfing, tennis, swimming, exercise rooms, library, game rooms and other meeting facilities. The residents will be 55 years or older, all owner occupants. Design features include security, landscape amenities and maintenance, and health care availability. A combination of townhouses, duplexes, and condominiums is planned with an average household size estimated at 1.6 persons per unit.

Retirement housing on Oahu is currently limited to three privately operated facilities. Two of these retirement communities, Arcadia, and Pohai Nani,

were interviewed by Economics Research Associates for the study Development Potential for the Waiawa Leisure Village. A summary of these two developments was presented as follows.

Arcadia

The Arcadia Retirement Residence includes 270 apartments and a 54-bed skilled nursing facility located in a 13-story complex on Punahou Street in Central Honolulu. It is owned and operated by Central Union Church of Honolulu, a non-profit organization.

The Arcadia is a life care contract facility providing housing, meals and general health care services for a one-time entrance fee plus monthly charges which vary by type of apartment and number of occupants.

In order to be placed on the waiting list for Arcadia, a person must be:

- At least 60 years old;
- Ambulatory and in good physical and mental health;
- Capable of adjusting to congregate living; and
- Financially able to meet the facility's financial guidelines.

In addition to housing, meals and health care services, the complex emphasizes provision of independent living in a secure environment. Facilities include: a library, chapel, lounge, and gift shop; private dining rooms for entertaining; a recreation area with shuffleboard, billiards, craft room and work spaces; laundry facilities; and on-site parking for residents.

Pohai Nani

Pohai Nani Good Samaritan Kauhale is one of two retirement centers on Oahu operated by the Good Samaritan Society. Located in Kaneohe on the windward coast of Oahu, Pohai Nani includes a 14-story main building housing 174 apartments, administrative, dining and recreational facilities.

Pohai Nani provides retirement housing, meals, recreation and health care support on a monthly fee basis plus a nominal admission fee which varies by type of residential unit. It is located in a pleasant residential neighborhood and is within a few blocks of a full service hospital.

In order to qualify for admission, an applicant must be at least 55 years of age, in reasonably good health, capable of independent living, and able to adjust to a congregate living environment. A personal financial statement is required before acceptance.

Facilities at Pohai Nani include lounge areas on each floor, an auditorium, and club room for movies, games, etc. There are arts and crafts facilities, hobby shop, a heated swimming pool, library, chapel, and beauty/barber shop.

Comprehensive health care services are provided by an Outpatient Clinic, a Personal Services Unit as residents require more care, and the Kahanaola Convalescent Hospital on the grounds for intermediate care and skilled nursing.

The ERA development report indicated that the adjacent Leisure Village would provide for a currently unfulfilled market. It was suggested that the demand for these type of accomodations would be strong in its' active retirement concept and its' extensive community planning.

ERA also noted that planning of the Leisure Village should include an abundance of recreational facilities, a good sense of security, and privacy. Design of the unit interior spaces should be on one level with ample storage space and well planned interior facilities. Extra bedrooms for use as a study or visitor accomodations are also expected to be in demand.

Most of the potential Leisure Village buyers will probably own their own homes and should be relatively independent of interest rate fluctuations and external market forces.

Conventional Community

The conventional housing types in Gentry 515 will include 1,090 residential units. These units are intended to provide housing to meet the needs of a wide spectrum of income and age groups of Hawaii's diversity of ethnic, social and economic groups.

The Central and Ewa districts of Oahu are currently experiencing a tremendous amount of activity in the planning and development of new communities, subdivisions, and master plan expansion. North of Waiawa, Mililani Town continues to grow while to the east, the new communities of Waikele and Waiola and the adjacent Gentry Waiawa are in the final planning stages. In light of this recent activity, it can be assumed that Central Oahu is a marketable and desireable area.

This recent activity may be related to the focus on Central Oahu and Ewa as the new targets for directed growth by the City and County of Honolulu. The timeliness of this new growth is also the result of new housing demands allowed by present day real estate economics.

The Housing Market Analysis for Gentry 515 noted that the westward movement is likely to continue because of the overall shortage of housing which created demand, the high price of housing close to the urban core, and "supply/pull" based on availability.

Gentry 515's contribution to the State's housing inventory will be positive in its' diverse offerings, its' thoughtful planning, and the overall nature of establishing an identifiable community.

D. PUBLIC SERVICE: Whether the development will affect:

- Medical facilities.
- Educational facilities.
- Recreational facilities.
- Transportation facilities.
- Police and fire protection.
- Public utilities facilities.

The project site is presently undeveloped with no urban uses present. Access to the site is also limited to agricultural service roads and no public access is required for its existing uses. For this reason, there has not been any need for public services on the site.

Existing facilities which serve adjacent subdivisions and nearby communities are expected to accomodate the project's needs during initial construction. However, the scope of the master planned Gentry 515 community requires extensive facilities planning from its very inception. This need has been recognized throughout the planning process and is an integral part of the master plan.

Medical Facilities

The general project area is well serviced by a number of medical clinics throughout the Central and Leeward districts. Clinics are located in Mililani, Waipahu, Pearl City and Aiea. Additionally, major hospitals are located in Wahiawa and Moanalua.

Demand for these facilities will increase as surrounding communities expand and new communities such as Waikele and Waiola are developed; however, the Gentry 515 plan has included excellent access to medical facilities in the adjacent Waiawa development. This center which will serve the general community, but more specifically, will be an important amenity to the retirement community.

Past experience of the Department of Education indicates that enrollment can be estimated based on the number of resident households, the type of housing, and the purchase price of such housing.

The adjacent Waiawa plan provides a site for an elementary school space should it be required. The school site would be developed when the Waiawa population has generated sufficient students to justify a new school facility. It is expected that these facilities should easily accommodate the Gentry 515 project.

A number of elementary schools located in Waipahu and Pearl City currently serve the project area. Additional schools are also planned for the proposed Waikele development and Village Park. As the Gentry 515 project is developed, it is anticipated that the existing outside facilities will be able to absorb the project's school age residents. However, the need for a permanent elementary school facility on site is likely and the developer will plan and coordinate with the Department of Education to address the need.

Intermediate and High Schools in Waipahu and Pearl City should have sufficient capacity to accomodate the increase in middle and upper school levels resulting from the project community.

Recreation Facilities

The Gentry 515 project will be afforded extensive recreational and open space from the adjacent Waiawa community. Two 18-hole golf courses are central features of the Waiawa project and extensive park and open spaces should also be available to the 515 community. An activitiy/recreation center is also planned as a central amenity for the retirement community.

Recreation facilities outside of the project site are limited and heavily used. However, Waiawa's recreational facilities should be more than adequate to serve both Waiawa and Gentry 515's populations and, in fact, are a central feature to the community plan.

Transportation Facilities

The Gentry 515 project will require additional transportation facilities. Access to site is presently limited to service roads; however, new ingress-egress points are being developed with the projects' transportation plan in coordination with the Department of Transportation. Additional traffic from the project will have impact on Kamehameha Highway and the H-2 freeway.

Public transportation needs will also be increased by the development of the project. Municipal bus service for the project should be provided as the project is phased and developed. The developer will contact the appropriate authorities at the applicable stages of development.

Police and Fire Protection

The need for police and fire protection will increase as the 515 project is developed. It is estimated that when fully developed, Waiawa would consist of approximately 9,800 residents. Based on the present Oahu ratio of police employees to population, (2.5 police employees per 1,000 populace), there would be a need for approximately 25 police employees to cover the area, as well as patrol cars and assorted equipment. This demand for police security would be phased in gradually as the project is developed.

Fire stations are currently in operation in Mililani, Pearl City and Waipahu. An additional station is also planned for the proposed Waikele and Waiawa developments. These should adequately serve the proposed project.

Public Utilities Facilities

Electricity, telephone, gas, and cable TV, services will be required in addition to the basic infrastructure of the project. These utilities are expected to be available and coordination between the developer and the appropriate services will be on-going as the project needs are identified. No adverse impacts are expected as a result of these additional requirements.

E. PHYSICAL; ENVIRONMENTAL: Whether the development will affect:

- The natural environment.
- Existing natural monuments, landmarks and scenic views.
- Open Space.
- The aesthetic quality of the area.

The 515 acre Gentry 515 site is located on the Waiawa plain of Central Oahu. Waiawa Gulch lies to the east and the H-2 freeway to the west. The site slopes gently from north to south at elevations from 550 feet down to 200 feet above mean sea level at the southern most end. There are several gulch areas with steeper slopes running along the site.

The site is currently vacant since it was fallowed by Oahu Sugar. Portions of the site are used for minor cattle grazing while the remainder lies untended. Scrub and noxious weeds are found throughout the site with extensive exotic growths in the gulches. No natural monuments, landmarks or archaeological finds are located on the site.

The project site is relatively flat and open. Views from the site are excellent over-looking the southern coast of Oahu. The site while, formerly in agricultural use, seems ideally suited for an asthetically pleasing residential development.

The site is physically separated from the eastern developments of Pearl City, Manana, and Pacific Palisades by the Waiawa Stream and Gulch. The Gentry Waiawa project is directly adjacent to the proposed project. The western developments of Seaview, Crestview, and Waipio Gentry are also physically separated from Waiawa by the H-2 Freeway and Panakauahi Gulch.

The alterations occuring from agricultural use to urban use will be extensive and largely permanent, however these changes are not necessarily negative.

Views of the Gentry 515 site are limited because of it's physical separation on the east and west. The view planes of Waiawa along the H-2 Freeway

are limited since the makai end is graded below the natural topography of the western end. View impacts from the east are also limited since the Waiawa Gulch serves as a buffer between eastern developments and the Waiawa plain. Mauka views from the H-1 Freeway and Leeward Oahu will not be significantly altered since the project site is located on an elevated plateau.

No scenic views should be significantly impacted from development of the Gentry 515 project. Extensive landscaping will also be provided to preserve the verdant quality of the site and to enhance the aesthetic quality of the area.

The project site contains no threatened or endangered flora or fauna species. Historically significant resources have also not been found and it is expected that no adversely significant impacts are expected to occur on the natural environment.

IV. CONCLUSIONS

The Waiawa district presents many interesting facets in its composition and characteristics. Taken as a whole, the Waiawa area, as defined by census tract, appears as an urban fringe community physically divided from higher density suburban communities on the east and south. Closer observation, however, reveals three distinct and separate subcommunities.

Existing Community:

If the area is statistically analyzed in total, Waiawa appears as a homogenous community with socio-economic characteristics similar to other established bedroom communities typical of the 1950-1960 subdivision development period. The community is predominantly comprised of established but young families with household sizes larger than the County wide average. The community is ethnically diverse with more than half of its' residents being Hawaii born and a sizeable portion being foreign born.

Median household incomes for the area are higher than the Countywide average but is also in line with, and representative of, the middle class status that is reflected in other socio/economic indicators. Employment within the area is very high with a large percentage of those employed working as wage earners in service and labor related fields. Most of the families in the area own their homes which is indicative of the non-transient nature of its residents. The community is strongly public school oriented. Summarily and statistically speaking, Waiawa is a very stable young middle-class community with an ethnic diversity.

As stated earlier, however, closer observation of the Waiawa area reveals three clearly identifiable separate sub-communities. Statistically, Waiawa is divided into two sub areas as defined by the Bureau of the Census. A portion of Waiawa falls into a census designated place, namely Waipahu Town, while the remainder (primarily Seaview and Crestview), fall into a remainder category. There are marked differences in these two sub

areas which are important in identifying the true nature of the existing community.

Perhaps the most marked differences lie in the statistics for place of birth and members per household. The Waipahu CDP area within the Waiawa tract consists of a population that is largely foreign born. As a former plantation town, the Waipahu CDP has served as a center of Oahu's Filipino community. This social gravity may account for the strong foreign ethnicity bias within the area. Extended households which are a cultural practice common to the Filipino community probably accounts for the significantly large household sizes (5.2 versus 3.3 for Honolulu County) recorded for the sub-area. The Waiawa area comprised of Crestview and Seaview, on the other hand, is predominantly local born with a smaller average household size of 3.6. In this respect, it is possible to derive a statistical profile of the total community, however, this would not be truly representative of the unique characteristics with the community.

Recent Development:

The Waiawa community has undergone significant change in recent years however, these changes lack statistical data since most occured after the 1980 census. The 95% population growth since 1980 is largely the result of the development of Waipio Gentry. The Waipio Gentry project, which consists of residential and industrial/commercial areas, is indicative of the progression of development in the area. This trend in development is further supported by the scope of the proposed Amfac Waikele, Waiola, Gentry Waiawa and Oceanic Mililani Town expansion projects. These self servicing developments are planned as comprehensive, cohesive communities rather than residential only subdivisions. Waipio Gentry's residential areas are primarily comprised of single family detached dwellings catering to established families and townhouse units which address the needs of first time home owners or smaller families.

In this respect, a pattern of development trends can be plotted which

show not only physical and geographic growth but also the conceptual development of Waiawa community expansion. The portion of Waipahu town located within the Waiawa tract was developed earliest from the other Waiawa sub-communities. This area was probably constructed as an extension or rather a fringe area of the urban Waipahu area. Such development is natural and expected from central urban places. Seaview and Crestview, which were developed in the 1960's, represent another trend in development; the subdivision. Such residential subdivisions of tract homes were common place during the rapid expansion period of the construction boom and growth era. Gentry Waipio which represents the latest trend in residential development, is designed much more comprehensively as a total community with planned commercial, recreational, industrial/business, and a diverse mixture of residential accomodations. This concept of internal self-sufficiency establishes a sense of community easier than residential subdivision that must integrate with larger urban areas.

The nature and degree of social changes in a community are dependant upon the type and size of a new development; however, it is important to define the amount of interaction expected between the old and the new. A good example of this is the interaction between the established Seaview and Crestview developments and Gentry Waipio. Prior to the development of Gentry Waipio, Seaview and Crestview depended upon commercial, recreational and education facilities outside of the immediate area but with the development of Gentry Waipio, these support services can now be found nearby in an area that is actually part of the community. This interaction is interesting in that Gentry Waipio was developed with a self-sufficient orientation and this self-sufficient orientation now lends support for interaction from outside communities. This is especially significant in that the Waipio Gentry development almost doubled the population in the area yet was afforded a smooth transition into the existing community.

The Proposed Development:

The proposed Gentry 515 project will also significantly add to the population

of the Waiawa area. With a projected figure of approximately 9,800 new residents, Gentry Waiawa will significantly increase the existing population. Although this figure represents a substantial increase, it also represents the summation of a 10-year residential build-out period. This expansion rate would be similar to the rate experienced from 1980 to 1984. At this fairly rapid growth rate, social changes have been supportive rather than adverse and development of the Gentry 515 project should provide even greater support to the surrounding existing communities and along with the Gentry Waiawa Development, may actually have enough social gravity to be the central focal place for the area.

The stability of the surrounding communities within the Waiawa area suggest that there is a good ability to adapt and adjust to change. With a solid middle class residential foundation that is relatively young, the area also presents itself as dynamic and growing. The Waiawa, and Central Oahu areas are already targeted for extensive comprehensive community growth by government as well as private developers. With this in mind, it is apparent that the Waiawa Development can be a key in the urban build up of central Oahu.

A particularly significant feature of the proposed development is it's retirement village orientation which would be unique in Hawaii. Residential projects in the local market do not orient towards the retirement buyer so choices for this type of housing are extremely limited. Gentry 515's retirement community on the other hand, would offer a full scale adult community which would meet an existing and unaddressed local need. Additionally, the development of a retirement community in the area will expand the diversity of the development and adjacent communities.

No visitor population changes are expected from the Gentry 515 project since it will be a residential community rather than a resort, however development of the retirement community will address the needs of retirement age interstate in-migrants.

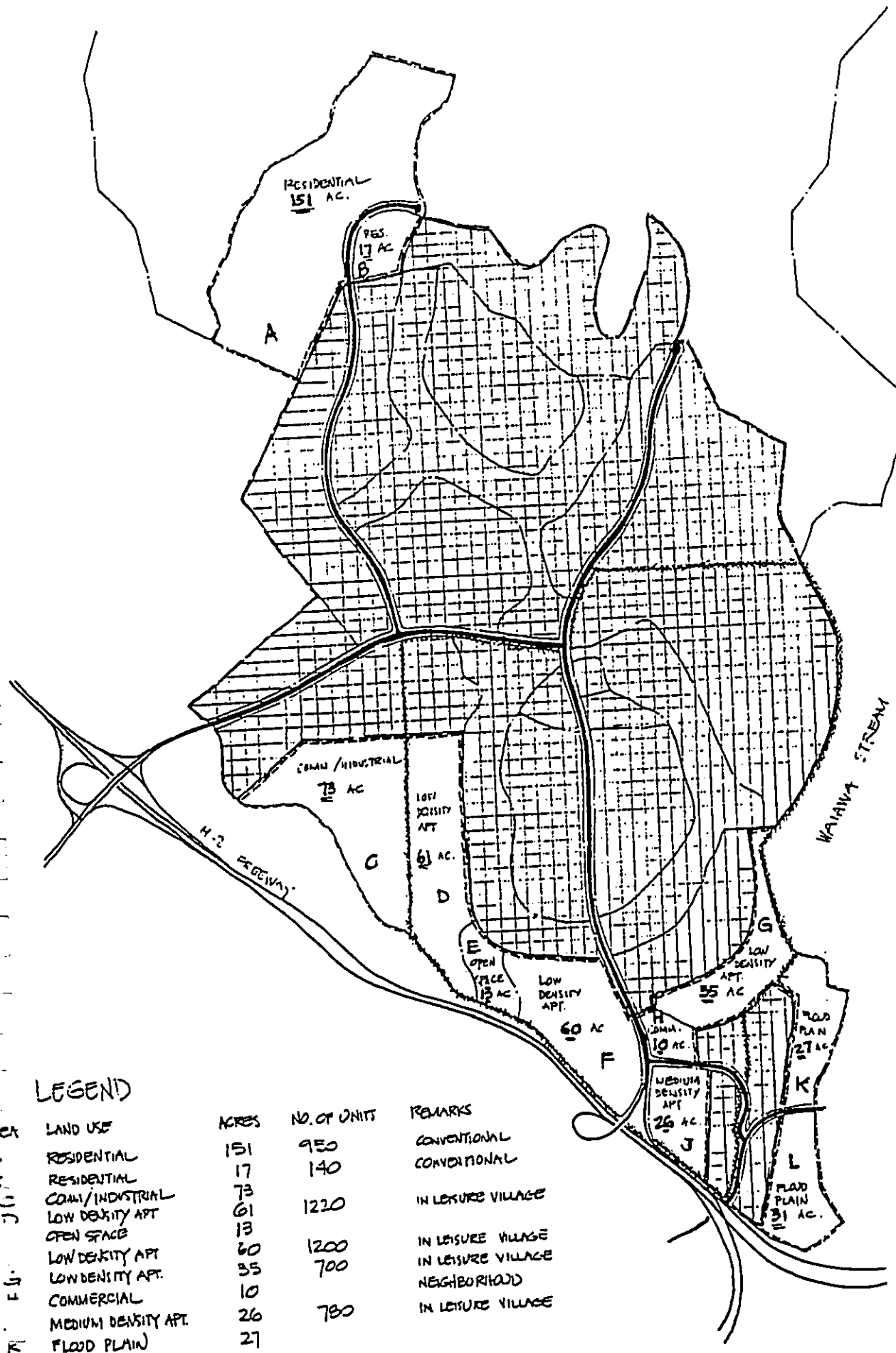
Community Integration:

With the development of the proposed Gentry 515 project changes will occur on the existing community. However, these changes should not be unexpected since changes of a similar nature have already occured with the development of Gentry Waipio and the larger, proposed Gentry Waiawa project. Gentry Waipio introduced totally new components of community into the existing neighborhood with the addition of industrial and commercial development, higher density multi-family housing and the concept of a community providing for its own needs. Similarly, the proposed development will serve as a continuation of these elements and will also provide additional desirable amenities such as additional commercial and industrial areas, open space and the retirement village.

Social impacts occuring as a result of this new development should be positive and enhancing to the existing community's lifestyle and quality of life. The addition of well planned community developments into the area will be beneficial with the improvements and facilities they add but perhaps more significantly, they provide a sense of gravity and continuity which should increase a sense of belonging to a larger total community. The developments of Seaview and Crestview, and to some extent, the Waipahu CDP portion of Waiawa tract, were developed to fulfill housing needs of the time but stopped short of providing all the elements required to establish larger, identifiable communities. Rather, Seaview and Crestview are more appropriately identified as subdivisions separated from the large Pearl City and Waipahu communities.

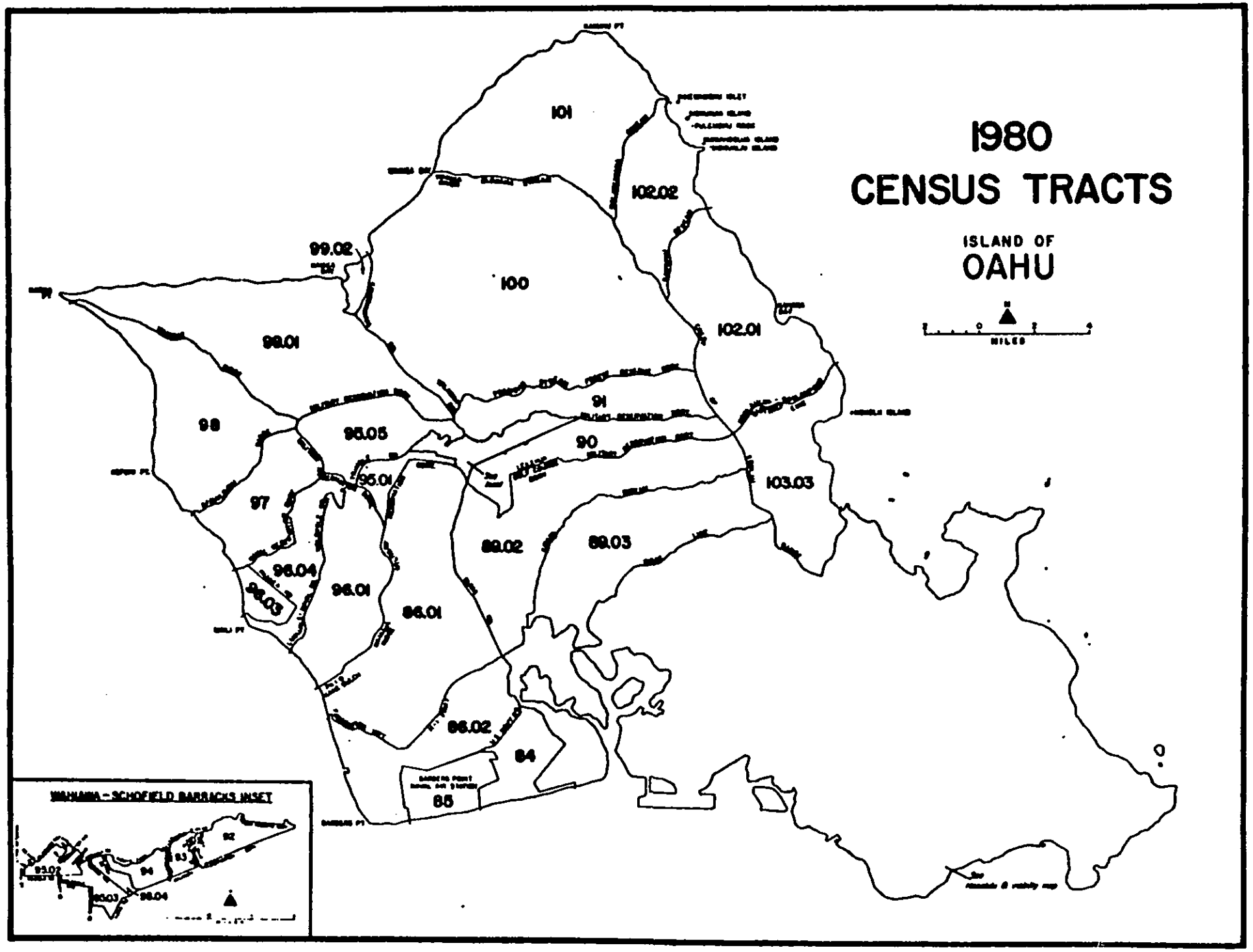
The high rate of home ownership indicates that existing residents have made financial and emotional commitments and are strongly motivated to maintain or enhance their existing lifestyle. With the development of the proposed project, a largely diverse community will be introduced, but a large portion of the mainstream new residents are anticipated to share similar socio-economic characteristics. With similar values and goals, the behavior norms between the existing population and new residents should be consistent.

Evaluated from this context, the proposed Gentry 515 project appears to be socially beneficial to both the existing Waiawa community and the Central Oahu area in general. By providing a diverse and exemplary model of a comprehensive community, the Gentry 515 project should prove to contain the catalyst which will solidify an even larger sense of community with the adjacent Waiawa project and outlying areas. The Gentry 515 project, with its conceptual ties to the larger Gentry Waiawa Development, should be afforded a smooth and complementary transition within the area. In this case, the idea of community gravity should prove to be even greater than the summation of Gentry Waiawa and Gentry 515.



LEGEND

AREA	LAND USE	ACRES	NO. OF UNITS	REMARKS
A	RESIDENTIAL	151	950	CONVENTIONAL
B	RESIDENTIAL	17	140	CONVENTIONAL
C	COMM./INDUSTRIAL	73		
D	LOW DENSITY APT	61	1220	IN LEISURE VILLAGE
E	OPEN SPACE	13		
F	LOW DENSITY APT	60	1200	IN LEISURE VILLAGE
G	LOW DENSITY APT.	35	700	IN LEISURE VILLAGE
H	COMMERCIAL	10		NEIGHBORHOOD
J	MEDIUM DENSITY APT.	26	780	IN LEISURE VILLAGE
K	FLOOD PLAIN	27		
L	FLOOD PLAIN	31		
	TOTAL	504	+190	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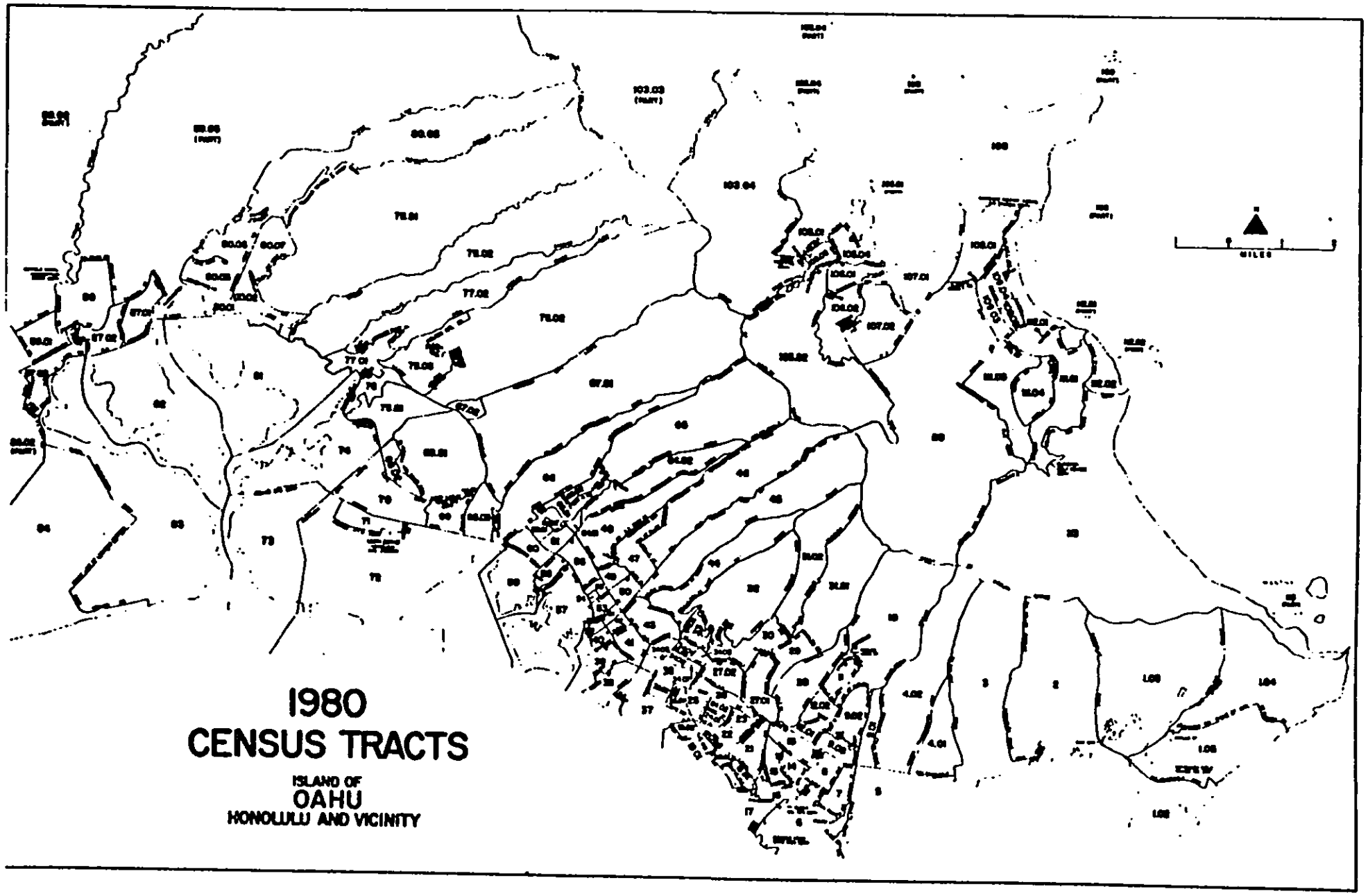
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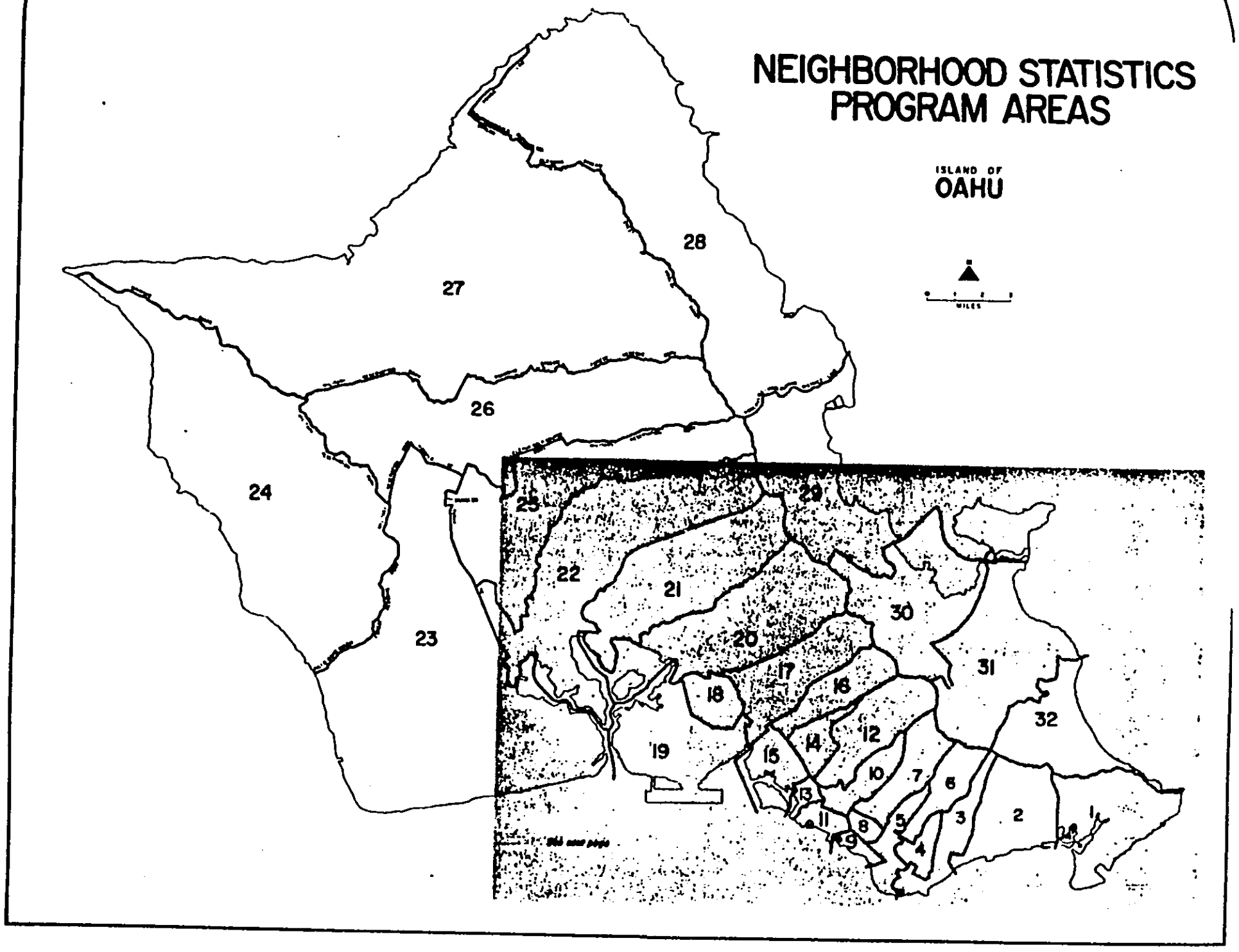

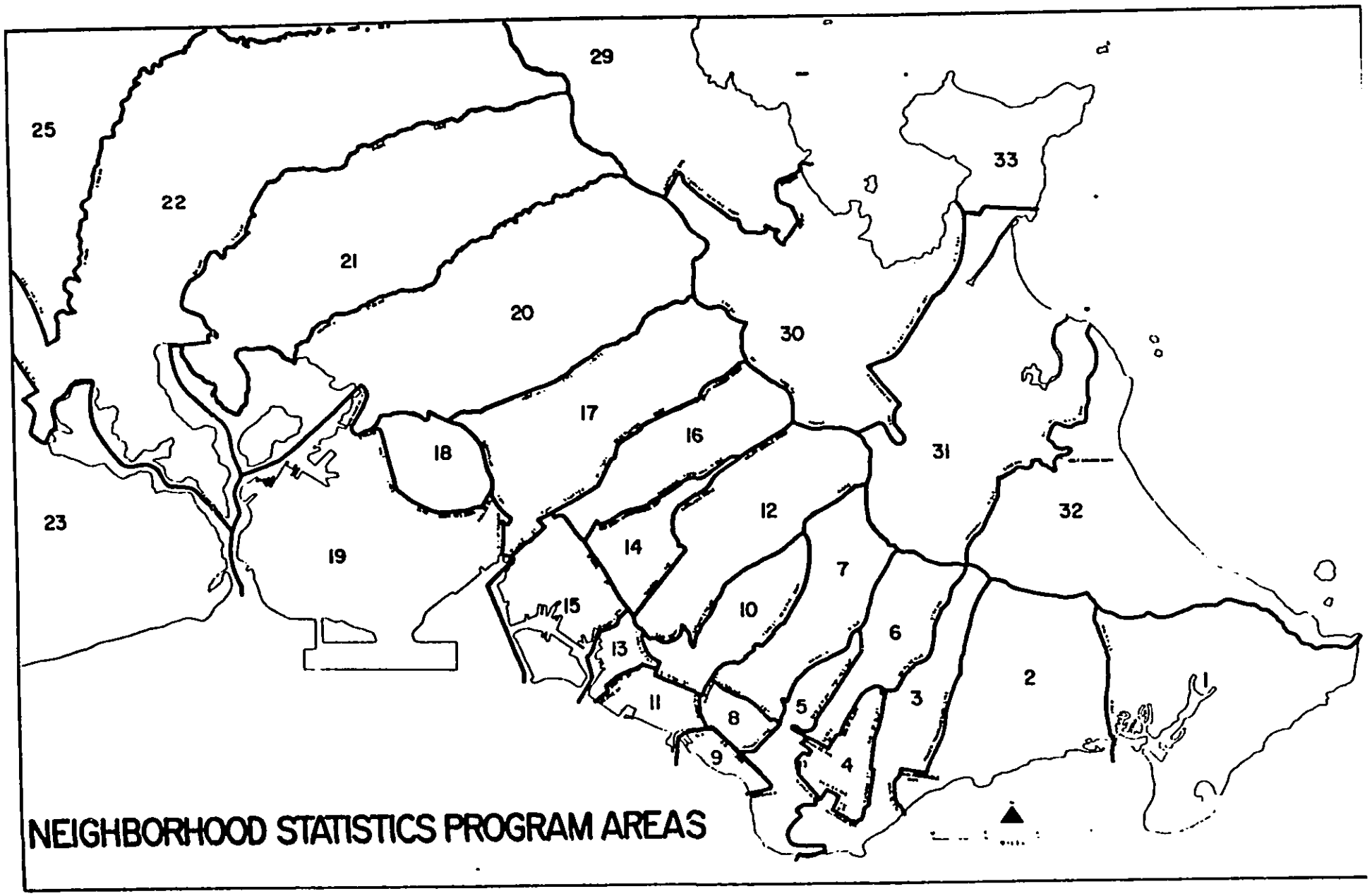

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APPENDIX I

Impact on Agriculture of the Proposed Waiawa Development

January 29, 1987

prepared by

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826 19th Avenue
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for

Environmental Communications, Inc.

Impact on Agriculture of the Proposed Waiawa Development

The proposed Waiawa development involves two parcels totaling 1,757 acres located on the Leeward side of Oahu roughly between the H2 freeway and Pearl City/Pacific Palisades. The lands are currently fallow, but previous to 1982, the land was used for sugarcane production.

The significance of the subject lands as part of the agricultural resources of the State of Hawaii can be evaluated by examining the potential uses of the land. These uses are determined by three sets of factors: (1) the physical, agronomic and environmental characteristics of the land; (2) economic variables such as the existence and location of markets for goods that can be feasibly produced on the land, the cost of inputs required to grow the goods, and the supply of similar products from other sources; and (3) the current and future demand of agricultural producers for land having the physical, environmental, agronomic, and economic characteristics of the subject lands.

A detailed description of the factors affecting the agronomic potential of the subject parcels is given in the accompanying report by Yukio Nakagawa, "The Agricultural Production Potential of the Lands in the Waiawa Revised Development Plan by Gentry -- Island of Oahu." Briefly, the subject parcels consist of fairly flat to gently and moderately sloping terrain ranging in elevation between 100 to 650 feet; the prevailing winds are brisk to gentle, averaging 5 mph from the northeast; the area is exposed to long hours of direct sunlight for the greater portion of the year; and averages between 26 and 43 inches of rain per year depending on elevation. Supplemental irrigation is required for most shallow rooted crops. The location is important in that it is near the major market in the State.

The agricultural potential of the subject lands can be examined in

terms of several different indices of productivity compiled by the State of Hawaii and Federal agencies. The majority of the subject lands, approximately 1,353 acres, are designated "Prime Agricultural Lands" by State of Hawaii Department of Agriculture. Another 202 acres are classified as "Other Important Agricultural Lands" and the remaining 198 acres are not suitable for agriculture.

The "Prime" designation means that the property has all the physical and climatic conditions which permit sustained high yields under economically advantageous operating conditions. Such lands are characterized by high yields with relatively low costs and little risk of damage to the physical environment. The category of "Other Important Lands" exhibits production problems such as flooding, erosion, etc. that require greater production costs, such as more drainage, more fertilizers, etc., and result in reduced yields.

The majority of the prime lands, an estimated 1,100 acres, were given a productivity rating of "A" by the Land Study Bureau. This is the highest rating. The remainder were given a productivity rating of "B". These latter lands were generally the steeper portions (slopes between 11 and 20 percent) of the parcel. These lands are well suited for the production of sugarcane, pineapple, orchards, vegetables, and forage. The crop capability classifications assigned by the Soil Conservation Service range between I to IIIe if the lands are irrigated. These rating imply that the parcel contains soils that range from soils with few limitations to soils subject to severe erosion hazard if not protected. In terms of the proposed Land Evaluation Site Assessment Classification the subject lands have Land Evaluation (LE) ratings ranging between 15 to 96, with approximately half the site receiving a LE rating of 80 or higher (letter from Jack K. Suwa, Chairman, Board of Agriculture to Fred Rodriquez,

Environmental Communications, Inc., June 23, 1986). The LE ratings vary between 12 and 96, the implication being that the higher the rating, the greater the production potential of the parcel.

The LE ratings provide a summary of all the productivity ratings. In fact, the LE rating is a weighted average of five different productivity indices, including the three discussed above. The rating for the Waiawa lands indicate that when irrigated the land has productive potential. However, the production potential varies widely within the parcels. About three-quarters of the site is definitely good land, capable of producing high yields with relatively low costs and little risk of damage to the physical environment if appropriate cultural practices are followed.

The agricultural significance of the subject lands can be examined in terms of the total amount of existing lands of similar quality. The subject lands constitute a very small percentage of such lands. The subject lands are less than 3 percent of the "Prime" lands on Oahu and less than 1 percent of such lands Statewide. The acreage in question appears slightly more significant when viewed as a percentage of the lands currently being used for crop production. Currently 41,600 acres are being used for crop production on Oahu (Table 1.) This would increase by more than 3 percent if the subject lands were to returned to production.

Agricultural lands similar to Waiawa are not scarce. Such lands are found throughout the State. As of 1984, 266,000 acres in Hawaii were used for crop production (including sugarcane and pineapple). This is 58,800 acres less than were used for crop production in 1969. See Table 1. Since 1967, the total acreage used for crop production on Oahu has decreased by 17,700 acres to the current level of 41,600 acres (as of 1984). The data in Table 1 are graphically displayed in Figures 1 and 2.

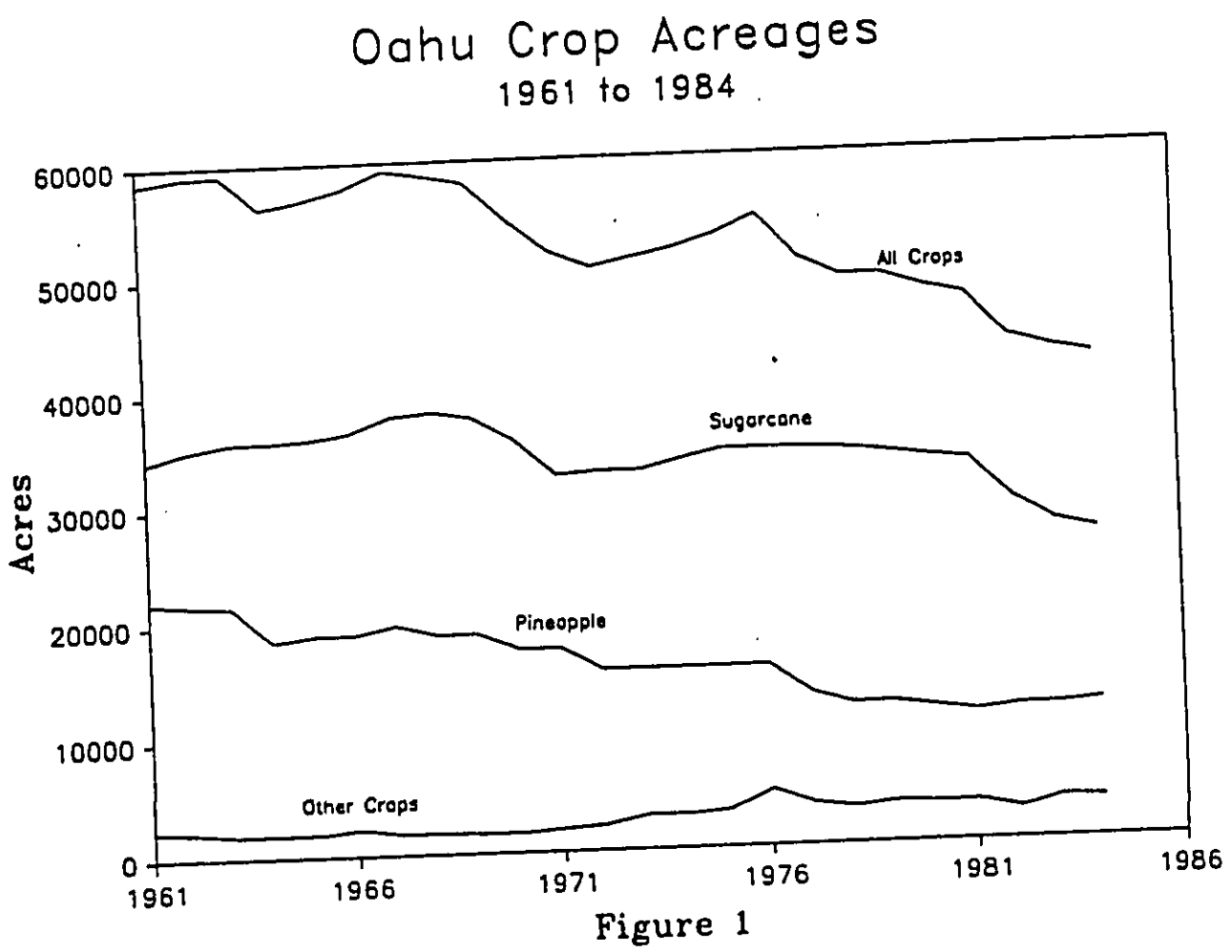

Figure 1

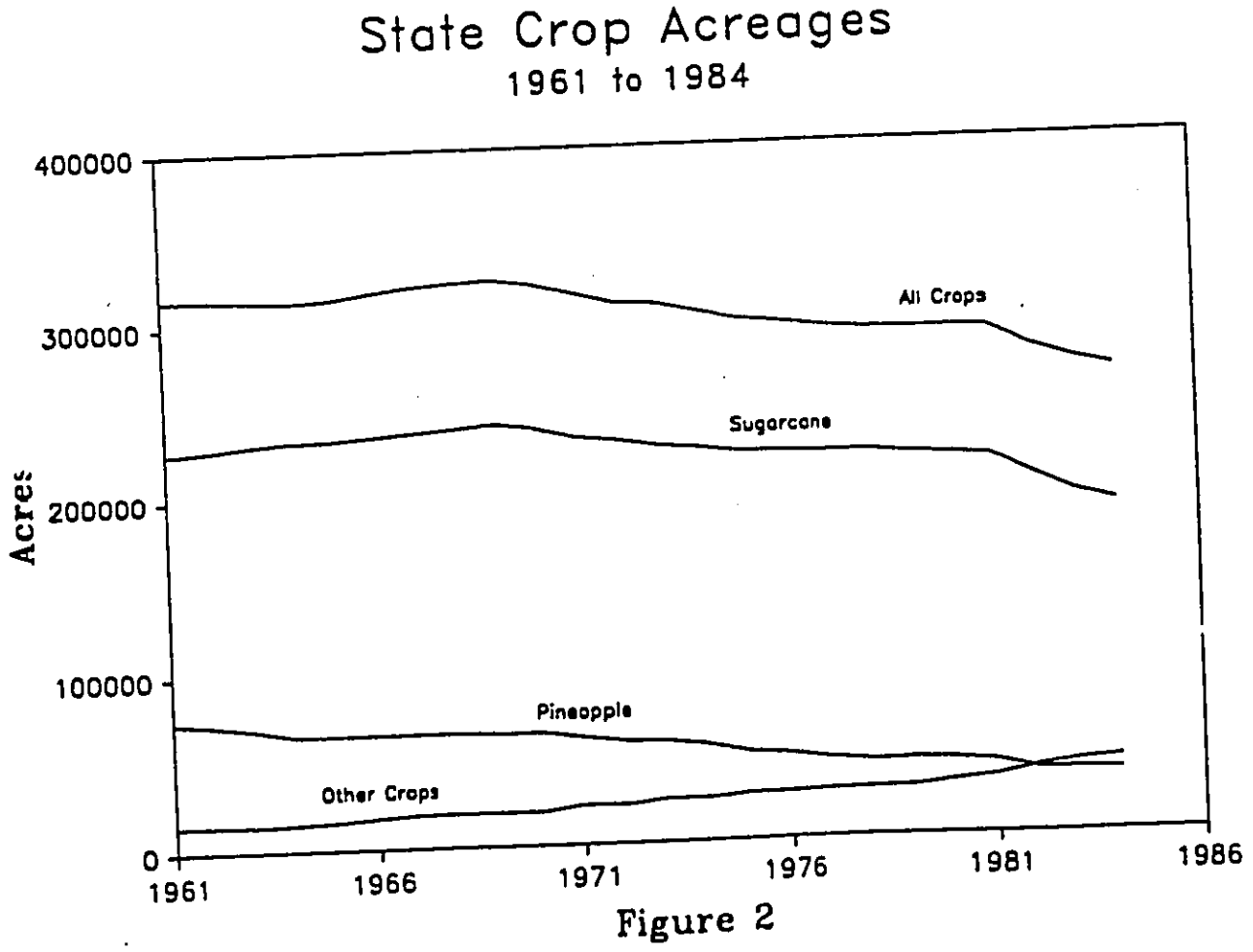

Figure 2

Table 1. Acreage Used for Crop Production in Hawaii and on Oahu, 1961 - 1984 (in thousands of acres)

Year	State				Oahu			
	Sugar-cane	Pine-apple	Other Crops	All Crops	Sugar-cane	Pine-apple	Other Crops	All Crops
1961	227.0	74.0	15.2	316.2	34.2	22.0	2.4	58.6
1962	228.9	72.0	14.9	315.8	35.2	21.7	2.2	59.1
1963	231.3	69.0	14.5	314.8	35.8	21.5	1.9	59.2
1964	233.1	65.0	15.6	313.7	35.8	18.5	1.9	56.2
1965	233.6	65.0	16.4	315.0	36.0	19.0	1.9	56.9
1966	235.4	65.0	18.1	318.5	36.5	19.0	2.3	57.8
1967	237.2	65.0	19.4	321.6	37.8	19.7	1.8	59.3
1968	238.9	65.0	19.5	323.4	38.1	18.8	1.8	58.7
1969	241.4	64.0	19.4	324.8	37.5	18.8	1.7	58.0
1970	237.9	64.0	19.4	321.3	35.5	17.4	1.7	54.6
1971	232.1	60.9	22.9	315.9	32.4	17.4	2.0	51.8
1972	229.6	58.1	22.0	309.7	32.7	15.5	2.2	50.4
1973	226.1	57.5	25.0	308.6	32.7	15.5	3.0	51.2
1974	224.2	55.0	24.4	303.6	33.5	15.5	2.9	51.9
1975	221.4	50.0	26.7	298.1	34.3	15.5	3.2	53.0
1976	221.6	48.0	26.4	296.0	34.3	15.5	4.8	54.6
1977	220.7	45.0	27.4	293.1	34.2	13.0	3.5	50.7
1978	220.7	43.0	27.7	291.4	34.0	12.0	3.1	49.1
1979	218.8	44.0	28.0	290.8	33.6	12.0	3.5	49.1
1980	217.7	43.0	30.7	291.4	33.1	11.5	3.3	47.9
1981	216.1	41.0	33.2	290.3	32.7	11.0	3.4	47.1
1982	204.8	36.0	38.0	278.8	29.2	11.5	2.6	43.3
1983	194.3	36.0	41.2	271.5	27.2	11.5	3.6	42.3
1984	188.4	35.0	42.6	266.0	26.4	11.8	3.4	41.6

Source: Statistics of Hawaiian Agriculture, Hawaii Agricultural Reporting Service, various issues.

Even after subtracting the past conversions of crop land to urban usages and the projected increases in agricultural land use on Oahu in the year 2015 based on the projections in the LESA commission report, there are over 12,000 acres of land suitable for crop production not currently in production on Oahu (see Table 2). If more sugarcane lands become fallow, this number will increase.

Potential Alternative Agricultural Uses

Based on the physical, agronomic, and environmental characteristics of the subject parcel previously discussed, in combination with the history of crop production in Hawaii, the following 24 vegetable crops and 8 fruit and

Table 2. Supply and Availability of Crop Lands

	State	Oahu	Neighbor Islands
Acreage Released from Crops	58,800	17,700	41,100
Converted to Urban Use[1]	6,250	4,350	1,900
Available	53,100	13,350	39,200
Projected Increase in Ag. Demand for Land[2]			
Year			
1990	6,423	-350	6,773
1995	14,089	453	13,636
2000	20,177	643	19,533
2005	26,396	834	25,562
2015	39,241	1,219	38,022

1 Oahu total includes: Mililani 1,800 acres; Waipio Gentry 600 acres; H-2 50 acres; Waikele 500 acres; West Beach 300 acres; Waitec 550; Miscellaneous 550 acres. Sugarcane withdrawals for the Pearl City area were largely compensated for by new plantings and are therefore excluded. State total is an estimate based on urbanization trends on the Neighbor Islands.

2Based on projected production goals in the LESA Commission Report, February 1986. The base year is 1983. The 1990 and 1995 acreages are taken from the LESA report. The data for 2000 to 2015 are based on the rate of increase implicit in Tables 2 and 3 of the LESA report. The increase in acreage reported above includes the projected increase in all agricultural land use (not just crops), except aquaculture. The most promising aquaculture activities are either brackish or saltwater systems, and these are not appropriate uses for good cropland, particularly if the lands overlay freshwater reserves.

nut crops can be considered to have agronomic potential in the Waiawa area: bittermelon, broccoli, bulb onion, cucumbers, daikon, dasheen, edible ginger root, edible podded peas, eggplant, green peppers, green or snap beans, green onions, green peppers, lettuce (semi-head types only), mustard cabbage (Kai Choy), red radish, oriental gourds, potato, pumpkin and winter squashes, summer squash, sweet potatoes, sweet corn, taro (upland varieties), tomatoes, watermelon, avocado, bananas, guavas, limes, yellow passion fruit, macadamia nuts, papaya, and pineapple. Forage, horticulture, and seed production are also agronomically possible. However, agronomic potential (the crop will grow) and economic potential

(the crop can be grown for a profit) are not the same. Some of the crops listed have been tried and found to be unprofitable, either because of high production costs, lack of markets, or the availability of less expensive imports. Also, some of the crops that can be grown in the Waiawa area could be grown elsewhere in the State more profitably.

Waiawa has some advantages in the production of fruit and vegetables relative to other areas in the State. The primary advantage is that it is close to the principal market in Hawaii and to transportation links to overseas markets.

There are factors, however, which limit the economic potential of Waiawa for the production of fruit and vegetables. One is the cost and supply of water. Under existing conditions, the most readily available supply of water is from the Oahu Sugar Company. Given that the cost of water is one the primary cost factors limiting the profitability of sugarcane production of Oahu, it is unlikely that this water would be made available, and if it was available, it would be expensive. There are wells on the property, but these wells are not on the Pearl Harbor Ground Water Control Area permitted use list. Also, the Waiahole ditch passes through the property inland of the proposed development. However, the ditch water is currently being used by Oahu Sugar Company and Castle and Cooke, Inc. Most crops require about 5 acre feet of water per year, although some, such as daikon and perennial crops, require more. Based on the estimated costs of delivering water to lands diverted from sugarcane production, it is estimated that delivery costs alone could exceed 500 dollars an acre and could be more at the higher elevations. The alternative source of water is the City and County of Honolulu. If water were purchased from the City and County under current agricultural rates, 5 acre feet would cost $1,126, and this does not include delivery to the field.

Another set of factors limiting the growth of diversified agriculture relate to the size of the local market and the difficulties the State has experienced in developing crops for export. These factors are discussed below.

Evaluation of Potential Fruit and Vegetable Crops for Waiawa

Crops produced in Hawaii can readily be separated into two groups -- those that are produced for export and those that are produced for local consumption. In terms of crops that have export potential, papaya, guava, passion fruit, macadamia nuts, edible ginger root, and pineapple can all be produced on lands similar to the subject lands. However, pineapple, papaya and edible ginger root are the only ones likely to economically feasible on the subject lands. Papaya production will only be feasible if the problems with mosaic virus can be overcome. Papaya is currently being grown on the Ewa plains near Campbell Industrial Park and on fallowed sugarcane lands in Palehua on a trial basis.

Producers of edible ginger root in Hawaii have been quite successful in marketing their product on the mainland. However, it does not take many acres of ginger to satisfy the existing the market. In 1984, over 5 million pounds were produced on 135 acres, of which an estimated 3.5 to 4 million pounds were marketed overseas. Currently, it would not take many more acres to saturate the mainland market during the season when Hawaii produced ginger is available, and the most likely area for expanded planting is on the Big Island where the great majority of the current production is located.

Pineapple is the most feasible export crop for the subject lands. After twenty years of declining pineapple acreage, plantings began to show a slight increase on Oahu in 1982 (see Figure 1). The increased viability of the pineapple industry has been attributed to several factors, including

increases in efficiency in field operations, declines in foreign competition, and the success the Hawaii industry has achieved in marketing fresh pineapple (First Hawaiian Bank, Economic Indicators). Currently Del Monte is expanding its plantings on Molokai and Dole's production on Lanai is expected to increase as more land is converted to drip irrigation. Increased planting on Oahu, if any, are likely to occur on lands that were once in pineapple, then converted to sugarcane when the industry reduced its acreage during the 1960's and 70's, and are currently out or being taken out of sugar production.

Passion fruit is uneconomical to produce because of the high cost of installing trellises. The market for guava is beginning to grow. However, it is still too soon to recommend increases in commercial planting. Also, any increases in plantings are more likely to occur proximate to existing plantings in order to take advantage of existing processing facilities. Macadamia nuts can be produced more profitably elsewhere in the State. Production in Waiawa would require irrigation and the nuts would have to be shipped off-island for processing or a processing facility would have to be constructed.

Several vegetable crops which are imported in great quantities are not climatically suited for production in Waiawa because they require cool temperatures for good quality and profitable yields. The following crops would be unsuitable for that reason: chinese head cabbage, head cabbage, carrots, cauliflower, celery, head lettuce, romaine lettuce, and during most of the year, potatoes. The good storage, long-day and medium-day length onions are also not suitable because they require longer day lengths for proper growth and curing. The high incidence of insect and disease infestations limit the feasibility of producing summer squash and melons except for zucchini and watermelon.

The fruit and vegetable crops which show some potential for commercial production in the Waiawa area are listed in Table 3. Also given in Table 3 are the quantities of the product or similar products sold in the Honolulu wholesale market in 1985. These quantities provide a crude estimate of the current demand for these products. The estimates are crude because the data for Honolulu are for aggregates of similar products. For example, all types of bulb onions are listed as "dry onions" and both oriental and American types of cucumbers are listed as "cucumbers." These quantities thus will overestimate the demand for local products since local products are not identical to all imports.

The next three columns of Table 3 provide information on market conditions that can be used to estimate the potential demand for increased production of the crops. The third column lists the percentage of the goods sold in the Honolulu market which are supplied from in State sources. When local production already supplies the entire market, any increase in production via additional planting will have two immediate effects: (1) the price of the product will fall, making it less profitable or unprofitable to produce; and (2) production elsewhere in the State will decline. That is, there will be a shift in production patterns from regions currently producing the crop to new regions. The total impact of the new planting would be a decrease in the profitability of existing operations and a resulting reduction in scale and a shift in production to the new plantings. The following crops listed in Table 3 fall into this category: eggplant (long), green or snap beans, semi-head lettuce, daikon, dasheen, ginger root (edible), oriental squash, radishes, bittermelon, and cabbage (kai choy).

TABLE 3
Agronomically Feasible Crops

Crop	Honolulu Demand (1,000 pounds)	Percent of Demand Met by Local Production	Maximum Percent of Monthly Local Demand Met by Local Products	Number of Months When Local Products Exceeds 70% of the Market
Crops for the Local Market				
Avocados	1,684	59	77	2
Bananas: Apple	616	100	100	12
Bluefield	91	100	100	12
Chinese	14,505	25	43	0
Beans, Green	804	86	100	9
Bittermelon	97	96	100	11
Broccoli	4,447	8	16	0
Cabbage, Kai Choy	768	96	100	11
Corn, Sweet	485	29	100	4
Cucumbers	3,715	57	87	6
Daikon	1,488	97	100	12
Dasheens	163	94	100	10
Eggplant: Long	496	99	100	12
Round	384	71	92	8
Lettuce, Semi-head	1,321	100	100	12
Limes	554	6	19	0
Onions: Dry	13,007	5	16	0
Green	829	77	92	8
Peas, Chinese	303	5	18	0
Peppers, Sweet	2,540	37	64	0
Potatos, Table	20,941	0	1	0
Pumpkins	1,128	10	100	5
Radishes	178	98	100	12
Squash: Oriental	465	84	100	12
Italian	1,806	47	89	3
Sweetpotatoes	1,804	67	96	6
Taro	1,197	15	23	0
Tomatoes	13,356	29	47	0
Watermelon	9,546	78	99	7
Crops for Local and Export Markets				
Ginger Root	1,348	80	100	8
Pineapples	34,130	100	100	12
Papayas	10,579	100	100	12

Source: Honolulu Arrivals: Fresh Fruits and Vegetables, 1985, Market News Service, Hawaii State Department of Agriculture, April 1986.

For several crops, the impact of new plantings will be similar to the above scenario even if local production is not currently satisfying the local market. For example, crops like tomatoes and some types of cucumbers can only be produced for a profit if they are marketed in the "off-season" when less expensive imports from the mainland and Mexico are not available. Other crops can only be economically produced during certain times of the year. The demand for some products is seasonal also. One example would be pumpkins. Local production satisfies the market except in the month of October. The orange gourds used for Jack-O-Lanterns are different from the pumpkins produced locally and the demand for these is met almost entirely by imports.

An indication of the seasonality of crops and potential demand for new plantings can be obtained by examining the market supply of local production relative to imports on a monthly basis. The fourth column of Table 3 gives the percentage of supply in Honolulu of the aggregate product group during the month when local production represents the largest percentage of supply, and the fifth column gives the number of months when local supply exceeds 70 percent of total market supply in Honolulu. Whenever local supply is greater than about 70 percent of market demand, any increase in supply from local sources can be expected to affect prices downward. Whenever local production or demand is seasonal and current production provides over seventy percent of demand for some months this is an indication that increases in local production will start to depress prices. This price decrease will make the new planting a less attractive enterprise and reduce the earning for all plantings of the crop -- both the existing and new plantings. Sweet potatoes, green onions, pumpkins, and avocados are crops which are currently imported in significant quantities. However, increases in planting of these crops would be expected to depress

market prices.

The three crops listed in Table 3 with the largest demands in the Honolulu market are tomatoes, dry onions, and potatoes. Most of the demand for these products is currently met by imports. This, however, does not necessarily imply that there is a substantial potential for expanded local production of these products. Potato production has been tried on Oahu and found to be unprofitable and thus this is not a likely crop for future expansion.

The demand datum listed for dry onions includes several different varieties of onions. Most of the onions currently imported are the medium and long day varieties and are priced below what it would cost to produce bulb onions in Hawaii. The demand for locally produced onions, which must have a higher price in order to be profitable, is limited. The potential for increased acreages of bulb onions is therefore limited.

Tomatoes can be a very profitable crop when marketed during the times when imports from the mainland and Mexico are scarce. However, when imports are plentiful and cheap, it is difficult to produce them competitively in Hawaii. Thus, there is some room for expansion in the production of tomatoes. However, the crop would have to be managed so as to produce during the late fall and winter. This is not the best agronomic time to grow tomatoes in Hawaii so yields will be low.

The crops for which there is a potential demand for increased acreage and which can be produced in a region with the physical, agronomic, and climatic characteristics of Waiawa are listed in Table 4. The second column gives the amount of additional acreage required to meet the entire Honolulu demand for the broad product group. However, for the reasons stated above, meeting such demand is not likely to be economically viable. The figures in the third column take into account the mix of products

contained within each product group, the seasonality of local production and demand, and the availability of low-priced competing products from sources outside the State during portions of the year. These numbers represent estimates of the number of acres that could be planted to the respective crop without significantly depressing prices in the local market.

Table 4. Feasible Crops for Expanded Plantings

Crop	Number of Acres Required to Meet 100 Percent of Honolulu Demand for Product Group	Number of Acres of New Plantings Estimated to be Economically Feasible
Avocados	116	0
Bananas, Chinese	543	398
Broccoli	185	80
Cucumbers	32	17
Eggplant, Round	4	1
Limes	54	43
Onions, Bulb	475	5
Onions, Green	7	1
Peas, Chinese	22	17
Peppers, Sweet	53	36
Potatoes, Table	1,632	0
Squash, Italian	38	24
Sweetpotatoes	22	9
Taro	83	10
Tomatoes	187	20
Watermelons	106	106
Total		766
Total net of bananas		368

The potential acreage for taro was reduced since the apparent market demand is for wetland and dryland types and only the dryland types are feasible on the Waiawa lands. Currently, there is little or no potential for expanded avocado production. Supplies on the mainland have increased dramatically and prices have declined drastically. Also, the U.S.D.A. animal and plant health inspection service (APHIS) no longer permits the export of Hawaii produced-avocados to Alaska.

From the viewpoint of the market, there is definitely a potential for increased production of bananas in the State. However, there are better places to produce bananas than Waiawa. Banana production in areas such as Waiawa would require irrigation. Production costs would be substantially less in areas such as Waimanalo (Oahu), the Puna and Hilo regions of the Big Island, and on parts of Kauai. Excluding bananas, the total potential demand for new plantings of crops suitable for lands similar to those in Waiawa is 368 acres.

Lands such as Waiawa, however, are not only suitable for the production of fruits and vegetables. They also could be used for the production of floral and nursery products, the production of seed, the production of forage crops and livestock uses.

Floral and Nursery Products

The floral and nursery industry in Hawaii has been expanding rapidly during the recent years. This industry, however, produces a large volume of highly valued products from a very small land area and does not require large acreages. The average size of all floral and nursery operations in the State is under three acres. For these crops, climate is typically more important in choosing a site than land quality. Current expansion of this industry is limited only by market availability and management capability, not by the availability of land. Also, several of the Agricultural Parks being developed make specific provisions for nurseries.

Seed Production

Lands such as Waiawa are suitable for the production of seed for crops such as corn if adequate irrigation water is available. The demand for land for the production of seed corn and other seeds tends to fluctuate depending on climatic conditions elsewhere in the world. It is difficult to plan on a long term demand for such a use and it appears that sufficient

lands are available to meet current levels of demand.

Forage Crop Production

Large amounts of grains are imported into the State as livestock feeds. The production of feed grains has not proven to be economically viable in Hawaii. However, the production of forage crops for green chop has potential. Corn for green chop has been produced on the North Shore of Oahu. The principal potential market for the green chop and other forage crops on Oahu is the dairy industry. However, if forage could be produced cheaply enough, the feedlot in Campbell Industrial Park is also a potential user.

The level and nearly level portions of lands such as Waiawa are well-suited for the production of forage crops if sufficient amounts of low-cost water are available. However, the production of forage for green chop on Waiawa is not likely to be an economically viable activity because of its location. Due to the fact that forage for green chop is a very bulky product and thus expensive to transport, most commercial forage operations are on lands adjacent to the place where it will be used. The current and potential users of green chop are the feedlot at Barber's Point and the dairies in Waianae and on the North Shore. Both the dairies and the feedlot are located too far from Waiawa to make Waiawa a viable location for forage production.

Livestock

The fields in Waiawa could be used for the production of livestock. The production of swine and poultry, however, do not require large acreages and would not be limited if the Waiawa lands were not available. The lands could also be used for grazing. In fact, some of the upper portions are currently fenced for grazing. However, grazing is a very extensive use of land and returns per acre are very low. The beef industry in Hawaii has

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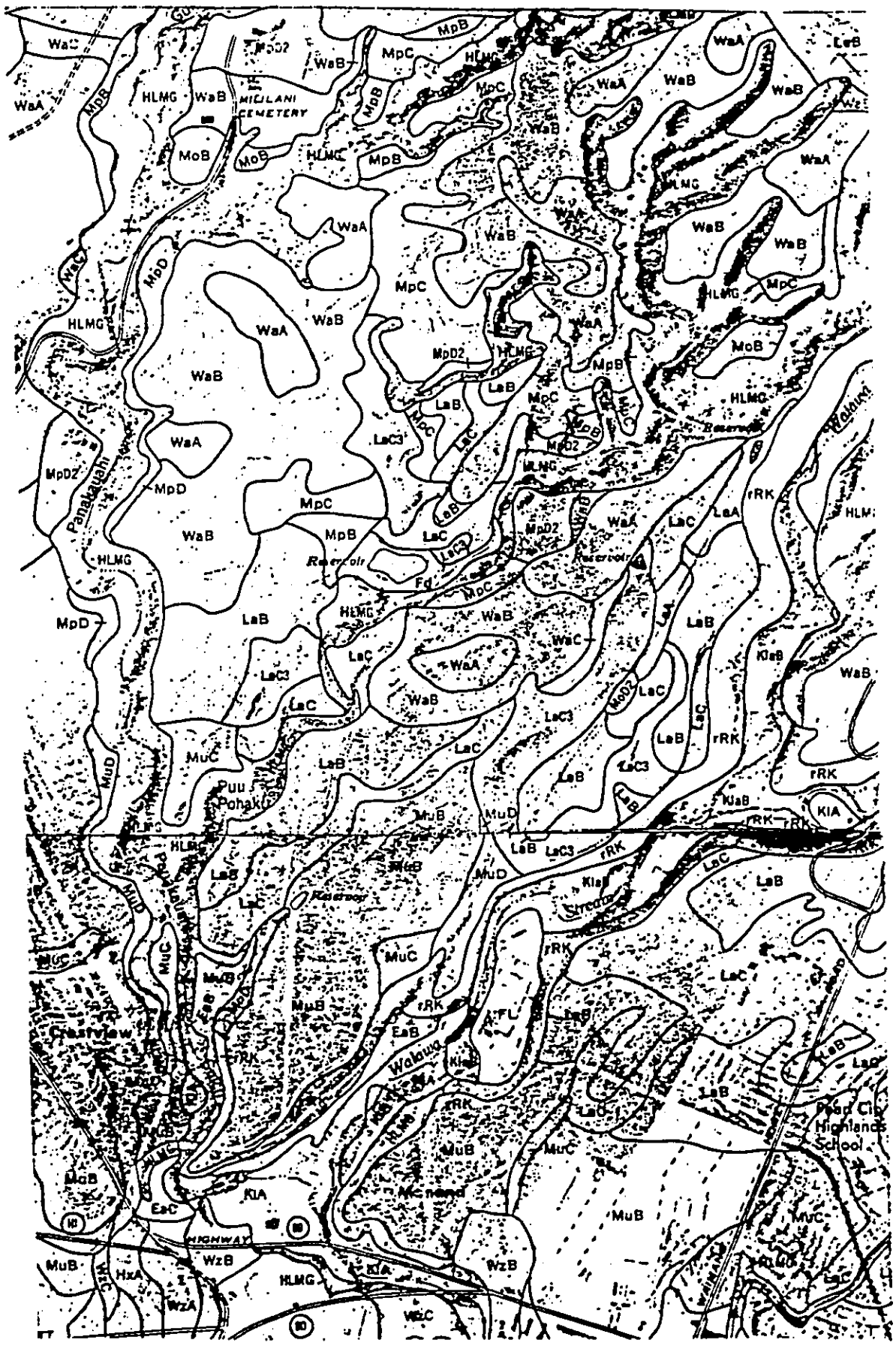
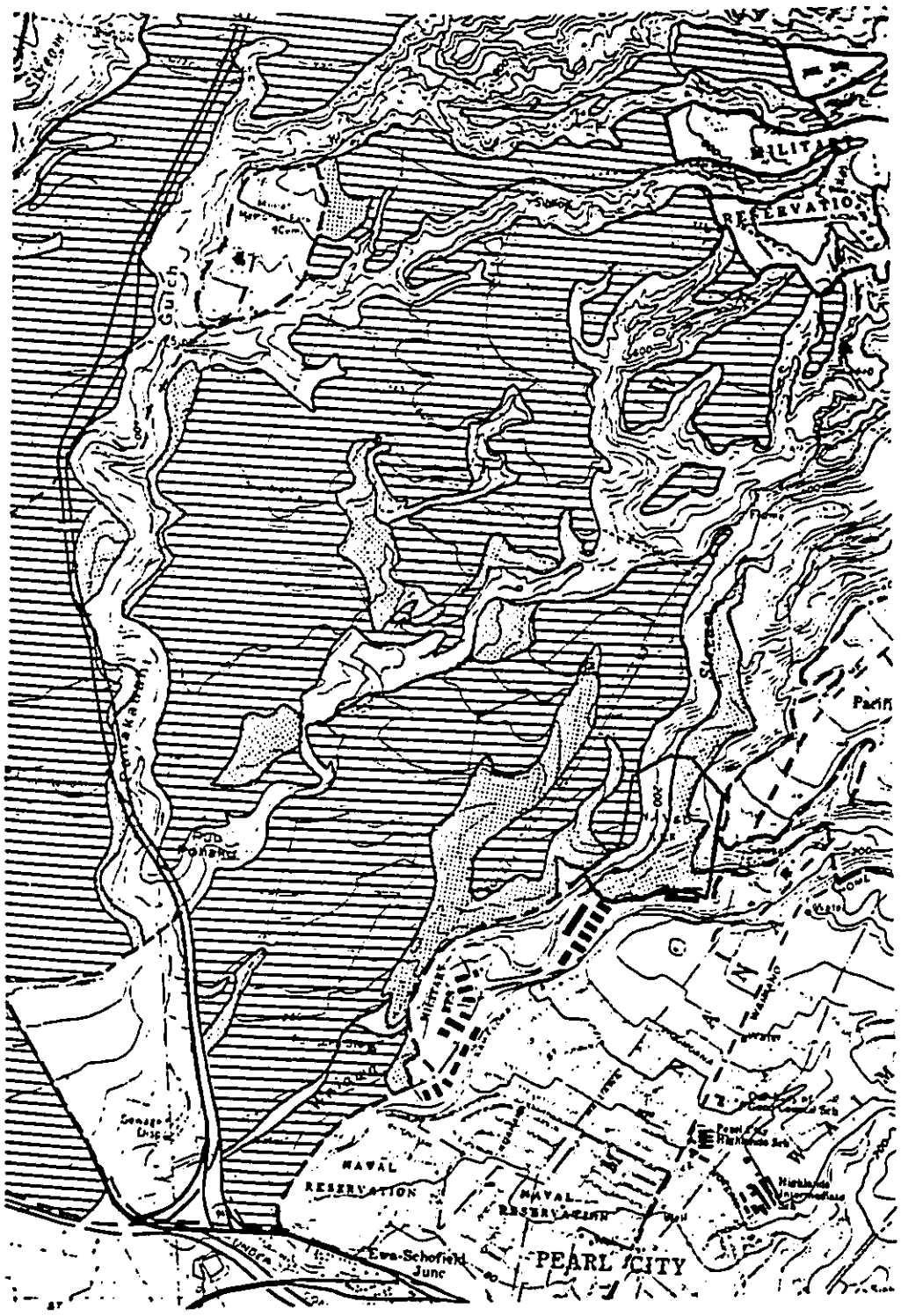
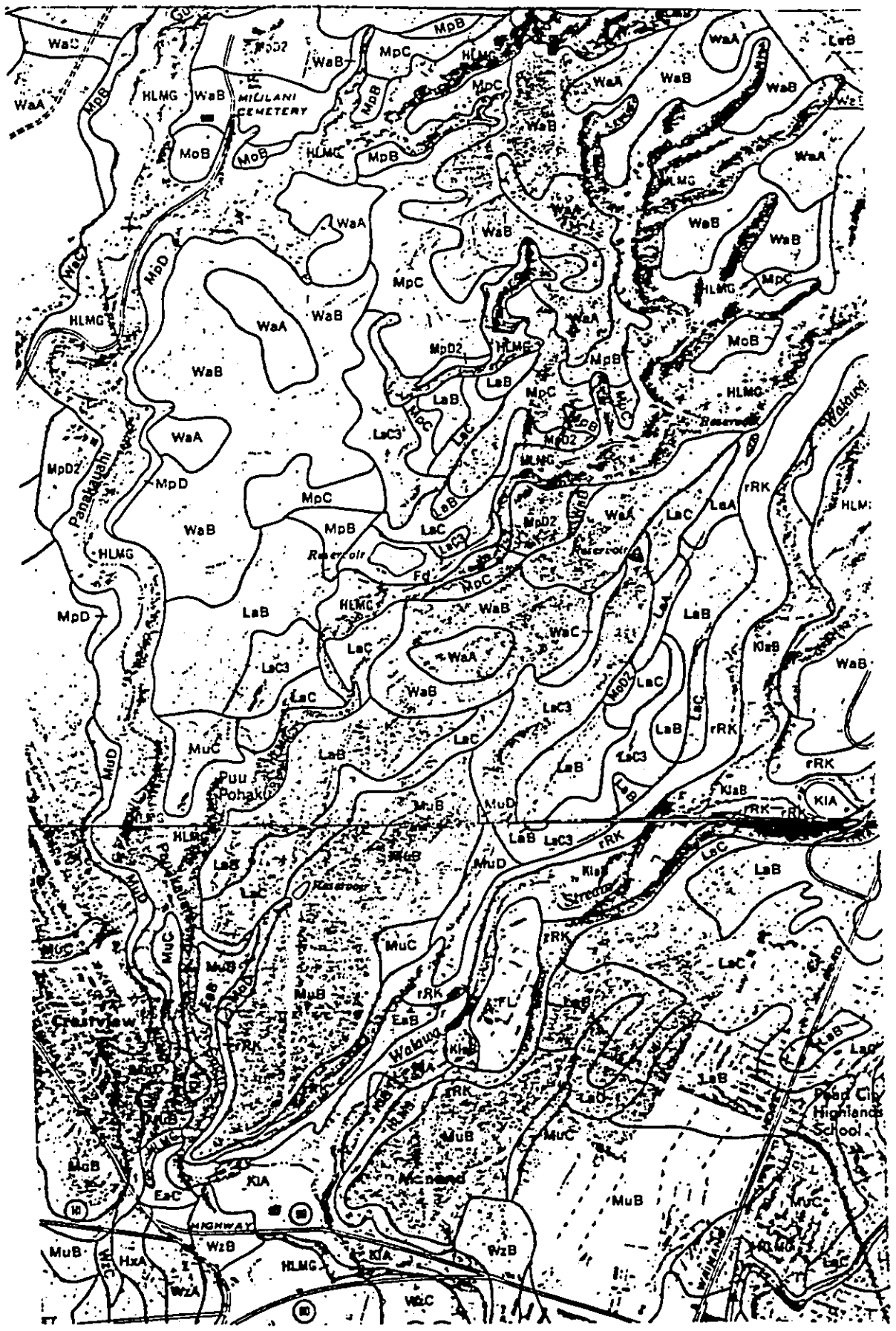


Soil Map of the Project Area

ALISH Classifications in the Project Area



▥ = Prime Agricultural Lands
▨ = Other Important Agricultural Lands
Blank = Unclassified



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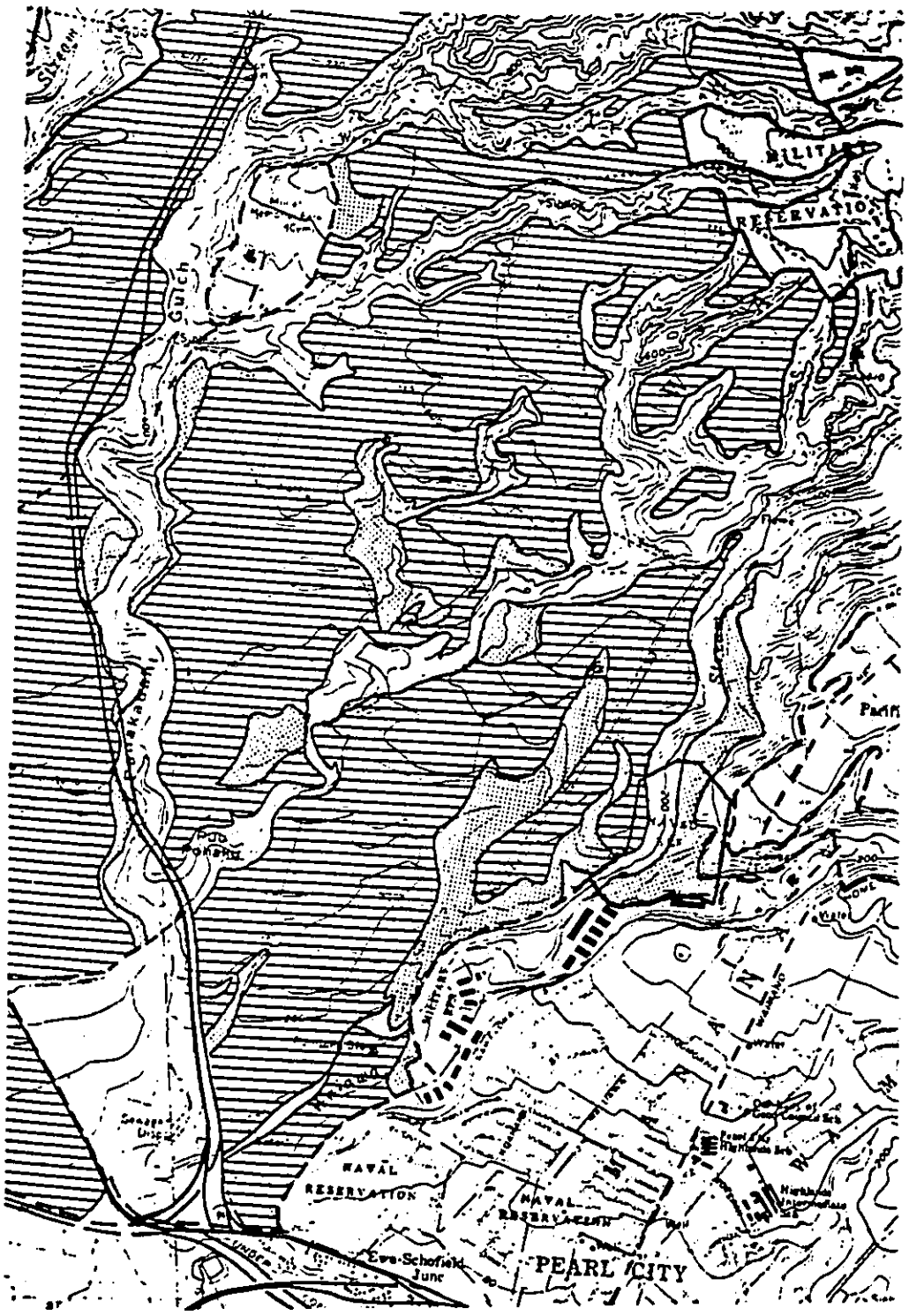

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