DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4414 • FAX: (808) 527-6743 • INTERNET: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

ERIC G. CRISPIN, AIA
DIRECTOR

BARBARA KIM STANTON
DEPUTY DIRECTOR

RECEIVED
'03 SEP -5 A9:52
OFC. OF ENVIRONMENTAL QUALITY CONTROL

2002/ED-11 (TH)

September 2, 2003

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
Leiopapa A Kamehameha Building
235 South Beretania Street, Room 702
Honolulu, Hawaii 96813-2437

Dear Ms. Salmonson:

Acceptance Notice for the Final Environmental Impact Statement
for the Gentry Ewa Makai (Residential Development) Project,
Tax Map Key: 9-1-069: 005 and 9-1-010: 007 Ewa, Oahu, Hawaii

We are notifying you of our acceptance of the subject Final Environmental Impact Statement (FEIS) for the Gentry Ewa Makai (Residential Development) Project. The Department of Planning and Permitting has determined that the subject FEIS is acceptable under the procedures established in Chapter 343 of the Hawaii Revised Statutes.

Pursuant to the procedures contained in Section 11-200-23(c), Chapter 200, Title 11 (Environmental Impact Statement Rules), Department of Health Administrative Rules, we request that this acceptance notice be published in the September 23, 2003 Environmental Notice.

Attached is a copy of our acceptance report. Should you have any questions, please contact Tim Hata of our staff at 527-6070.

Sincerely yours,

Eric G. Crispin

ERIC G. CRISPIN, AIA
Director of Planning and Permitting

EGC:js
236955
Attachment
cc: Ms. Debra Luning, Gentry Investment Properties
Mr. Taeyong Kim, Environmental Communications
The Estate of James Campbell

2003- Oahu- FEIS-
Gentry Ewa Makai

FINAL ENVIRONMENTAL IMPACT STATEMENT
GENTRY ‘EWA MAKAI
‘EWA, O‘AHU, HAWAI‘I

July 2003

GENTRY
Gentry Investment Properties

FINAL ENVIRONMENTAL IMPACT STATEMENT
GENTRY ʻEWA MAKAI
ʻEWA, OʻAHU, HAWAIʻI

Accepting Authority:

City and County of Honolulu
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, Hawaiʻi 96813

Applicant:

Gentry Investment Properties
P.O. Box 295
Honolulu, Hawaiʻi 96809-0295

EIS Consultant:

Environmental Communications, Inc.
1188 Bishop Street, Suite 2210
Honolulu, Hawaiʻi 96813

This Environmental Impact Statement and all ancillary documents were prepared under my direction or supervision, and the information submitted, to the best of my knowledge, fully addresses EIS content requirements as set forth in Section 11-200-17, Hawaiʻi Administrative Rules.

Taeyong M. Kim
Principal
Environmental Communications, Inc.

Date

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1.0 INTRODUCTION AND SUMMARY

1.0 INTRODUCTION

'Ewa by Gentry is a 1,000 acre planned community of approximately 7,200 homes. More than 5,300 units have been completed thus far and are occupied. Gentry Investment Properties is seeking favorable consideration from the State Land Use Commission for a boundary map amendment from Agriculture to Urban, and for appropriate zoning from the Department of Planning and Permitting, for two separate parcels that represent the balance of the 'Ewa by Gentry Master Plan.

1.1 Project Summary

Applicant:	Gentry Investment Properties P.O. Box 295 Honolulu, Hawai'i 96809-0295
Consultant:	Environmental Communications, Inc. 1188 Bishop Street, Suite 2210 Honolulu, Hawai'i 96813
Approving Agencies:	Zone Change (Chapter 343 HRS required document) City & County of Honolulu Department of Planning & Permitting 650 South King Street, 7th Floor Honolulu, Hawai'i 96813
Landowner:	The Estate of James Campbell
Tax Map Keys/Location:	1-9-1-069: 005 (167.997 acres) 1-9-1-010: 007 (114.617 acres) 'Ewa District, O'ahu, Hawai'i
Project Area:	282.669 acres
Existing Use:	Vacant fallowed lands formerly used for sugar cane production. Portions are presently used for minor grazing activity.
State Land Use District:	Agricultural District
'Ewa Development Plan:	Low and Medium Density Residential Industrial Parks and Golf Courses Agricultural and Preservation

City and County of Honolulu Zoning:	'Ewa Makai-East	AG-1 Restricted Agriculture
	'Ewa Makai-West	AG-2 General Agriculture

1.2 Purpose of this Document

~~This document is prepared as an exhibit to the State Land Use Boundary Amendment Petition which requests a reclassification from Agriculture to Urban designation of approximately 283 acres of Campbell Estate lands lying adjacent to and makai of the existing 'Ewa by Gentry for urban mixed use development. The subject boundary amendment request represents the second increment of the 'Ewa by Gentry Master Plan accepted by the State Land Use Commission (SLUC) in 1993. The document is prepared in accordance to City and County of Honolulu zoning regulations that requires the preparation of a Chapter 343, Hawai'i Revised Statutes compliant environmental document.~~ *The Ewa Development Plan states that projects involving a significant zone change are required to submit an Environmental Assessment [to the City Department of Planning and Permitting] to determine whether the project involves a significant environmental effect and if the project is supportive of the vision for Ewa's development. This Environmental Impact Statement has been prepared in response to the Ewa Development Plan requirement, and has been prepared in conformance with procedures for Chapter 343, Hawaii Revised Statutes, and Hawaii Administrative Rules, Title 11, Chapter 200, Environmental Impact Statement Rules.*

1.3 Ownership

Tax Map Keys for the subject parcels are: 9-1-69: 005 (168.052 acres) and 9-1-10: 7 (114.617 acres). Together, these parcels represent a total of 282.669 acres (Figure 1). The subject parcels were formerly operated by O'ahu Sugar Co. (OSCO) under lease from the Estate of James Campbell. The property is owned by the Estate of James Campbell.

1.4 Need for Proposed Action

The 'Ewa by Gentry Master Planned Community is planned and phased as a large scale, complete community that requires development incrementally to suit market demand and community needs. The Gentry 'Ewa Makai project represents the final increment of the 'Ewa by Gentry Master Plan. The proposed boundary reclassification is initiated at this time by a declining inventory of available land for the development of housing units and the need for the pubic and community facility opportunities that will be created by the implementation of the final 'Ewa by Gentry phase.

1.5 Location and Description of Property

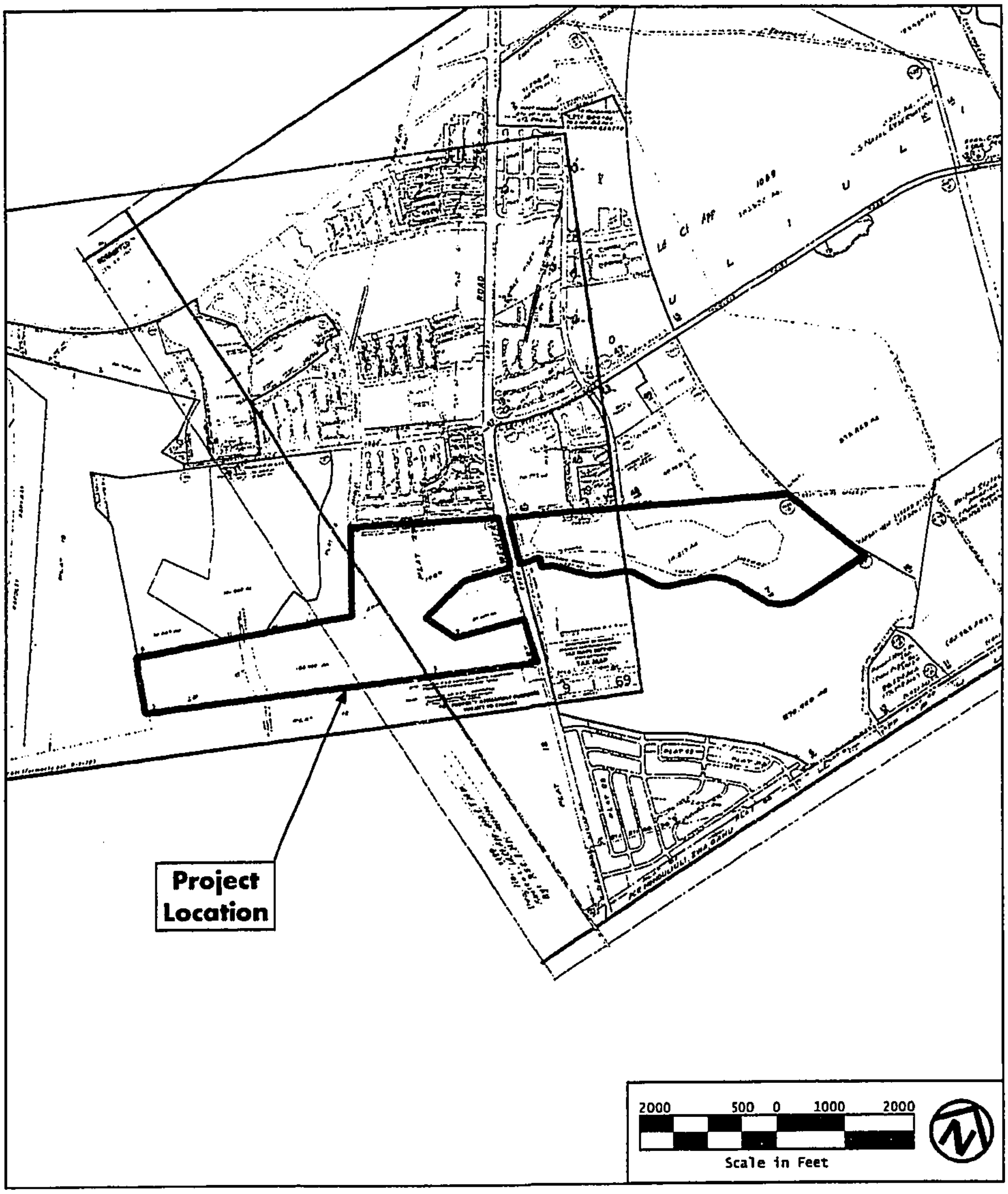
The subject project is located on two parcels of land located on opposite sides of Fort Weaver Road in 'Ewa, O'ahu, Hawai'i. The proposed project is contiguous to existing developed urban-residential lands. The project also represents the final increment of development along the Fort Weaver Road corridor mauka of the adjacent Ocean Pointe development (Figures 2 and 3).

The western portion of the Gentry 'Ewa Makai lands consists of approximately 168 acres. The tax map key for this parcel is 1-9-1-069: 005. This parcel lies between 'Ewa by Gentry's Sun Terra residential development, the proposed Areas 17 and 14, as well as a portion of the Coral Creek Golf Course to the north, and the Ocean Pointe Community to the south. The former Barbers Point Naval Air Station Hawai'i, now known as Kalaeloa, is located to the west, while Fort Weaver Road serves as the eastern parcel boundary.

The eastern parcel of the proposed development consists of approximately 115 acres. The tax map key for this parcel is 1-9-1-010: 007. 'Ewa by Gentry's Areas 19 and 20 lie to the north of this parcel while The Hawai'i Prince Golf Course bounds the southern side of the parcel. Fort Weaver Road serves as the western boundary while open, vacant lands are located to east of this parcel. This eastern boundary is determined by U.S. Navy Explosive Safety Quantity Distance boundary (ESQD) which is in effect around the Pearl Harbor West Loch. This area consists of open space that will remain undeveloped for the foreseeable future.

1.6 Surrounding Land Uses

As previously stated, the Gentry 'Ewa Makai represents an urban infill project that will serve as the final component of the 'Ewa by Gentry master plan community. It will serve as an integral link between the existing Gentry developments to the north, and other planned developments and 'Ewa Beach town to the south.

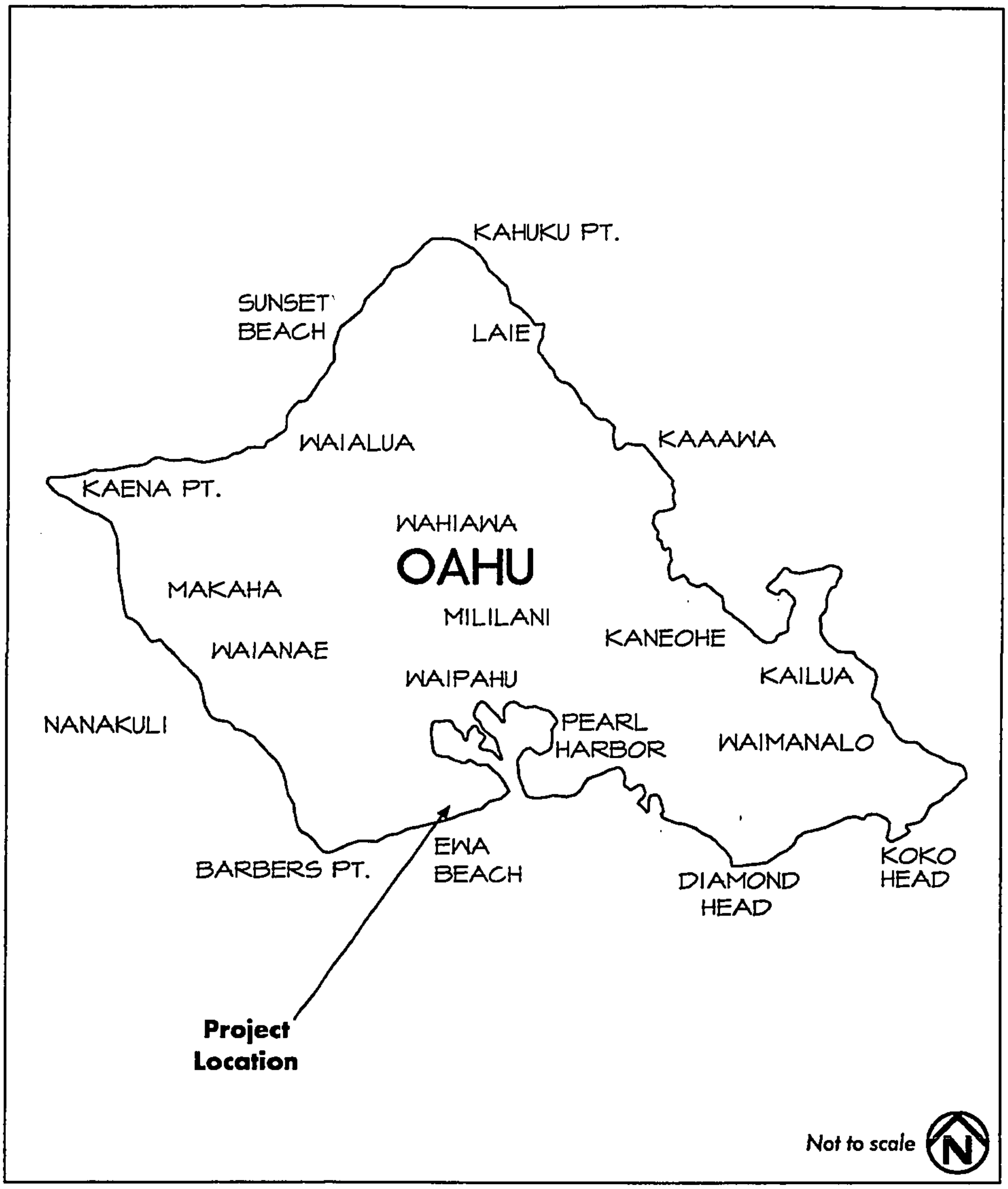


Gentry 'Ewa Makai

Tax Map

Prepared by: Environmental Communications, Inc.
Source: City and County of Honolulu

Figure 1
Page 1-5

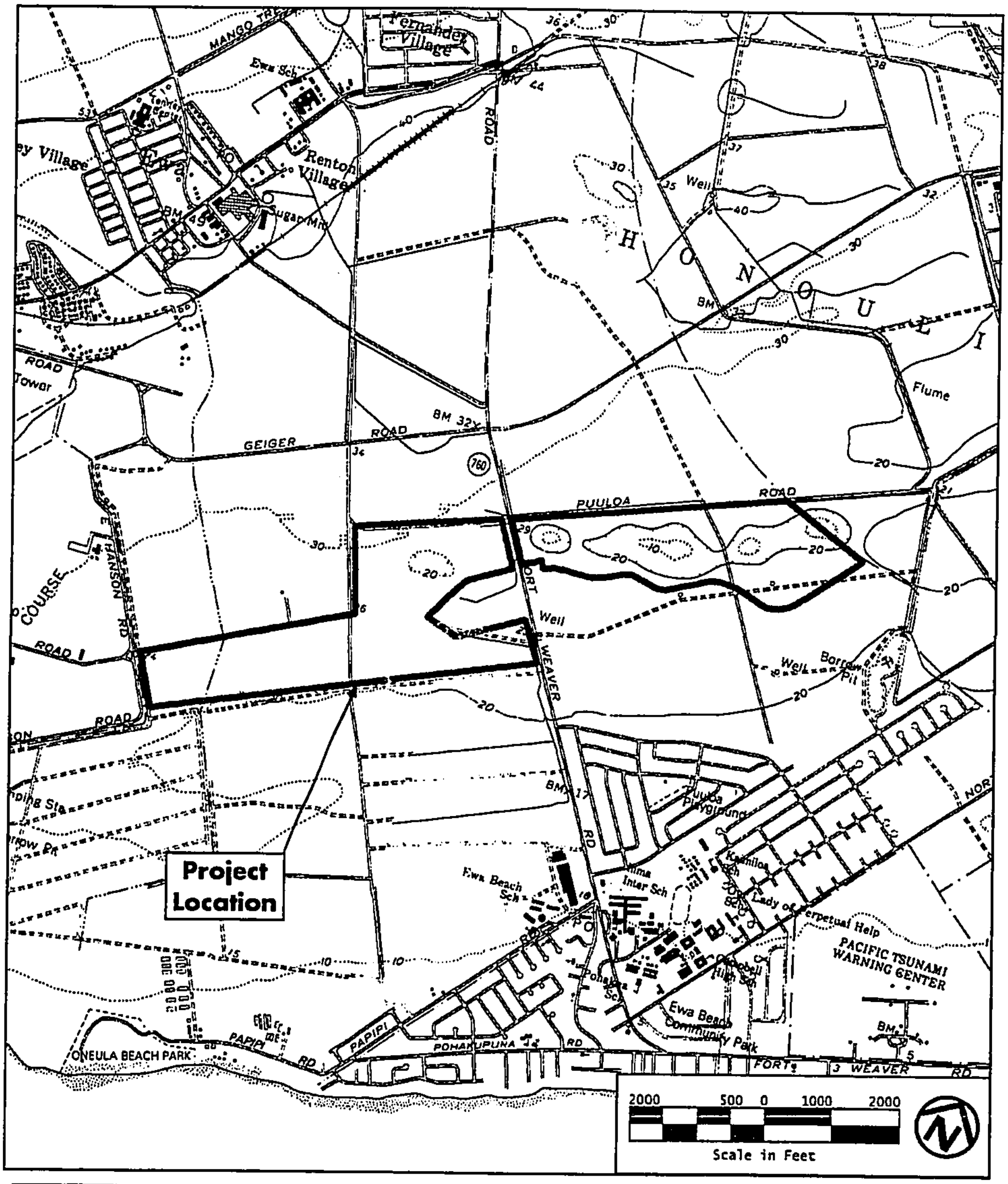


Gentry 'Ewa Makai

Vicinity Map

Prepared by: Environmental Communications, Inc.
Source: Environmental Communications, Inc.

Figure 2
Page 1-6



Gentry 'Ewa Makai

Location Map

Prepared by: Environmental Communications, Inc.
Source: U.S. Geological Survey

Figure 3
Page 1-7

This page left blank

2.0 PROJECT DESCRIPTION

2.0 PROJECT DESCRIPTION

2.1 Need for Project

City & County Ordinance 97-49 states in section 2.2.6 Master Planned Residential Communities that "a network of master planned residential communities will provide a wide variety of housing and accommodate the need for affordable housing. Master Plans will guide new developments in the City of Kapolei, East Kapolei, 'Ewa by Gentry, 'Ewa Marina, Ko Olina, Laulani, Makaiwa Hills, and the Villages of Kapolei and the rehabilitation of existing structures and development of new housing in 'Ewa Villages. These master plans will incorporate planning principles and guidelines to preserve historic and cultural values, establish open space and greenway networks, and create well designed, livable communities."

The proposed second phase of the 'Ewa by Gentry Master Plan~~,~~ *includes what was formerly referred to as "Laulani" and "Fairways." It is* hereafter referred to as Gentry 'Ewa Makai, *and* represents remaining urban infill portion of the 'Ewa by Gentry Master Plan. The requested boundary amendment is requested at this time in anticipation of a market demand for the project in the ~~near~~ *immediate* future. Current housing inventory within the already approved portions of the 'Ewa by Gentry development are low and additional zoned lands will be required to meet the current market conditions.

Beyond the need for additional housing units, the proposed project will provide ~~commercial,~~ a mixed use industrial/commercial center *that will provide employment opportunities*, community facilities, ~~and open space that will provide employment centers,~~ sites for needed services~~-and~~ *including a middle* school, and, open space areas that will provide regional benefits and are important components of a complete community.

2.2 Existing and Surrounding Land Uses

The project site was formerly in sugar cane production use for approximately 100 years. This use has since been abandoned and the project site has been fallowed and cleared and holds very little by way of ground cover. Plants and scrub that remain are fairly sparse and do not serve as a scenic or visual resource. While not well suited for grazing, horses ~~have been~~ *were, until recently,* seen on sight foraging for edible plant material. No other uses of the site have been noted since its clearing.

When viewed in total, the project area is located south of a growing planned community developed by the applicant (Figures 4 &5). This area consists of single-family and multi-family homes, planned open spaces and some commercial development. The area immediately north of the project site also includes the Coral Creek Golf Course which was designed to accommodate drainage from the existing and future developments within the area. Further to the northwest lie the older Varona, Tenney and Renton Villages. The Honouliuli Wastewater Treatment Plant also lies further northwest of the project site.

The area immediately west of the project consists largely of the Barbers Point Golf Course located in the area now known as Kalaeloa. While this area was the site of a former Naval Air Station, *much of* the area has recently been turned over to the State of Hawai'i and the City and County for residential and community development.

The areas south of the Gentry 'Ewa Makai site include the Ocean Pointe Community located west of Fort Weaver Road, and the Hawai'i Prince Golf Course located east of Fort Weaver Road (Figure ~~5~~ *6*). Defined further, the areas within the Ocean Pointe community that abut the western portion of the project site are planned to include: residential areas, a golf course, and elementary school site, and a district park. The western portion of the Gentry 'Ewa Makai project is bounded in its entirety by the Hawai'i Prince Golf Course. Further south lies 'Ewa Beach town.

The areas east of the project site consists of open lands that are required by the Federally mandated safety area that surrounds munitions storage areas. This essentially creates a permanent open space area that will remain as long as the U.S. Navy operations further east remain in existence.

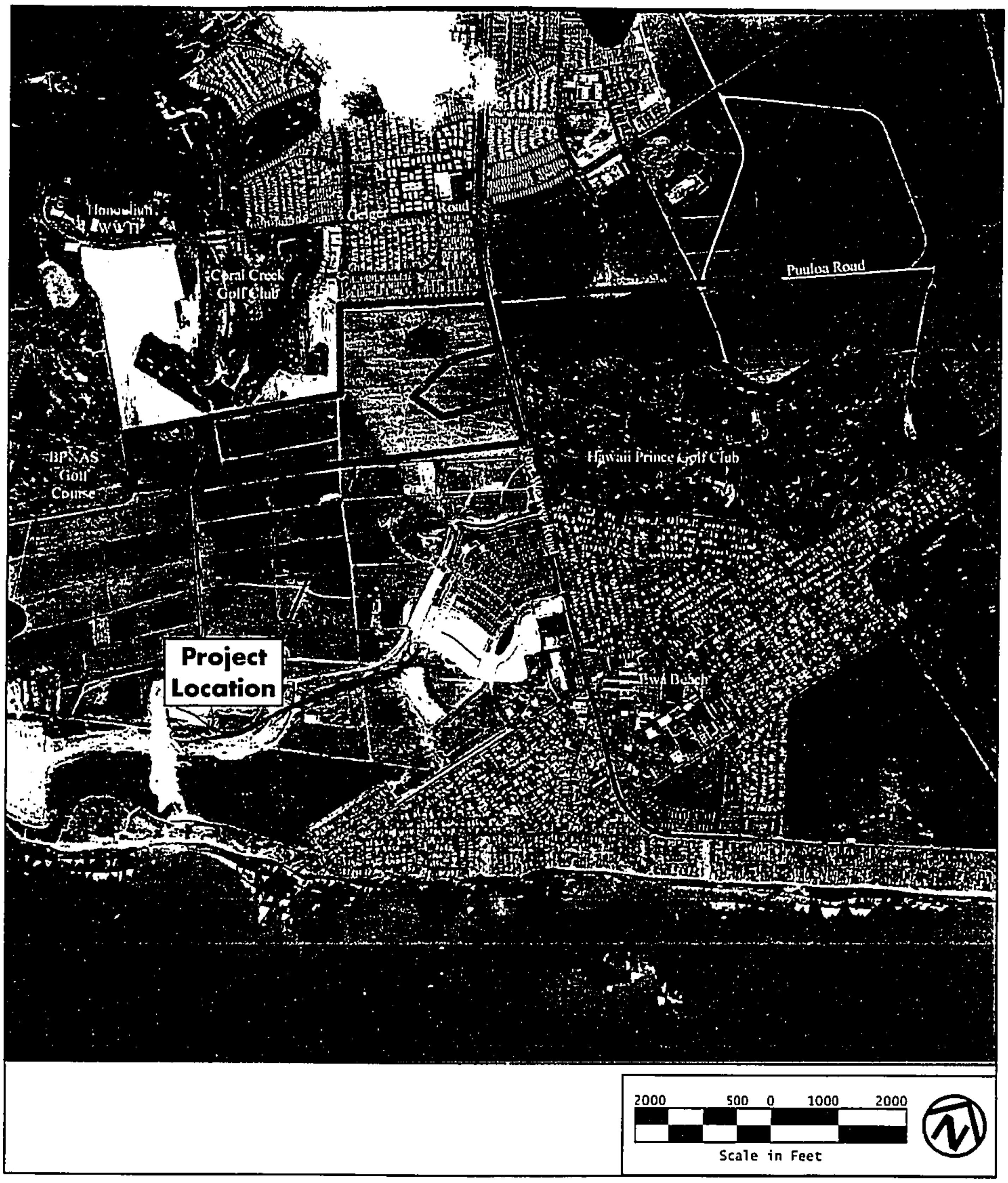
2.3 Master Plan

The 'Ewa Makai Master Plan represents the final phase of the 'Ewa by Gentry development and consists of a comprehensive community that includes residential, industrial/commercial mixed uses, open and park spaces, school, and community uses. These integrated uses are linked to the existing communities to the north, the future Ocean Pointe development to the south and by a new link crossing Fort Weaver Road. A summary of these uses is shown below, in Figure ~~6~~ *7*, and *in* Appendix A. *An illustrative plan is shown as Figure 8.*

Development Summary

Land Use	Area in Acres	Units	Units per Acre
Single Family	103 (73 net)	550	7.5
Cluster	54	675	12.5
Multi Family	32	640	20
Commercial*	20*		
Industrial /Com'l	30		
Middle School	18		
Community Ctr.	2		
Churches	4		
Parks	11.5		
Open Space	14		
Internal Roads	14.5**		
Total	283	1,865	

* To be developed by the Estate of James Campbell and not included in area total
** Excludes Fort Weaver Road and Kapolei Parkway

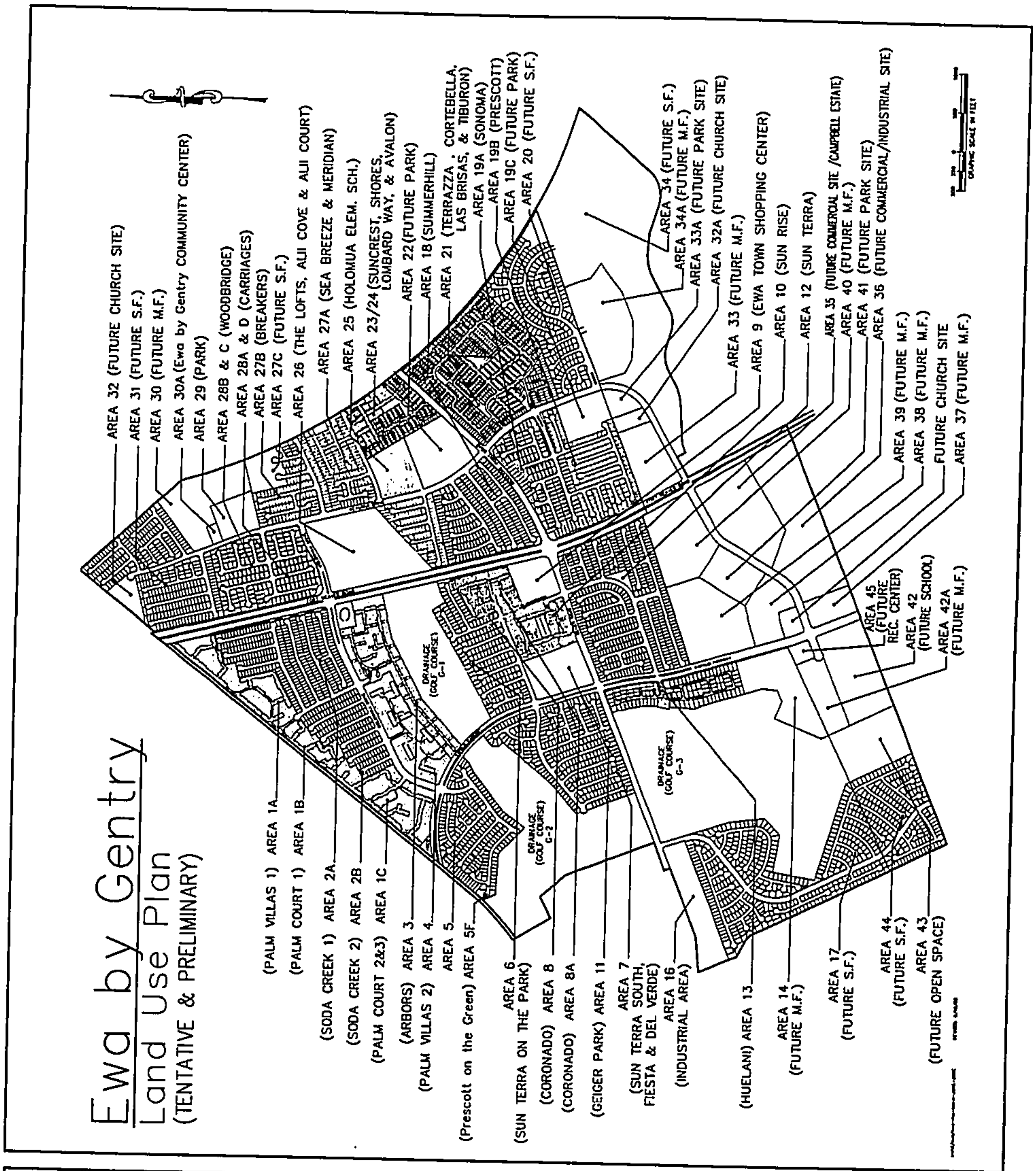


Gentry 'Ewa Makai

Aerial Photograph

Prepared by: Environmental Communications, Inc.
Source: CAD Photogrammetric Consultants

Figure 4
Page 2-3

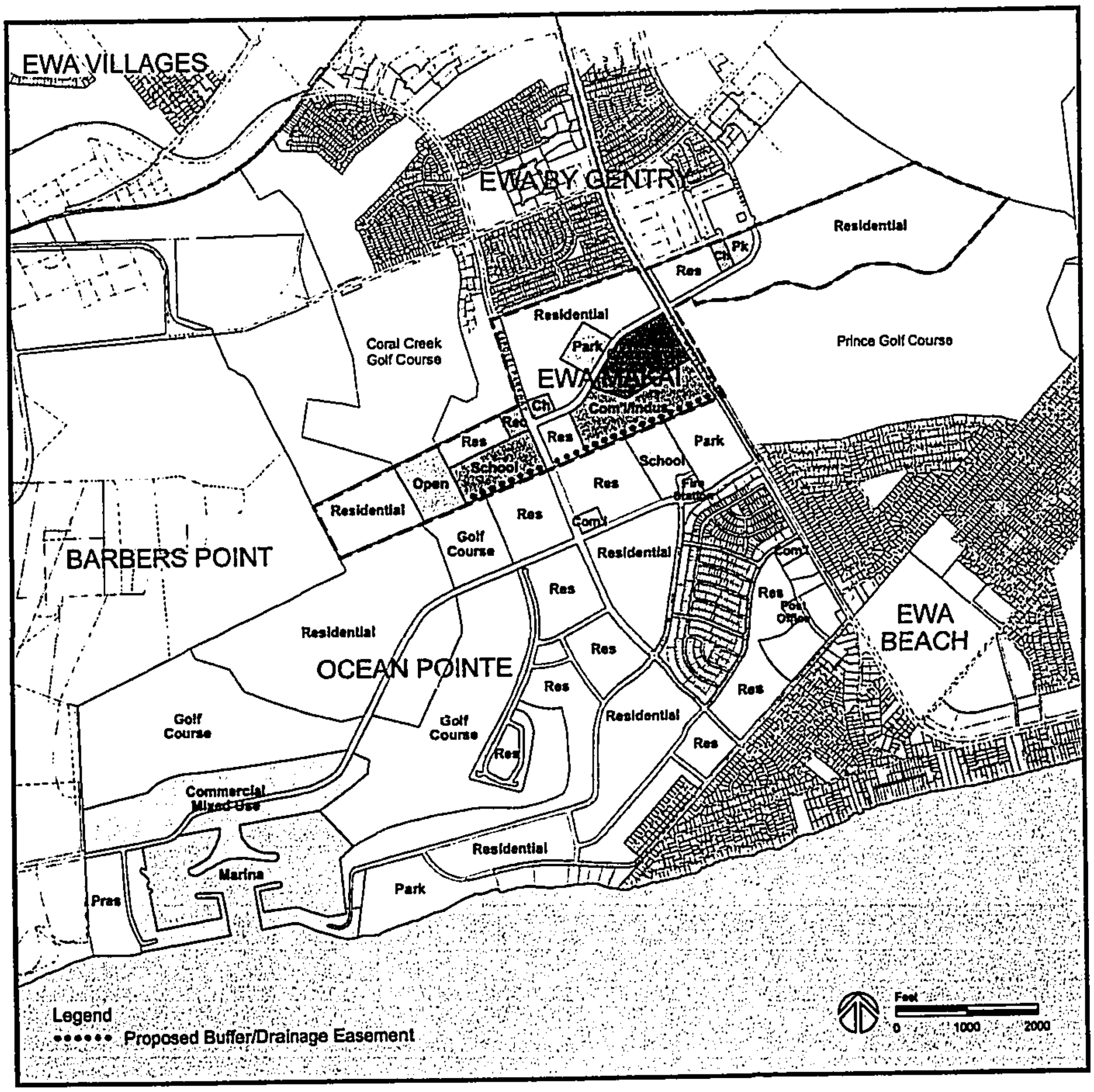


Gentry 'Ewa Makai

'Ewa by Gentry Land Use Plan

Prepared by: Environmental Communications, Inc.
Source: Gentry Homes, Ltd.

Figure 5
Page 2-4



Map of Ewa Makai in Relation to Ocean Pointe

June 2003

Gentry 'Ewa Makai

Prepared by: Helbert Hastert & Fee Planners
Source: Helbert Hastert & Fee Planners

Relationship to 'Ewa Makai and Ocean Pointe

Figure 6

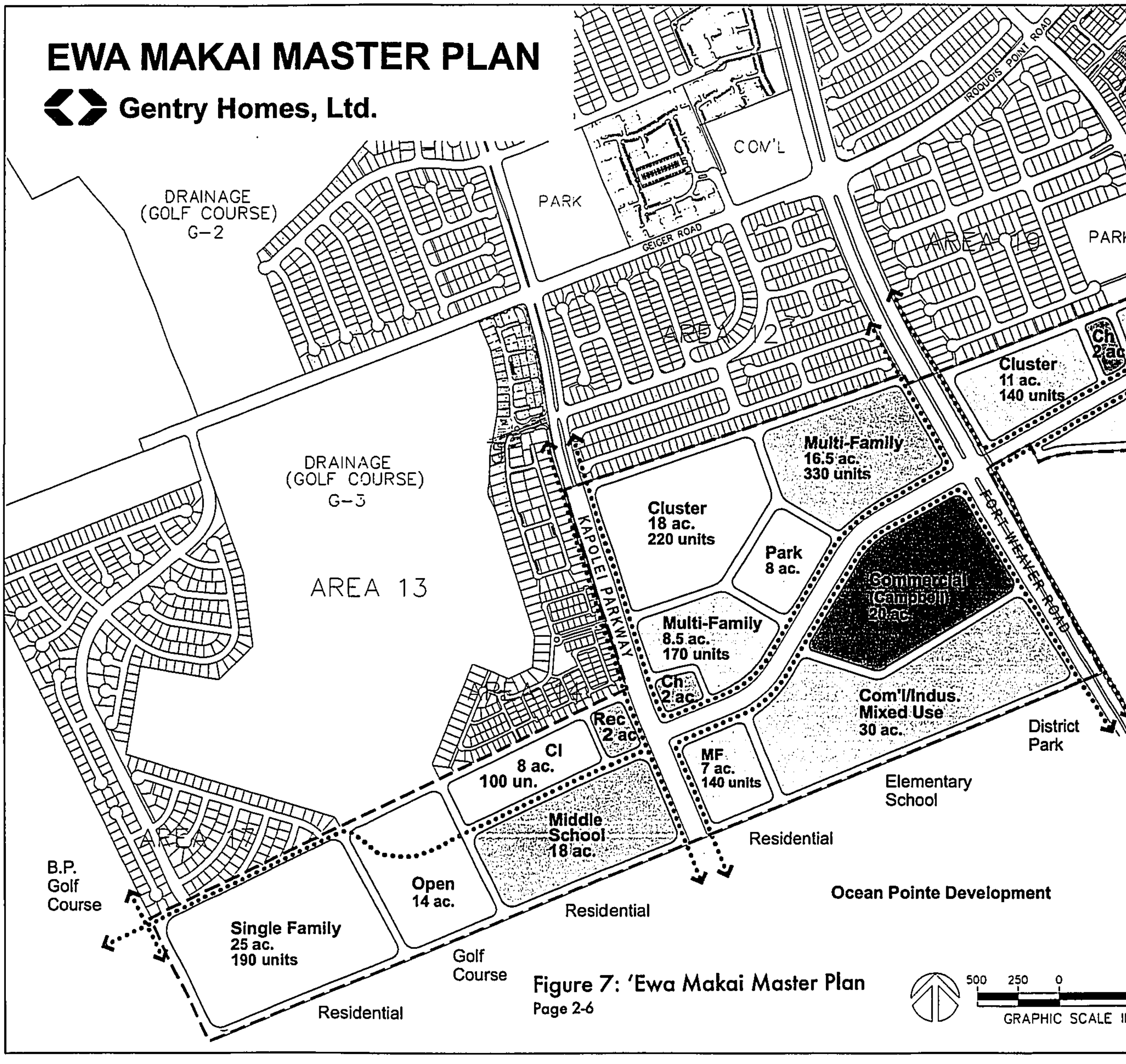
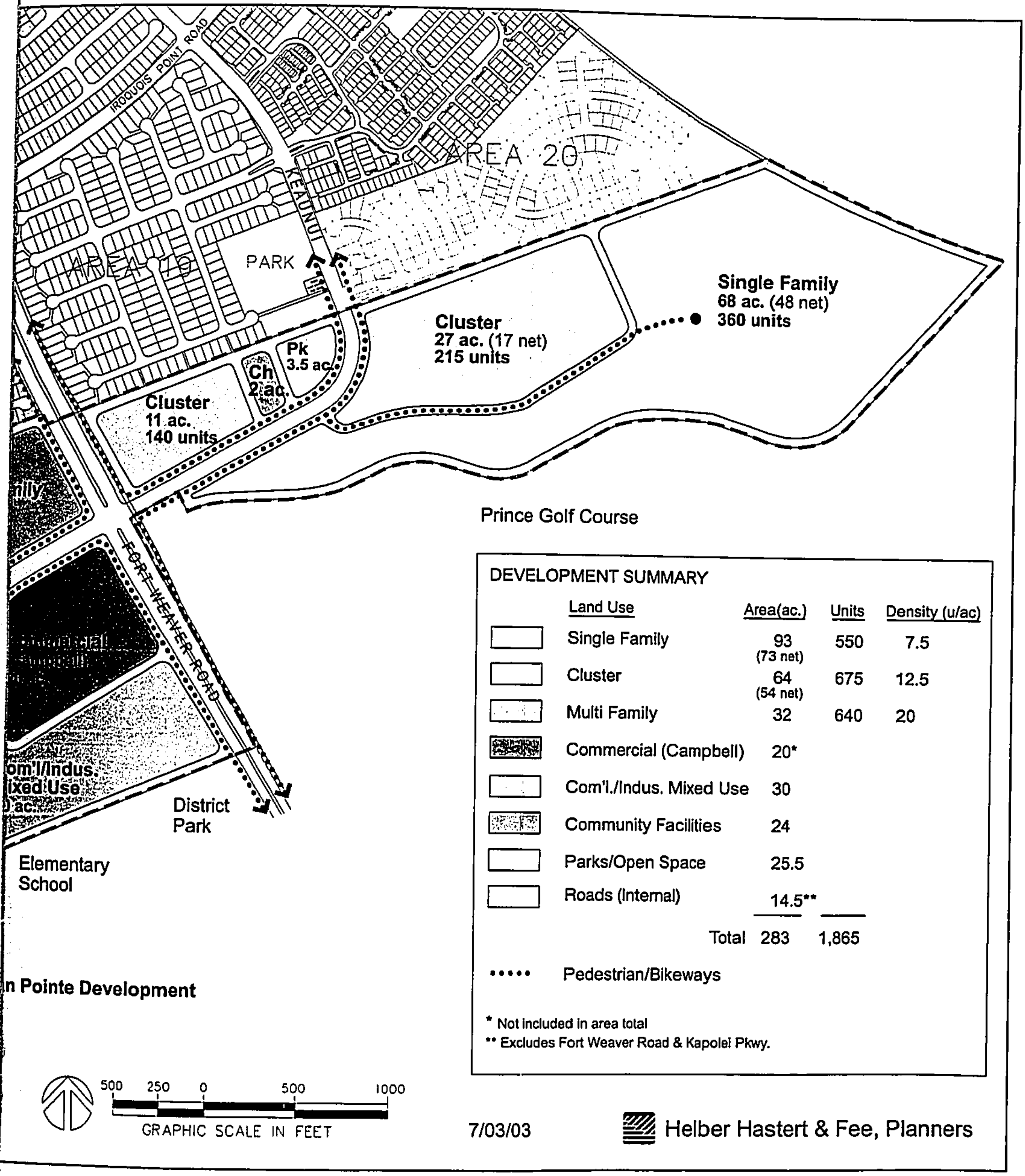


Figure 7: 'Ewa Makai Master Plan



DEVELOPMENT SUMMARY

Land Use	Area(ac.)	Units	Density (u/ac)
Single Family	93 (73 net)	550	7.5
Cluster	64 (54 net)	675	12.5
Multi Family	32	640	20
Commercial (Campbell)	20*		
Com'l./Indus. Mixed Use	30		
Community Facilities	24		
Parks/Open Space	25.5		
Roads (Internal)	14.5**		
Total	283	1,865	

•••••• Pedestrian/Bikeways

* Not included in area total
** Excludes Fort Weaver Road & Kapolei Pkwy.

Parcel Location Key

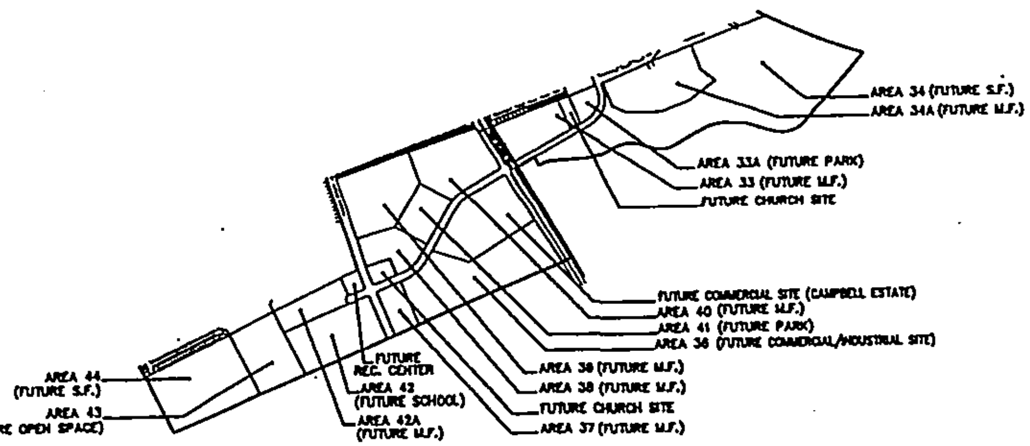


Table 1

Estimated Development Timetable for Ewa Makai Including Major Roadway Improvements

Parcel No.	Location	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Single Family															360
Area 34	Ewa Makai-East	30	48	60	72	86	64								190
Area 44	Ewa Makai-East											40	70	80	
Single Family Condo															215
Area 34A	Ewa Makai-East	30	72	72	41										140
Area 33	Ewa Makai-East	30	72	35	3										220
Area 39	Ewa Makai-West				74	80	66								100
Area42A	Ewa Makai-West						30	30	30	10					
Multi-Family								63	60	17					
Area 38	Ewa Makai-West									60	60	50			
Area 37	Ewa Makai-West			60	80	80	80	30							
Area 40	Ewa Makai-West	90	192	227	270	246	240	123	90	87	60	90	70	80	1865
	Total Units														
Industrial/Commercial					15	15									
Area 36	Ewa Makai-West				15	15									
	Total Development Area														
Roadway	**Location**														
Keaunui Drive	East of Fort Weaver Road														
Keaunui Drive	West of Fort Weaver Road														
Kapolei Parkway	Through Ewa Makai														

2.4 Single Family Residential

Single-family units will be located in both the eastern and western portions of the project site. These low-density locations are in close proximity to the Coral Creek, Barbers Point, Ocean Pointe, and Hawai'i Prince golf courses. These low-density areas are also located the furthest from Fort Weaver Road which is conducive to traffic flow. The western end of the proposed development area is planned for 190 units on 25 acres of land. The single-family area located east of Fort Weaver Road along the Hawai'i Prince Golf Course consists of 78 acres of which 48 acres are buildable. The remaining 30 acres consist of lands that will serve as a drainage basin and vegetated greenway for the project.

360 single-family homes are planned for 'Ewa Makai-East, while 190 homes are planned for 'Ewa Makai-West. Most of the single-family units will be sold in fee as house and lot packages, although a few custom built homes on larger lots may also be a possibility.

For 'Ewa Makai-East, the applicant proposes to continue its single-family residential development from the mauka direction into the petition/zone change area. Single-family residences in 'Ewa east would take advantage of the frontage along the existing Hawaii Prince Golf Course.

The proposed 'Ewa Makai residential subdivisions will be designed for consistency with the exiting 'Ewa by Gentry community. Presently, single-family densities are estimated to average 7.5 units per acre, based on lot sizes averaging 5,000 square feet. Average prices will range from $300,000 to $435,000 in 2003 dollars.

2.5 Cluster Development

Moderate density cluster development areas are interspersed throughout the site. An 8-acre, 100-unit area is designated adjacent to the middle school area while further to the north lies another 18-acre, 220 unit cluster located adjacent to a park space. Additional cluster areas of 11-acres and 140 units, and 17-acres and 215 units are located east of Fort Weaver Road. *These single-family condominiums will be sold in fee simple on lands that are zoned A-1 Low Density Apartment. Densities for cluster developments are estimated to average 12.5 units per acre. In contrast to the more conventional layout of homes, single family condominiums are often zero-side yard units on smaller lots, with each lot being a "limited common element." Because of the small size, individual homes will be carefully designed to maximize the feel for interior space, and at the same time, optimize the limited exterior space.*

Single-family condos have been popular choices among the applicant/developer's new homebuyers because; they are less dense than multi-family apartments; they offer more privacy; they offer individual lots that are easy to maintain; and they are more affordable than single-family homes on standard R-5 houselots. Smaller houselots and reduced infrastructure costs enable the applicant to sell these types of units at very competitive *prices. It is anticipated that sales prices for cluster homes will range from approximately $200,00 to $300,00 in 2003 dollars.*

2.6 Multi-Family Residential

Multi-family units are based on a density of 20 units per acre. These units are all located west of Fort Weaver Road with direct access to the linking roads within the project site. Three areas have been designated for multi-family development. These areas include sites of: 7-acres and 140 units, 8.5-acres and 170 units, and 16.5-acres and 330 units *for a total of 640 multi-family units.*

Multi-family residences may include single-family condominiums, duplexes, townhomes, or stacked flats, with product types being largely dependent upon market conditions at the time of sale. It is estimated that these units will sell for approximately $150,000 to $200,000 in 2003 dollars. Densities are estimated to average 20 units per acre.

To minimize the need for vehicular transportation, the multi-family units will be located in areas close to public transportation facilities, commercial facilities, school sites, and parks. Pedestrian walkways and bike paths will be incorporated to enhance internal circulation between major trip generation centers and residential areas.

2.7 Commercial Development

A commercial area of 20 acres is located ~~within~~ *adjacent to* the bounds of the Gentry 'Ewa Makai project but is not part of the applicant's development proposal. This 20-acre area is owned by the Estate of James Campbell and is proposed for commercial/shopping center development. While not part of the Gentry 'Ewa Makai project, the use is consistent ~~to and integral~~ with the Gentry 'Ewa Makai project. This area is not included in the State Land Use Boundary Amendment Petition or the forthcoming Zone Change application, but is discussed within this report due to the cumulative impacts that the project areas will experience from the development of the Gentry 'Ewa Makai project.

2.8 Industrial/ Commercial Mixed Uses

The Gentry 'Ewa Makai master plan features a 30-acre industrial/commercial mixed-use site. This area will provide opportunities for diversified businesses that are safe and non-polluting in nature and convenient to the residents in the 'Ewa area. ~~It is anticipated that uses would include warehousing, light assembly operations, wholesaling, commercial and other permitted uses to provide employment and to serve the surrounding community.~~ *It is estimated that this area will provide a source of employment for 1,500 full-time, part-time and self-employment jobs at buildout.*

The industrial-commercial development is expected to contain 35 to 40 lots ranging in size from approximately 15,000 square feet up to 3 acres. Uses are anticipated to be similar to those found in the existing industrial-commercial developments in Kaneohe, Kalihi, Waipio, Kakaako, Mapunapuna, and Hawaii Kai. This component may include *warehousing, light assembly operations, wholesaling, commercial, and other permitted uses. The IMX-1 district is intended to promote and maintain a viable mix of light industrial and commercial uses to serve the surrounding community without exposing non-industrial uses to unsafe and unhealthy environments.*

Based on the number of lots, the lot sizes, and the anticipated operations, it is expected there will be approximately 40 major buildings within the complex. Although the proposed IMX-1 zoning allows floor area ratio (FAR) maximums of 1.5 to 2.5 (depending on the mix of industrial and non-industrial uses), it is anticipated that the average FAR for this development will be approximately 0.60. Assuming approximately 4 acres of the 30-acre site is taken up by roadways, the remaining 26 acres of developable land would generate approximately 680,000 square feet of total building area.

Although off-street parking requirements will vary significantly depending on the specific types of use on each lot, most will require between 1 stall per 300 square feet and 1 stall per 1,500 square feet of floor area. Assuming an average of 1 stall per 900 square feet, approximately 756 parking stalls will be needed within the complex.

Although the zoning map for the area will establish the maximum height of the buildings in the complex, it is anticipated that structures will not exceed 40 feet. Many are expected to be single-story facilities. Some may have mezzanines or second story spaces for administrative or light storage uses, and others may be "high cube" families.

2.9 Community Facilities

Community facilities provided within the Gentry 'Ewa Makai master plan consists of a Department of Education middle school site, a recreation/community center site, ~~and~~ two sites reserved for church/day care use, *and two park sites.*

The middle school site consists of 18-acres located immediately west of Kapolei Parkway in the western half of the project site. This school site was reserved in coordination with the Department of Education to ensure that future development, and the educational needs of future populations within the region can be satisfactorily accommodated.

Two acres located immediately north of the middle school site have been planned for recreational and community center use. This area is easily accessible from all areas of the proposed project.

Two church sites located on either side of Fort Weaver Road have also been included within the master plan. These uses have been determined to be in high demand and will serve as centers for day care and/or other community uses.

The conceptual plan incorporates two neighborhood parks: an 8-acre park in Ewa Makai-West and a 3.5 acre park in Ewa Makai-East. The 8-acre park in Ewa Makai-West will be centrally located and within walking or biking distance for many area *residents. The 3.5 acre park in Ewa Makai-East will be an extension of a planned 6.8 acre park in the existing Ewa by Gentry community, thereby increasing the overall park size to 10.3 acres.*

2.10 Infrastructure

2.10.1 Roadway System

Roadways account for 14.5 acres of the proposed development. Fort Weaver Road presently serves as the major north-south arterial for both the site and the 'Ewa region. Kapolei Parkway is an existing roadway that serves the mauka 'Ewa by Gentry developed areas but does not yet go through the project site. This road is planned for extension through the Gentry 'Ewa Makai project and will extend further into the future Ocean Pointe development.

A new major west-east arterial is planned for the subject project. This Keaunui Drive extension will connect the Kapolei Parkway extension with Fort Weaver Road and will continue through the eastern portion of the Gentry 'Ewa Makai site until it connects with the existing Keaunui Drive.

Interior roadway systems will be developed with the site to serve all uses and will be submitted for City approval prior to subdivision approval.

2.10.2 Water Supply System

~~The applicant is a member of the 'Ewa Plain Water Development Corporation (EPWDC) which has dedicated source and well facilities, storage, and transmission systems to the City and County of Honolulu. The purpose of these privately funded and County dedicated infrastructure systems are to ensure that there will be an adequate supply of potable water for EPWDC members' current and future projects. This dedicated system has been planned to accommodate the water supply needs of the 'Ewa Makai project.~~

~~A potable water system master plan for the entire 'Ewa by Gentry development was been approved by the City and County of Honolulu Board of Water Supply.~~

~~The master planned 'Ewa by Gentry development, which includes the 'Ewa Makai project, also makes efficient use of non-potable water through its participation in the Puuloa Caprock Users Group (PCUG).~~

<u>*Potable Water*</u>

All necessary on-site water facilities will be provided in consultation with the Board of Water Supply (BWS) and will be built in accordance with an approved Water Master Plan. (The latest approved potable water master plan for the Ewa by Gentry project, which included Ewa Makai-East and West, was prepared by

Tom Nance Water Resource Engineering in September 2000, and was approved by the BWS on November 3, 2000. Based on the current Ewa Makai Land Use Plan, the approved water master plan should still be valid according to Tom Nance (January 2003).)

In addition, Gentry is a member of the Ewa Plain Water Development Corporation (EPWDC), a non-profit corporation responsible for planning, financing, and implementing the construction of regional source development, storage reservoirs, and distribution systems. Major portions of EPWDC's water program (including dedicated source and well facilities, storage and transmission for a water system of 6.72 million gallons per day) have already been implemented and were dedicated to BWS in 1991. Although the BWS does not provide advance water allocations or water reservations for projects such as Ewa Makai, BWS expects to have sufficient water for the Ewa Region. According to a BWS letter to Gentry dated January 24, 2003, BWS currently has water system improvement projects in the construction and design stages, which will provide adequate source capacity to accommodate Gentry's proposed development. The Ewa Shaft's estimated yield is 15 million gallons per day (mgd). In addition, the proposed Desalination Facility in Kalaeloa is being designed for 5 mgd with a potential to expand to 35 mgd in the future. The installation of wells at the Waipahu Wells II Station and completion of the Waipahu Wells IV will add 4.21 mgd to BWS's capacity to deliver water. These two projects should be completed this year. (Source: Board of Water Supply, January 2003.)

<u>Non-potable Water</u>

Groundwater exists beneath the Ewa Makai area as a thin, brackish basal lens in hydraulic contact with saline water at depth and seawater at the shoreline. It is typically referred to as the Ewa Caprock Aquifer. Use of this resource for irrigation was begun by the Ewa Plantation in the 1930s and continued until Oahu Sugar ceased cultivation of sugarcane on the Ewa Plain in late 1994. During that 60-year period of use, a number of skimming type wells were used to extract 15 to 20 million gallons per day (MGD), most of which was drawn from the eastern (Pu'uloa) side of the Ewa Plain. The rate of pumpage was actually far in excess of the aquifer's natural rate of recharge. However, it was sustained by the plantation's excess irrigation of mauka fields by better quality water and the direct import of this water to the largest of the pumping centers on the caprock.

In late 1994, use of caprock groundwater abruptly dropped, from more than 15 MGD to about 3 MGD. Most of the remaining use was by three golf courses around the Ewa Makai area: Hawaii Prince, New Ewa Beach, and Coral Creek. In the year 2001, BWS began selling treated wastewater effluent of R-1 quality to two of the three courses, further reducing the draft from the aquifer. At present, use of the caprock aquifer on the eastern side of the Ewa Plain consists of 0.7

MGD by the New Ewa Beach golf course and a far lesser amount by a number of small capacity wells throughout the existing Ewa by Gentry developed area.

The caprock aquifer is still in the process of adjusting to the major changes in its use described above. However, development of the Ewa Makai site should have no significant impact on this naturally shrinking resource. (Source: Discussion with Tom Nance, Tom Nance Water Resource Engineering, January 2003.)

Gentry is also studying the possible use of reclaimed water as an alternative to potable water when the non-potable systems are inoperable or are no longer available.

2.10.3 Wastewater System

Wastewater from the project will be accommodated by two separate pump systems that were specifically designed to serve the 'Ewa Makai project. *These systems were previously accepted by the City and County of Honolulu under the Wastewater Master Plans developed for the 'Ewa Makai project. (Sewer Master Plan for Ewa Makai-West (Engineering Concepts, Inc., approved November 1999; Wastewater Pump Station and Force Main for Ewa Makai-West (Engineering Concepts, December 2001, approved April 3, 2002; Revised Ewa by Gentry Sewer Master Plan (Park Engineering, August 2001, approved January 18, 2002.)* These independent systems are identified as Gentry Ewa Makai-West Wastewater Pump Station and Force Main and the 'Ewa by Gentry-East Wastewater Pump Station and Force Main.

The Gentry 'Ewa Makai-West Wastewater Pump Station and Force Main will be located at the end of the Kapolei Parkway extension road and is designed for an average flow of .816 MGD with a peak flow capacity of 2.760 MGD. The 'Ewa by Gentry-East Wastewater Pump Station and Force Main is already in existence at the end of Keaunui Drive immediately north of the project site. This facility has a design average flow of .38 MGD and a peak flow capacity of 1.47 MGD. These systems will ensure the efficient conveyance of wastewater to the Honouliuli Wastewater Treatment Plant (WWTP).

~~*Since the time of acceptance of these sewer system plans in 1999, the 'Ewa Makai project has changed, therefore revised plans are presently being developed to address the project changes. Revised sewer plans for the 'Ewa Makai East and 'Ewa Makai West sites will be submitted to the City and County of Honolulu Department of Planning and Permitting for approval.*~~ *The approved sewer master plans will be revised and supplemented as necessary, based on the Ewa Makai Master Plan. Preliminary reviews indicate that no significant changes are anticipated.*

2.11 Project Phasing and Proposed Timing

A total of 1,865 units will be developed on a phased and incremental basis. Regulatory approvals, planning and design, and project financing require significant lead-time which warrant the boundary reclassification request at this time. Developable lands in 'Ewa by Gentry will soon be exhausted and the timely development of 'Ewa Makai is vital to maintaining an adequate inventory for this high demand area. The applicant plans to begin infrastructure development as soon as entitlements for the property are obtained. Delivery of the first homes within the project are anticipated for 2005. Table 1 shows the projected development schedule for each unit type within the project.

2.12 Project Costs

Development of 283 acres of residential, commercial/ light industrial, and public facilities lands will cost approximately $400,000,000. This in turn will create salable residential units and leasable industrial lots. Anticipated revenues should range between $450,000,000 and $500,000,000. Construction will occur over a period of 10 years and will create approximately 500 construction and support jobs with associated tax and spending revenues.

No direct use of public funds or lands are proposed. Project design, construction and marketing will be solely borne by applicant. Public money will be used to provide school and public park improvements and support services.

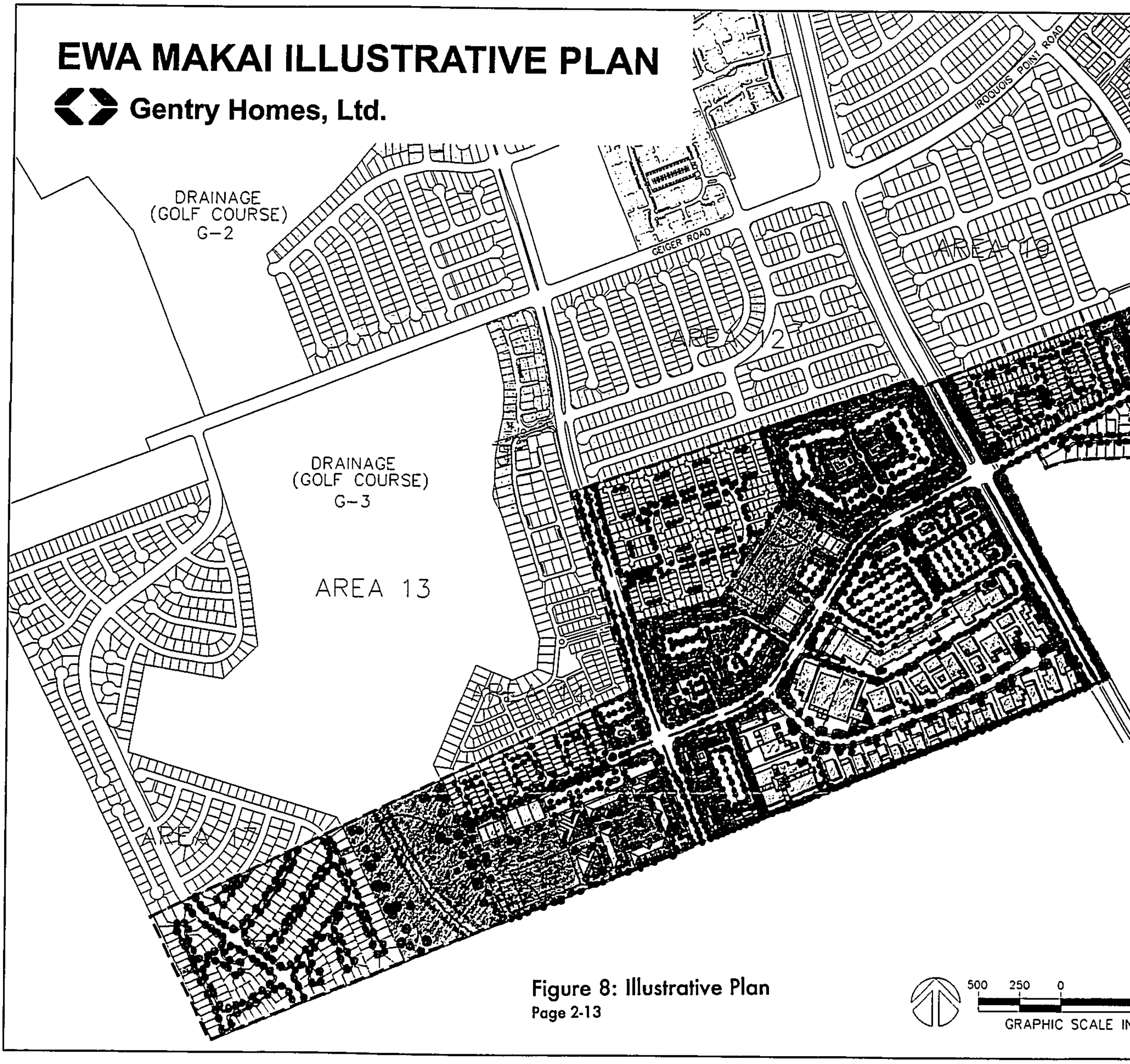
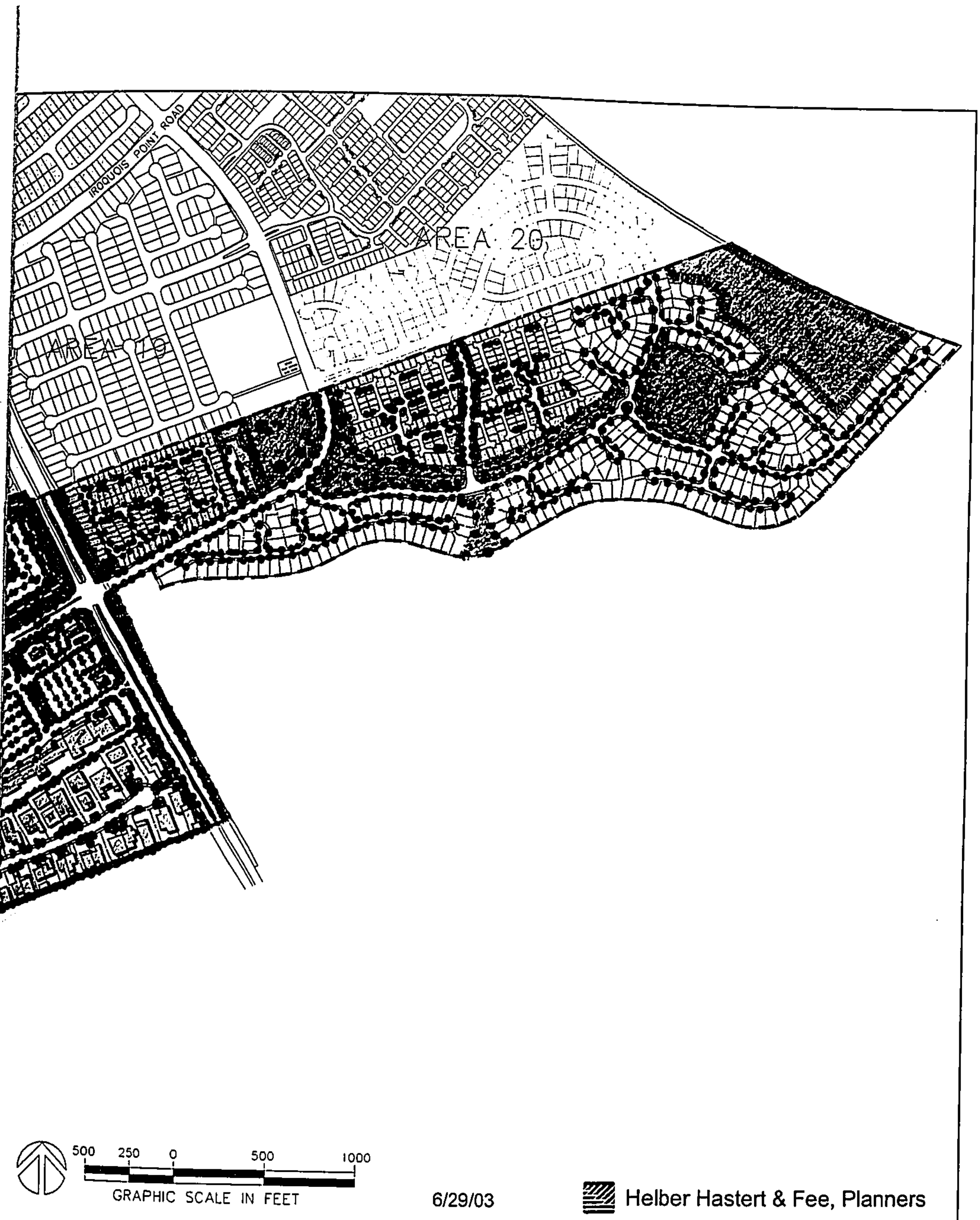


Figure 8: Illustrative Plan
Page 2-13



6/29/03

Helber Hastert & Fee, Planners

3.0 Required Approvals and Permits

3.0 REQUIRED APPROVALS AND PERMITS

The processing and approval of various land use and development permits is required prior to the construction of the 'Ewa Makai project. These permits consists of both discretionary and administrative approvals. The relevant State and County plans, policies and controls are presented below.

3.1. State Land Use District

The project area is presently designated as an Agricultural District under the current land use district classification. As stated in Hawai'i Administrative Rules, Title 15, Chapter 15, Land Use Commission Rules, any project involving more than 15 acres requires a State Land Use District Boundary Amendment. This discretionary approval is issued by the State Land Use Commission through a petition process. The applicant is requesting the redesignation of approximately 283 acres of land in the State Agricultural district to Urban use.

3.2 Chapter 343, Hawai'i Revised Statutes

Documentation of compliance with applicable environmental regulations including Chapter 343, Hawai'i Revised Statutes (HRS), State Environmental Impact Statement Law, is required for Zone Change. The subject document is prepared to fulfill this requirement.

3.3 City and County of Honolulu

The following City and County of Honolulu land use regulations are in effect over the proposed project. Each of the following is administered by the Department of Planning and Permitting.

3.3.1 'Ewa Development Plan Land Use Map

Land uses consistent with the proposed project have already been established in the 'Ewa Development Plan Land Use Map under City and County of Honolulu Ordinance No. 97-49. No additional changes are required.

3.3.2 Development Plan Public Facilities Map

Land uses consistent with the proposed project have already been established in the 'Ewa Development Plan Public Facilities Map. No additional changes are required at this time.

3.3.3 Land Use Ordinance Zoning

The 'Ewa Makai project will require the rezoning of approximately 283 acres of land from AG-1 Restricted Agriculture and AG-2 General Agriculture as follows:

R-5 Residential	93 acres
A-1 Apartment	146 acres
P-2 General Preservation	14 acres
IMX-1 Industrial-Commercial Mixed Use	30 acres
	283 acres

Figure 9 shows the proposed zoning classifications within the proposed project site.

3.3.4 Special Management Area

The project is not located within the Special Management Area regulated by Revised Ordinances of Honolulu, Chapter 25. A Special Management Area permit will not be required.

3.3.5 Building Related

Other permits required consist of administrative approvals typical of any development. County permits will include grubbing, grading stockpiling permit, building permits, subdivision approval, and sundry certificates including street naming and house numbering. In the event that ~~cluster housing is~~ *Cluster Housing or Planned Development-Housing as defined in the Land Use Ordinance are* developed within the project, cluster housing permits will be required. Churches and recreational centers are also considered "meeting facilities" and as such, would require conditional use permits.

~~*Sewer Master Plans for the 'Ewa Makai East and 'Ewa Makai West sites were previously accepted by the City and County of Honolulu in 1999. Since that time, the project scope has changed and revised sewer plans are necessary. Revised sewer plans are presently being developed and will be submitted to the City and County of Honolulu for approval of these revised systems.*~~ *Approved water, sewer, and drainage master plans will be revised slightly or supplemented, based on changes to the Ewa Makai Master Plan. A roadway master plan will need to be developed and approved.*

3.4 Other Permits and Approvals

A National Pollution Discharge Elimination System (NPDES) permit is required for all clearing activities equal or greater than five acres. This permit is issued by the Department of Health Clean Water Branch.

EWA MAKAI PROPOSED ZONING

Gentry Homes, Ltd.

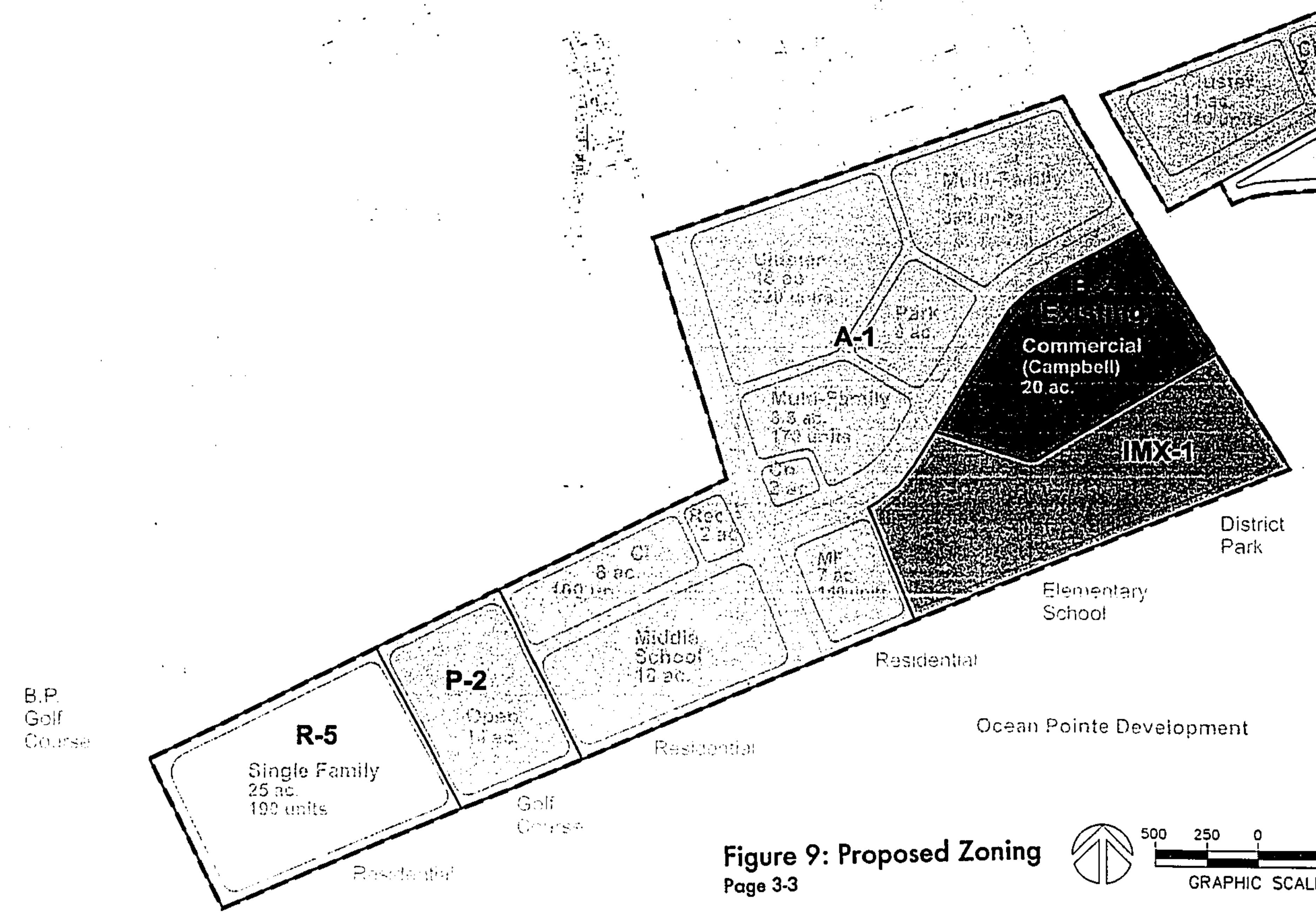
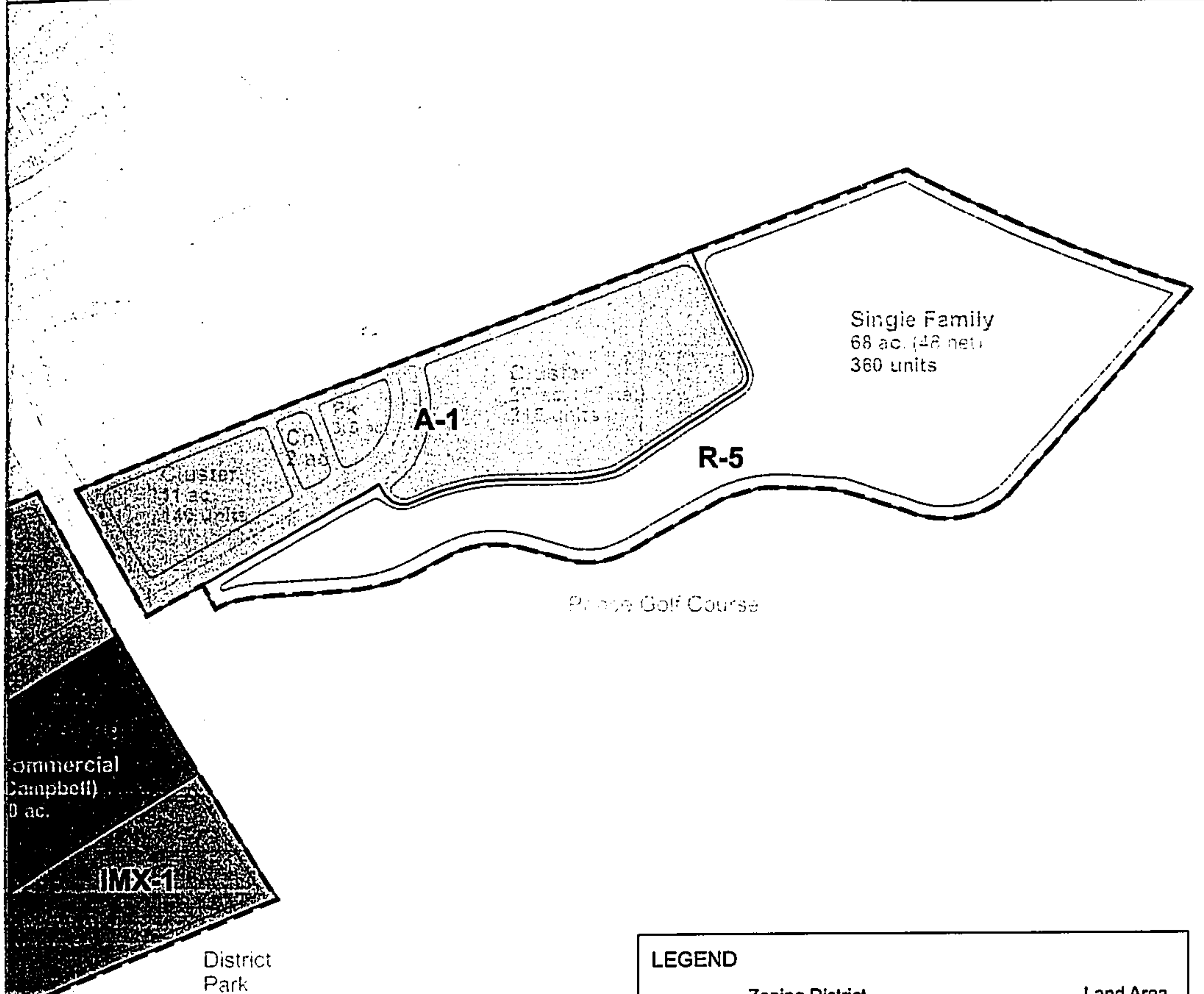


Figure 9: Proposed Zoning

Page 3-3



LEGEND

	Zoning District	Land Area
R-5	Residential	93 ac.
A-1	Low Density Apartment	146 ac.
B-2	Community Business	N.A.
IMX	Industrial - Commercial Mixed Use	30 ac.
P-2	General Preservation	14 ac.
	TOTAL	283 ac.

n Pointe Development

g

500 250 0 500 1000
GRAPHIC SCALE IN FEET

6/24/03

Helber Hastert & Fee, Planners

4.0 Existing Natural Environment, Potential Impacts, and Mitigative Measures

4.0 EXISTING NATURAL ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATIVE MEASURES

4.1 Climate

Existing Conditions

Weather on the 'Ewa Plain is generally constant and dry. The average temperature range varies from 21 to 28 degrees Celsius. Average rainfall is approximately 20 inches annually, with most rain falling between December and April. The prevailing northeasterly tradewinds blow at an average of approximately 9 knots and are generally constant through the year.

Anticipated Impacts and Mitigative Measures

The project will not affect the climatic conditions of the area and will not require any mitigative actions.

4.2 Physical Characteristics

Existing Conditions

The topographic contours of the project site are generally level. Elevations within the two parcels vary from 20 feet above mean sea level (msl) to approximately 35 feet msl. The ground slope is approximately 1 percent. The area consists of former cane lands that have been cleared and are largely covered with grasses and noxious scrub.

Anticipated Impacts and Mitigative Measures

There are no significant impacts on the topography. Site grading will be limited to scarification, minor grading and contouring of the sump area for golf course and drainage purposes. No mitigation measures are required.

4.3 Drainage

Existing Conditions

'Ewa Makai-West, when developed, will discharge surface runoff to the Kaloi Gulch improvements, and/or into existing greenway/sumps on Gentry lands. 'Ewa Makai-East will be designed to release surface runoff into large sumps on the property with excess water flowing into the adjacent Hawai'i Prince Golf Course lands which have been designed to accommodate this drainage. ~~These planning strategies are preliminary and have not been finally determined.~~

'Ewa Makai-West

The topography of 'Ewa Makai-West is generally flat, with ground slopes from less than one-half percent to about five percent. The project site is an abandoned sugar cane field that was, until recently, used for grazing. Elevations of the site range from about 18 mean sea level (msl) at the makai boundary to about 30 feet msl at the northwest corner, just below the existing Sun Terra development in 'Ewa by Gentry.

The former Kaloi ditch, which was built above ground and traversed the western end of the site, has been replaced with a drainageway in the form of 14 acres of open space that stretches from the southern boundary of Coral Creek to the planned golf course in Ocean Pointe. This drainageway is part of the Kaloi Gulch system, and will help to prevent upland areas from flooding during heavy rainstorms. Portions of 'Ewa Makai-West also flow into the 14-acre open channel; the remaining areas of 'Ewa Makai are presently open and naturally drained.

'Ewa Makai-East

As in the 'Ewa Makai-West area, the eastern portion of the project is located on relatively flat lands very similar in topography. Recent development in the area has leveled large portions of the site as staging areas for the construction activities taking place to the west of the site. No structures or significant natural features are located on the site. Existing vegetation is limited to grasses. Three existing sump areas are located on site and hold drainage from the site as well as some drainage from the area immediate to the west. The remainder of the site is naturally drained. ~~*The Hawaii Prince Golf Course, which lies immediately to the east, was designed to accept drainage from the 'Ewa by Gentry development.*~~

Anticipated Impacts and Mitigative Measures

~~The topography of the 'Ewa by Gentry area is generally flat. Drainage of currently built areas are accommodated by existing drainage facilities. The 'Ewa Makai area is presently open and naturally drained. The addition of the 'Ewa Makai project area will increase drainage demand and is subject to an overall drainage plan that is currently being revised for 'Ewa East. A drainage plan for 'Ewa Makai West has been approved by the City *and a revised plan for the 'Ewa Makai East portion has been recently completed.*~~

'Ewa Makai-West, when developed, will be an extension of the 'Ewa by Gentry community to the north, integrating roadways and utility systems between the two projects. Consequently, ultimate drainage improvements will be planned to provide a coordinated drainage system benefiting all of Gentry's developments within the Kaloi Gulch watershed. Interim drainage measures will be required due to phasing of the development and downstream capacity restrictions at the Ocean Pointe/'Ewa Makai-West boundary; however interim improvements will also be coordinated to allow a logical progression of development. Both interim and ultimate drainage plans include a

box culvert within and along the makai boundary of the 'Ewa Makai-West site to help retain/detain and convey storm water runoff to Ocean Pointe.

~~*'Ewa Makai-East will largely maintain the drainage conditions that presently exist. Storm drainage will be accommodated by on-site sumps or will be conveyed into the Hawaii Prince Golf Course.*~~ *The overall drainage concept for 'Ewa Makai-East (which is currently under review by the City) is based largely on the use of permanent on-site drainage sumps that route the storm runoff from the post development areas through a series of detention ponds such that the discharge onto the downstream property will be equal or less than the pre-development runoff. The remaining portion of 'Ewa Makai-East will drain into the Hawaii Prince Golf Course at one or more of the coordinated points of discharge. Areas immediately adjacent to the golf course will flow either by sheet flow or by small pipes into the golf course. During the interim, sufficient sump volume will be maintained to keep the outflow at the downstream boundary equal to or less than the pre-development flow.*

Both 'Ewa Makai-West and 'Ewa Makai-East will be designed in accordance with the Rules Relating to Storm Drainage Standards (Department of Planning and Permitting, City and County of Honolulu, January 2000).

Best Management Practices will be used to minimize soil erosion. Measures that may be used to control soil loss include the use of mats and hydromulch to prevent unnecessary soil exposure. Sites will not be cleared until grading plans are ready to be implemented.

4.4 Geological Resources

Existing Conditions

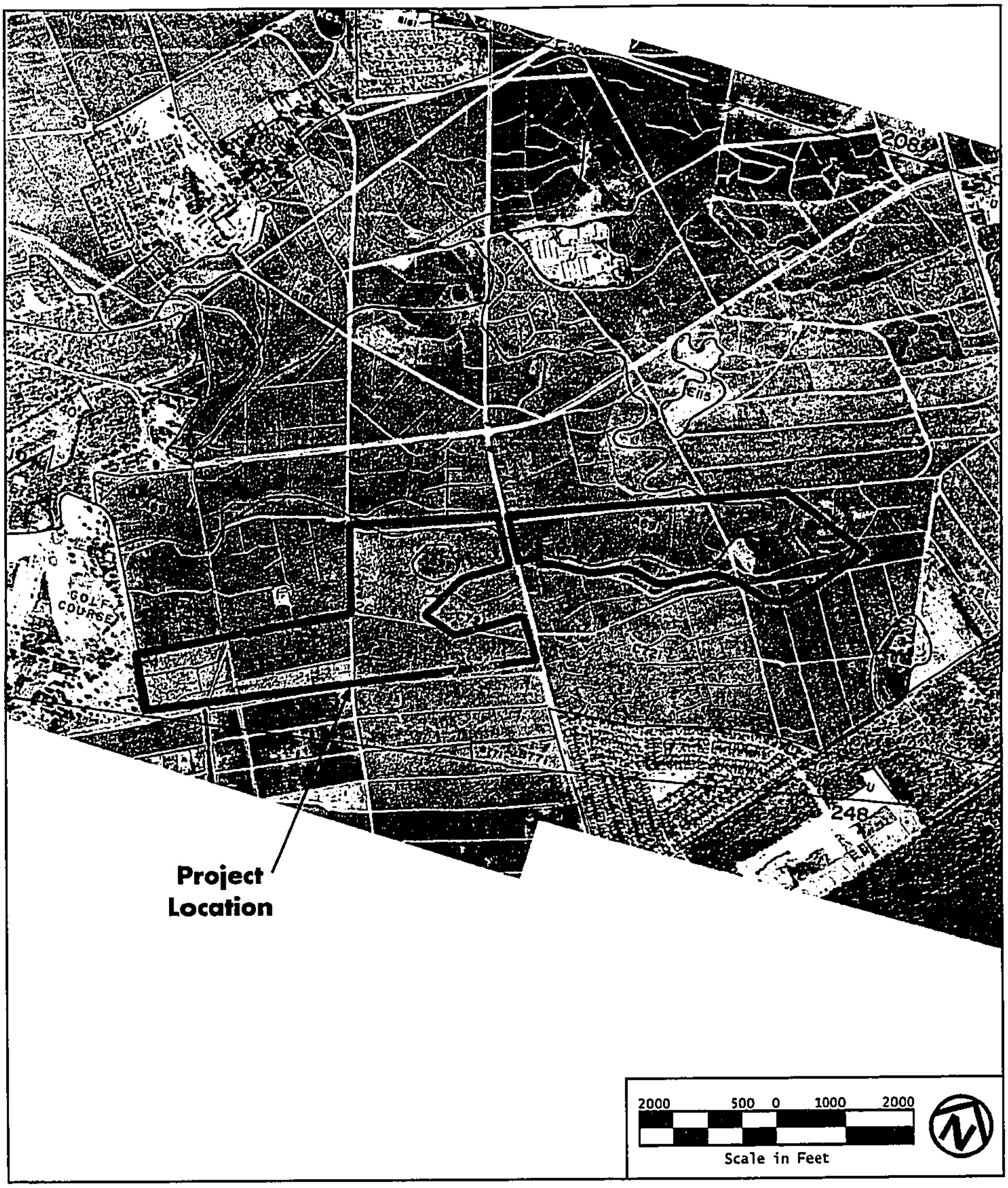
The 'Ewa coastal plains were formed initially by ponded lava of the Koolau Volcano (Sterns, 1985). As the sea level rose, coral formation and marine sediment were deposited on the lava. Lowering of the sea level caused erosion and valley cutting of the Waianae Range and Schofield Plateau. This in turn deposited silt over the coral formations.

4.4.1 Land Study Bureau Classification

In 1972, the UH Land Study Bureau (LSB) developed the Overall Productivity Rating, which classifies soils according to five levels with A representing the class of highest productivity and E the lowest. About 23.2% of the Project area is rated A and the remaining 76.8% is rated C (Figure ~~8~~-*10*).

4.4.2 Soil Conservation Service Soil Survey

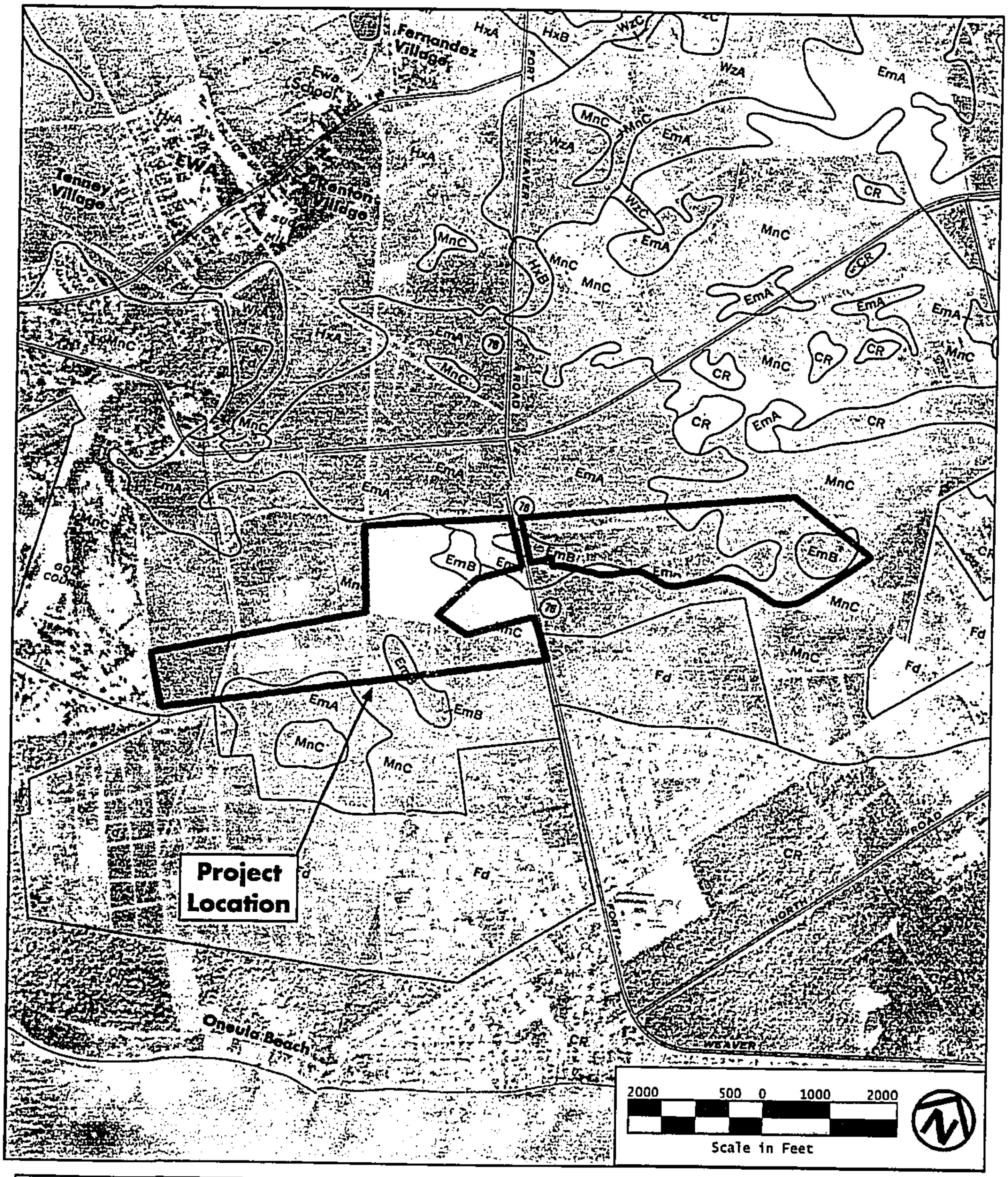
Soil survey maps prepared by the U.S. Department of Agriculture, Soil Conservation Service (SCS), 1972, indicate that the predominant soil series types in the 'Ewa Coastal Plain are: the 'Ewa (EmA, EmB, Mamala (MnC) and



Gentry 'Ewa Makai | Land Classification Map

Prepared by: Environmental Communications, Inc.
Source: Land Study Bureau

Figure 10
Page 4-4



Gentry 'Ewa Makai

Soil Survey Map

Prepared by: Environmental Communications, Inc.
Source: U.S. Department of Agriculture Soil Survey

Figure 11
Page 4-5

Waipahu (WzA, WzB, WzC) soil series (Figure ~~9~~ *11*). Soils found of the project site consist of the following.

EmA 'Ewa silty clay loam, moderately shallow, 0 to 2 percent slopes: 65.1
EmB 'Ewa silty clay loam, moderately shallow, 2 to 6 percent slopes: 21.4
MnC Mamala stony silty clay loam, 0 to 12 percent slopes: 196.1

4.4.3 Agricultural Lands of Importance

The State Department of Agriculture "Agricultural Lands of Importance to the State of Hawai'i" (ALISH) map for O'ahu identifies the lands as *Prime and Other Important Agricultural Lands.* This system classifies lands as *prime, unique or other.* A portion of the project site is classified as *prime* while the majority is categorized as *other* which is non-prime or non-unique (Figure ~~10~~ *12*).

4.4.4 Geotechnical Engineering

A study of soil conditions as they relate to construction methodologies and impacts was conducted by Geolabs, Inc. for the proposed *'Ewa Makai-East* project. The study, titled *Geotechnical Engineering Exploration, East 'Ewa Makai Project, 'Ewa, O'ahu, Hawaii*, is provided as Appendix B. Please refer to this document for a technical analysis of soil conditions in relationship to building foundation methodologies. *A geotechnical engineering study for Ewa Makai-West is currently under contract.*

Anticipated Impacts and Mitigative Measures

The proposed project will not create or cause significant environmental impacts on the geology or soils. No mitigation measures are required.

4.5 Agricultural Impact

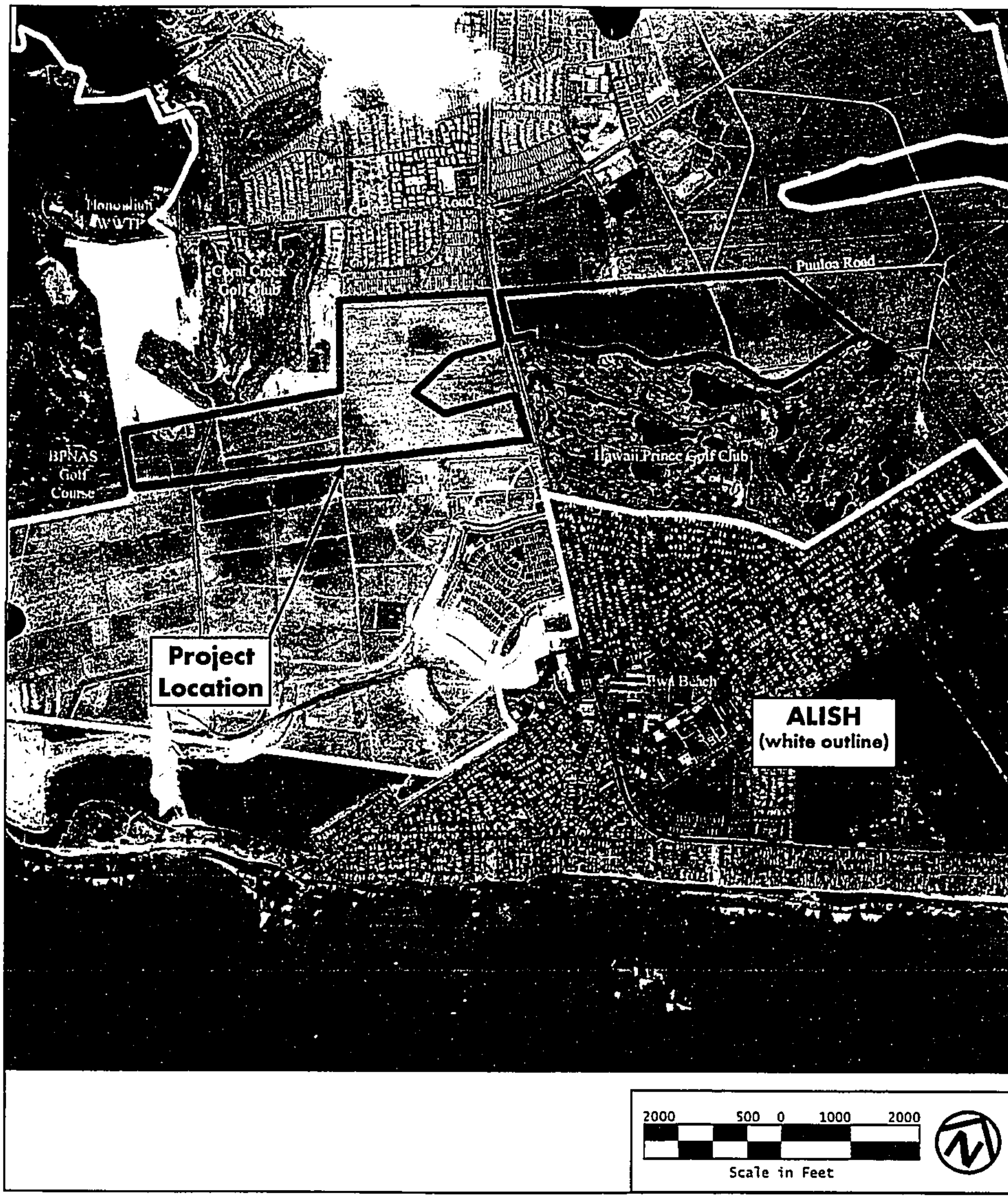
A report on the agricultural impact of the proposed action was prepared by Decision Analyst, Inc. and is attached as Appendix C. This report, titled *Impact on Agriculture*, is summarized as follows.

Existing Conditions

4.5.1 Agricultural Policy and Rating Conditions

The Project area contains three soil types as determined by the Soil Conservation Service, now known as the Natural Resources Conservation Service (NRCS):

	Acres
EmA, 'Ewa silty clay loam, moderately shallow, 0 to 2 percent slopes.	65.1
EmB, 'Ewa silty clay loam, moderately shallow, 2 to 6 percent slopes.	21.4
MnC, Mamala stony silty clay loam, 0 to 12 percent slopes.	196.1



Gentry 'Ewa Makai

Agricultural Lands of Importance to the State of Hawai'i (ALISH)

Prepared by: Environmental Communications, Inc.
Source: State of Hawai'i, Department of Agriculture

Figure 12
Page 4-7

Three classification systems are commonly used to rate soils in Hawai'i: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawai'i, and (3) Overall Productivity Rating.

Land Capability Grouping (NRCS Rating)
The 1972 Land Capability Grouping by the United States Department of Agriculture NRCS, rates soils according to eight levels, ranging from the highest classification level, I, to the lowest level, VIII.

Assuming that the land is irrigated, soil types EmA and EmB - which cover about 30.6% of the Project area—have land capability ratings of ~~IIs and IIe~~ *IIs and IIe*, respectively. The II indicates that the soils have moderate limitations that reduce the choice of crops that can be grown successfully, or indicates that moderate conservation practices are required. The subclassification "s" indicates that the limitation is due to stoniness, unfavorable texture, shallowness, or low water-holding capacity; the subclassification "e" indicates a risk of erosion.

Soil MnC, which covers 69.4% of the Project area, has a land capability rating of IIIs, which indicates that the soils have severe limitations that reduce the options on plants, require special conservation practices, or both.

Agricultural Lands of Importance in the State of Hawai'i (ALISH)
The ALISH ratings were developed in 1977 by the NRCS, the University of Hawai'i (UH) College of Tropical Agriculture and Human Resources, and the State of Hawai'i, Department of Agriculture. This system classifies agricultural land into three categories: (a) Prime, which is best suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment; (b) Unique, which is non-Prime agricultural land currently being used for the production of specific high-value crops; and (c) Other, which is non-Prime and non-Unique agricultural land that is important to the production of crops.

Approximately 30.6% of the Project area is rated Prime (soil types EmA and EmB), and 69.4% is rated Other (soil type MnC).

Overall Productivity Rating (LSB Rating)
In 1972, the UH Land Study Bureau (LSB) developed the Overall Productivity Rating, which classifies soils according to five levels with A representing the class of highest productivity and E the lowest. About 23.2% of the Project area is rated A and the remaining 76.8% is rated C.

Summary Evaluation of Soil Quality:
About 23% to 31% of the Project area is comprised of higher quality soils. The remaining lands have lower quality (stony) soils, but they are still suitable for crop farming.

4.5.2 Physical Conditions as Relating to Agriculture

Consistent with the above soil ratings, the better agricultural lands exhibit a number of favorable characteristics: they are good for machine tilling; slopes are gentle (see below); and the soils are moderately fine in texture, not stony, more than 30 inches deep, and well-drained.

Most of the lower-quality lands have characteristics quite similar to the more highly rated soils in the Project area, except that the soils are moderately good for machine tilling, stony, and less than 30 inches deep.

The elevation of the Project area ranges from about 20 to 35 feet above mean sea level. At this elevation, the land is suitable for crops that are generally referred to as "low-elevation crops," as opposed to "high-elevation crops" (such as those being grown in Kula, Maui or Waimea on the Big Island).

Except for two pronounced sumps near the eastern boundary of 'Ewa Makai-East, slopes are approximately 1%.

The climatic conditions of the site are temperate. The Project area receives considerable sunshine, with an average daily insolation exceeding 500 calories per square centimeter. The average low temperatures range from about 60°F in the winter to about 70° in the summer, while the average high temperature ranges from just under 80° in the winter to just under 90° in the summer. Average annual rainfall in the Project area is slightly more than 20 inches.

Access to a large volume of low-cost irrigation water may no longer be available to irrigate crops in the Project area because groundwater recharge from diversified crops in 'Ewa is far less than it was when the surrounding land was planted in sugarcane.

The fields are reached via Fort Weaver Road and former cane haul roads. The Project area is well located for serving the Honolulu consumer market and export markets. This is due to the short trucking distance to Honolulu markets, Honolulu Airport, and Honolulu Harbor.

Given the nearby homes at 'Ewa Gentry and Ocean Pointe, nuisances arising from farm operations could become an issue for both residents and farm operators if the land were to be farmed. Some residents close to farming operations would be likely to complain about occasional noise, dust, chemical spraying, etc. In turn, addressing the complaints could adversely affect farming operations.

Summary of Soil and Physical Conditions:
As much as 86 acres of the Project area are well suited for growing low-elevation crops. This evaluation is based on the favorable soil conditions and ratings over 31% of the site, the gently sloping terrain, the very sunny climate, good access,

and the short trucking distance to the Honolulu markets and to shipping terminals. However, crop farming could be limited by a lack of access to a large volume of low-cost irrigation water and by nuisance problems with neighboring residential communities.

4.5.3 Impact on Potential and Existing Agricultural Uses

Based on the above agronomic conditions, the Project area is suitable for low-elevation crops commercially grown in Hawai'i, including but not limited to: asparagus, beans (green, bush, and snap), bell peppers, bittermelon, cantaloupe, Chinese peas, cucumbers, daikon, dry onions, eggplant, flowers/nursery products, ginger root, green onions, green peppers, head and semi-head lettuces, herbs, honeydew melons, limes, lotus root, lychee, Manoa lettuce, mango, mustard cabbage, Oriental squash, parsley, pumpkins, seed crops, sweet corn, sweet potatoes, tangerines, and watermelons.

For approximately 100 years ending in the early 1990s, the land was used for cultivating sugarcane. Since the closure of O'ahu Sugar Co., Ltd., limited grazing has occurred on the property (see below).

~~Currently~~ *Until recently*, nearly all of the property is leased to Ralph's Ranch on a month to month basis, which also leases about 500 acres in Kunia and Kahuku. About 75 head of cattle and a half dozen horses ~~graze~~ *grazed* on the total acreage, and another 10 or so horses ~~are~~ *were* penned. The 'Ewa acreage ~~provides~~ *provided* sufficient grass to graze about 20 head, more or less, depending on rainfall and supplemental feed. The ranch is operated as a hobby by a father and son and has no employees. Development of the Project is expected to have a modest impact on ranch operations, possibly reducing the size of the herd by a dozen or more head.

The Project will commit about 283 acres of agricultural land to a non-agricultural use. However, this commitment will not adversely affect the growth of diversified agriculture. This conclusion is based on the findings from Appendix A of the *Impact on Agriculture* report which states "ample land is available for diversified agriculture".

> A vast amount of land has been released from plantation agriculture (about 236,200 acres since 1968), and this release of land has far outpaced the demand for land for diversified crops (an increase of about 38,500 acres over this same period). The net decrease in crop land amounted to 197,700 acres. While some of the released land has been converted or is scheduled to be converted to non-agricultural uses, most of it remains available for diversified crops. Thus, ample land is available in Hawai'i to accommodate the growth of diversified agriculture.

It also states that "Land is not the limiting factor to the growth of diversified agriculture".

> Consistent with the above, the limiting factor to the growth of diversified agriculture is *not* the *land supply,* but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

These findings also apply to O'ahu. Since 1968, the contraction and eventual closure of Kahuku Plantation Co., O'ahu Sugar Co., Ltd., and Waialua Sugar Co., Inc. released about 37,860 acres. Also, most of the 22,500 acres released from sugar production during the 1990s remain available. Fields in Kunia and 'Ewa are regarded as among the best farmland in Hawai'i. These lands have been leased, but markets for crops grown on the land are still being developed. On the North Shore, various crops are being explored, but most of the former sugarcane land remains fallow.

With regard to the Project, it will involve the loss of far too little good agricultural land to adversely affect the availability of land to farmers on O'ahu or in other parts of Hawai'i, or to adversely affect the growth of diversified agriculture in Hawai'i.

While the Project will result in urban development on some good agricultural land, this loss to agriculture will be offset by the following benefits: new homes for about 1,865 families, about 1,500 jobs at the industrial-commercial center, ~~30~~ *24* acres of community facilities, and 11.5 acres of new parks.

For comparison, the ~~current~~ *past* grazing operation supports a fraction of one job, while 283 acres planted in crops could support about 35 jobs (based on 12.5 farm jobs per 100 acres).

4.5.4 Consistency with State and County Agricultural Policies

The *Hawai'i State Constitution*, the *Hawai'i State Plan*, the *State Agriculture Functional Plan*, and the *General Plan of the City and County of Honolulu* call for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture. To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to plantation agriculture, no existing sugarcane or pineapple plantation will be impacted by the Project.

With regard to diversified agriculture, the Project will reduce the availability of agricultural land. However, because of the vast amount of land that has been released from plantation agriculture since the late 1960s, ample agricultural land is available on O'ahu and on other islands to accommodate the growth of diversified agriculture. Thus, the Project will *not* limit the potential growth of diversified agriculture.

Regarding policies "to preserve and protect agricultural lands," discussions in the "Agriculture" portion of the *State Functional Plan* recognize that redesignation of lands from Agriculture to Urban should be allowed "upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in" agriculture; that is, when an "overriding public interest exists." The enormous contraction in plantation agriculture resulting in the supply of agricultural land far exceeding demand constitutes a major change in economic and social conditions. Furthermore, the proposed Project will provide benefits (about 1,865 homes, about 1,500 jobs, etc.) that far exceed those provided by current grazing operations (less than 1 job) or could be provided by diversified agriculture (about 35 jobs). Even with the Project, there will be no loss in existing or potential agricultural employment in view of the availability of agricultural land on O'ahu and throughout the State.

Anticipated Impacts and Mitigative Measures

As concluded by the *Impact on Agriculture* report, the Project will not conflict with the major thrust of the plantation-agriculture portions or the diversified-agriculture portions of State and County policies.

4.6 Hydrology and Groundwater Resources

Existing Conditions

The 'Ewa Plains is divided into two aquifers. The higher aquifer is referred to as a "caprock" coral aquifer and is recharged from surface water drainage. As such, it is not of potable quality and is used primarily as irrigation water. The higher quality aquifer is the basaltic Koolau volcanic series. The makai boundary of this Koolau aquifer is believed to be located north of the project site and above the H-1 Freeway. This aquifer is fed by rainfall occurring in the Koolau Range, which infiltrates surface soils and rock to supply basal groundwater. The surface "cap rock" coral aquifer acts as a barrier between the ground surface and the basaltic aquifer.

Groundwater exists beneath the 'Ewa Makai area as a thin, brackish basal lens in hydraulic contact with saline water at depth and seawater at the shoreline. It is typically referred to as the 'Ewa Caprock Aquifer. Use of this resource for irrigation was begun by the 'Ewa Plantation in the 1930s and continued until Oahu Sugar ceased cultivation of sugarcane on the 'Ewa Plain in late 1994. During that 60-year period of use, a number of skimming type wells were used to extract 15 to 20 million gallons per day (MGD), most of which was drawn from the eastern (Pu'uloa) side of the 'Ewa Plain. The rate of pumpage was actually far in excess of the aquifer's natural rate of recharge. However, it was sustained by the plantation's excess irrigation of mauka fields by better *quality water and the direct import of this water to the largest of the pumping centers on the caprock.*

In late 1994, use of caprock groundwater abruptly dropped, from more than 15 MGD to about 3 MGD. Most of the remaining use was by three golf courses around the 'Ewa Makai area: Hawaii Prince, New 'Ewa Beach, and Coral Creek. In the year 2001, BWS began selling treated wastewater effluent of R-1 quality to two of the three courses, further reducing the draft from the aquifer. At present, use of the caprock aquifer on the eastern side of the 'Ewa Plain consists of 0.7 MGD by the New 'Ewa Beach golf course and a far lesser amount by a number of small capacity wells throughout the existing 'Ewa by Gentry developed area.

The proposed average demand of potable water is estimated at .5026 MGD (Nance, 1993, *Potable Water Master Plan for 'Ewa by Gentry*, Appendix D). This quantity is based on the proposed scope of development which represents a relatively small portion of the 4.2274 MGD average demand of the entire 'Ewa by Gentry community upon final build out.

The State Commission on Water Resource Management monitors and approves the cumulative request for source development. Source requirements for the total Master Plan Project were approved by this Commission for the water requirements reported in the 1993 EIS and have been reconfirmed, based on the current requirements identified in the 1993 supplemental document. The Board of Water Supply has indicated that an adequate supply to serve the entire 'Ewa region is available through existing and soon to be completed sources (Appendix E).

Anticipated Impacts and Mitigative Measures

Potable water use will increase by .5026 MGD. No mitigation measures are required; however, water conservation programs within the development will be used wherever practicable.

The caprock aquifer is still in the process of adjusting to the major changes in its use described above. However, development of the 'Ewa Makai site should have no significant impact on this naturally shrinking resource. (Source: Discussion with Tom Nance, Tom Nance Water Resource Engineering, January 2003.)

All necessary on-site water facilities will be provided in consultation with the Board of Water Supply (BWS) and will be built in accordance with an approved Water Master Plan. (The latest approved potable water master plan for the Ewa by Gentry project, which included Ewa Makai-East and West, was prepared by Tom Nance Water Resource Engineering in September 2000, and was approved by the BWS on November 3, 2000. Included as part of Appendix D is a letter from Tom Nance dated January 31, 2003, which states that based on the current Ewa Makai Land Use Plan, the approved water master plan should still be valid.)

In addition, Gentry is a member of the Ewa Plain Water Development Corporation (EPWDC), a non-profit corporation responsible for planning, financing, and implementing the construction of regional source development, storage reservoirs, and distribution systems. Major portions of EPWDC's water program (including dedicated source and well facilities, storage and transmission for a water system of 6.72 million gallons per day) have already been implemented and were dedicated to BWS in 1991. Although the BWS does not provide advance water allocations or water reservations for projects such as Ewa Makai, BWS expects to have sufficient water for the Ewa Region. According to a BWS letter to Gentry dated January 24, 2003, (also included as part of Appendix D), BWS currently has water system improvement projects in the construction and design stages, which will provide adequate source capacity to accommodate Gentry's proposed development. The Ewa Shaft's estimated yield is 15 million gallons per day (mgd). In addition, the proposed Desalination Facility in Kalaeloa is being designed for 5 mgd with a potential to expand to 35 mgd in the future. The installation of wells at the Waipahu Wells II Station and completion of the Waipahu Wells IV will add 4.21 mgd to BWS's capacity to deliver water. These two projects should be completed this year.

With respect to water conservation practices, Gentry has incorporated the use of non-potable brackish water in its Ewa by Gentry development. It is also studying the possible use of reclaimed water as an alternative to potable water when the nonúpotable systems are inoperable or are no longer available.

4.7 Natural Hazards

Existing Conditions

4.7.1 Flood Hazard

'Ewa by Gentry is located between two major watershed areas. The watershed to the western side of the project site and in close proximity to the proposed action is Kaloi Gulch. ~~According to Panel 150001-0110 of the Federal Flood Insurance Rate Map of 1990, the project site is located in Zone D, and area in which flood hazards are undetermined~~ *The project site, according to FEMA Community Panel Numbers 15001 0310 E and 15001 0330 E (November 30, 2000), is located in zone D. This is an area in which flood hazards are undetermined* (Figure ~~11~~ *13*).

4.7.2 Tsunami Inundation

Under Chapter 205A, Hawai'i Revised Statutes, the project site is not within a Special Management District as indicated on the City and County of Honolulu Special Management Area maps. The project site is not indicated as a vulnerable inundation area on the Civil Defense Tsunami Inundation Maps.

Anticipated Impacts and Mitigative Measures

As previously stated, 'Ewa Makai-West, when developed, will discharge surface runoff to the Kaloi Gulch improvements, and/or into existing greenway/sumps on Gentry lands. 'Ewa Makai-East will be designed to release surface runoff into large sumps on the property with *limited* excess water flowing into the adjacent Hawai'i Prince Golf Course lands ~~which have been designed to accommodate this drainage~~.

4.8 Botanical Resources

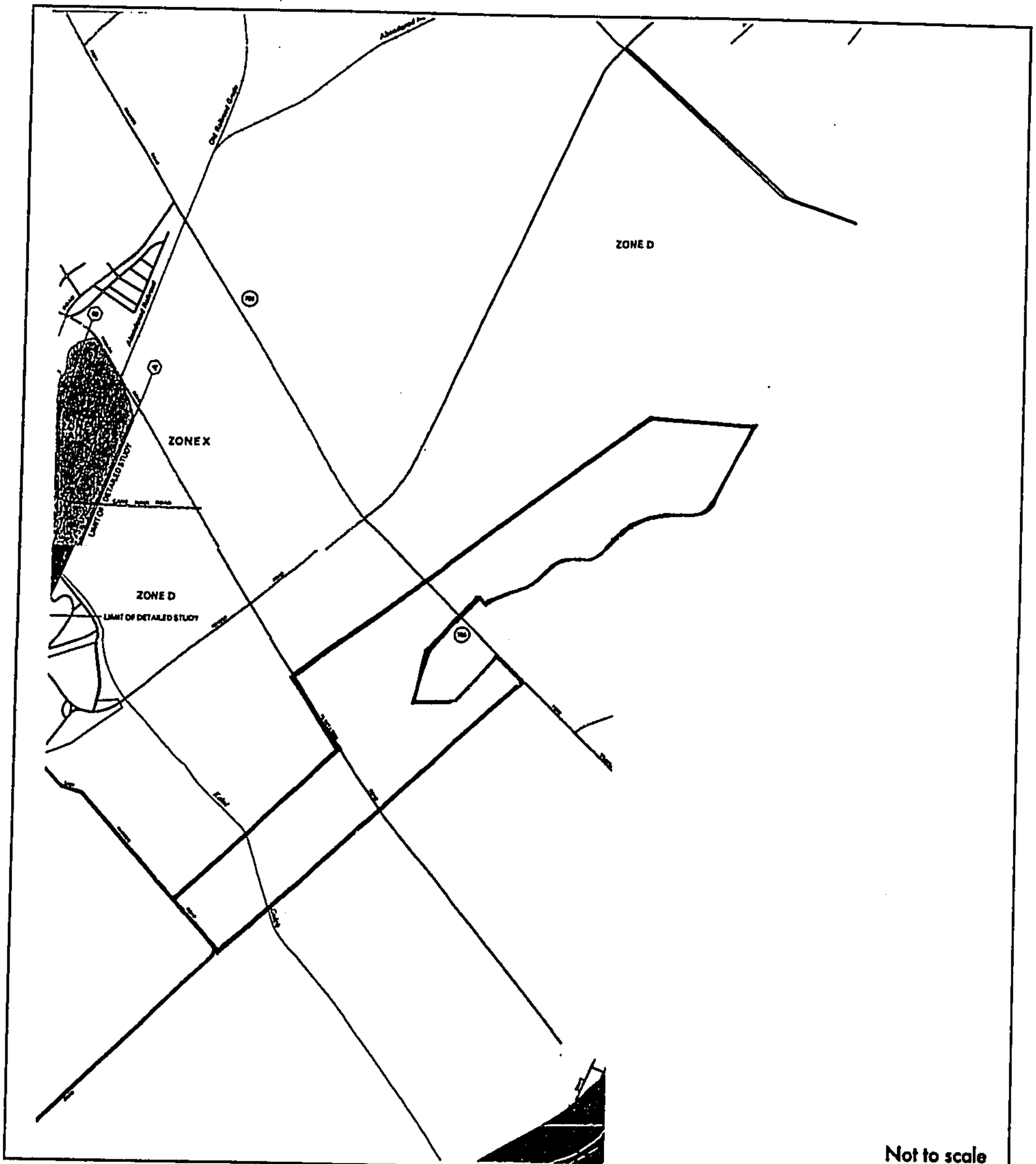
A botanical survey was prepared for the proposed action by Char & Associates in 2001. The study is included in Appendix F and is summarized below.

Existing Conditions

Prior to 1995, the project site was under active sugar cane cultivation. A botanical survey of the site by Char in 1991 described dense fields of sugar cane on the cultivated portions of the site, and weedy vegetation on the uncultivated areas such as along cane haul roads, irrigation ditches, and the Kaloi drainage channel. A ±20-acre parcel surrounded by the 'Ewa Makai West property and Fort Weaver Road was surveyed in 1998 by Char for the proposed Laulani Commercial Center. Weedy scrub vegetation had replaced the former sugar cane fields.

Today, the 283-acre project site is covered by scattered weedy patches and large areas with barren soil. Both the 'Ewa Makai East and 'Ewa Makai-West parcels have been used for grazing horses; as a result the vegetation on both parcels is sparse with about 50 to 60% plant cover.

Due to prolonged drought conditions and grazing pressure, the vegetation on the site consists of live and dried up patches of weedy plants with scattered young trees of kiawe (Prosopis pallida), 10 to 15 ft. tall. Locally abundant are golden crownbeard (Verbesina encelioides), running pop (Passiflora foetida), and 'uhaloa (Waltheria indica). Where the substrate consists of soil and broken up coralline material, Indian pluchea (Pluchea indica) and sourbush (Pluchea carolinensis) become abundant, forming 20 to 30% of the plant cover. A few shrubs of koa haole (Leucaena leucocephala), klu (Acacia farnesiana), and Christmas berry (Schinus terebinthifolius) are found scattered here and there; these tend to be 1 to 3 ft. tall. Other plants which occur here in smaller numbers include buffelgrass (Cenchrus ciliaris), Australian saltbush (Atriplex semibaccata), virgate mimosa (Desmathus pernambucanus), Sida ciliaris, and pa'uohi'iaka (Jacquemontia ovalifolia ssp. sandwicensis). 'Ilima (Sida fallax) occurs as scattered shrubs, but may be locally abundant during the wetter months.



Gentry 'Ewa Makai

Flood Insurance Rate Map (FIRM)
Panels 15001 0310 E and 15001 0330 E

Prepared by: Environmental Communications, Inc.
Source: Federal Emergency Management Agency, 11/30/2000

Figure 13
Page 4-16

On the 'Ewa Makai-West parcel, the former Kaloi drainage channel supports dried clumps of Guinea grass (Panicum. maximum) and koa haole shrubs. A few live castor bean plants (Ricinus communis) are found here. Where the parcel abuts the Barbers Point Naval Air Station Golf Course, there is a strip of greener vegetation with more or less dense buffelgrass and weeds such as false mallow (Malvastrum coromandelianum), hairy spurge (Chamaesyce hirta), Boerhavia coccinea, and Calyptocarpus vialis.

On the 'Ewa Makai-East parcel, low lying swale areas which receive runoff from the adjacent mauka projects support dense, green patches of golden crown-beard, large Pluchea shrubs (7 to 8 ft. tall), 'ilima, ivy gourd (Coccinia grandis), 'uhaloa, hoary abutilon (Abutilon incanum), coat buttons (Tridax procumbens), etc. A small drainage way with standing water supports a number of weedy species including spiny amaranth (Amaranthus spinosus), slender amaranth (Amaranthus viridis), wiregrass (Eleusine indica), false daisy (Eclipta alba), castor bean, Leptochloa fusca ssp. uninervia, common purslane (Portulaca oleracea), nutgrass (Cyperus rotundus), and Bermuda grass (Cynodon dactylon).

Anticipated Impacts and Mitigative Measures

The project site has been disturbed for a long period of time, first by extensive sugar cane cultivation and recently by grazing activity. As a result, the vegetation on the site consists largely of introduced or alien plant species such as sourbush, Indian pluchea, golden crown-beard, buffelgrass, kiawe, etc. Of a total of 62 species inventoried on the site, 56 (90%) are introduced. A few native species occur on the site, some of them in fairly large numbers. These are: 'uhaloa, 'ilima, pa'uohi'iaka, kipukai (Heliotropium curassavicum), hoary abutilon, and popolo (Solaum americanum). Only the pa'uohi'iaka is endemic, that is, it is native only to the Hawaiian Islands. The other species are indigenous, that is, they are native to the Hawaiian Islands and elsewhere.

An intensive search was made for Abutilon menziesii, a listed endangered species belonging to the mallow family. The Abutilon is known from the abandoned sugar cane fields on the Varona Village/ 'Ewa mill area (Nagata 1996; PBR Hawai'i 1998). No Abutilon menziesii plants were found nor did we encounter any other threatened and endangered species or species of concern (U.S. Fish and Wildlife Service 1999; Wagner et al. 1999) on the project site.

Given these findings, the proposed development of the site is not expected to have a significant negative impact on the botanical resources. It is recommended, however, that landscaping be installed as soon as possible to prevent dust problems and soil loss.

4.9 Faunal Resources

A faunal survey for the project area was prepared by Phil Bruner, Environmental Consultant in May of 2001. This report, titled *Avifaunal and Feral Mammal Survey of the 'Ewa by Gentry Makai Development Project, O'ahu*, is found in Appendix G and is summarized below.

Existing Conditions

Native Birds:
No native birds were recorded on the field survey. The only native species that might occur in this area is the endangered Short-eared Owl (Asioflammeus sandwichensis). The Hawaiian name for this bird is Pueo. They are found on all the main Hawaiian Islands but are only listed as endangered on O'ahu. Pueo nest on the ground and forage over open fields and forests. They are known to occur in 'Ewa and have been seen on the nearby HASEKO property (Bruner 1994). The available habitats and location of this site are not appropriate for other native birds. The absence of wetlands also makes this property unattractive to native waterbirds. Earlier studies in this region have found similar results (Bruner 1991, 1993, 1994).

Migratory Birds:
Two species of migrants were seen on the survey. An average of 18 Pacific Golden-Plover (Pluvialisfulva) were tallied over the two survey days. Five Ruddy Turnstone (Arenaria interpres) were seen on 26 April. These species are not endangered or threatened. They are the two most common migrants to Hawai'i (Pratt et al. 1987), Hawai'i Audubon Society 1993).

Introduced Birds:
Sixteen species of introduced birds were recorded over the two survey days. Table 2 lists these birds and gives their relative abundance. None of these species is endangered or threatened. The array of birds recorded at this location is typical of this region of the island (Hawaiian Audubon Society 1993).

Mammals:
The only species of mammal observed on the survey was the Small Indian Mongoose (Herpestes auropunctatus). A total of three mongoose were tallied. Feral cats (Felis catus) and rats (Rattus spp.) were not recorded but likely occur on and near the property. The endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus) was not found. This species is rarely recorded on O'ahu but is fairly common on Kauai and the Big Island (Tomich 1986, Kepler and Scott 1990). The Hawaiian Hoary Bat forages in a wide variety of native and non-native habitats including urban areas. They generally roost solitarily in trees.

Anticipated Impacts and Mitigative Measures

The survey of this site found the typical array of introduced birds that normally occur in the lowlands in this region of the island. The presence of the two migratory species was likewise expected. These birds utilize open habitats such as fields and lawns to forage for insects. The Small Indian Mongoose is common in dry lowland habitats.

No unique resources important to native birds were discovered on this property. Weed covered fields are not uncommon in west O'ahu. The development of this property will likely result in the decrease of some species and an increase in the populations of other introduced birds.

Table 2: Introduced Birds Survey

Common Name	Scientific Name	Relative Abundance
Cattle Egret	*Bubulcus ibis*	R
Ring-necked Pheasant	*Phasianus colchicus*	R
Spotted Dove	*Streptopelia chinensis*	C
Zebra Dove	*Geopelia striata*	A
Sky Lark	*Alauda arvensis*	A
Red-vented Bulbul	*Pycnonotus cafer*	C
Northern Mockingbird	*Mimus polyglottos*	U
Common Myna	*Acridotheres tristis*	A
Japanese White-eye	*Zosterops japonicus*	U
Northern Cardinal	*Cardinalis cardinalis*	C
Red-crested Cardinal	*Paroaria coronata*	U
House Finch	*Carpodacus mexicanus*	A
House Sparrow	*Passer domesticus*	R
Common Waxbill	*Estrilda astrild*	A
Nutmeg Mannikin	*Lonchura punctulata*	A
Java Sparrow	*Padda oryzivora*	C

Relative abundance estimates are based on the following scale: Abundant = 25+; Common = 15-24; Uncommon = 5-14; Rare = less than 5 tallied for the entire time of the survey.

5.0 Built Environment, Potential Impacts and Mitigative Measures

5.0 EXISTING BUILT ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATIVE MEASURES

5.1 Archaeology, Historic and Cultural Resources

Pacific Legacy, Inc., conducted an archaeological survey for the proposed project to assess the probability of an archaeological or cultural remains on the project site. This report, titled *Archaeological Survey for the Proposed* 'Ewa *Gentry Makai Development* 'Ewa *District, Ahupua'a of Honouliuli, Island Of O'ahu* can be found in its entirety in Appendix H.

5.1.1 Historic Land Use

Kamehameha gave the entire *ahupua'a* of Honouliuli to Kalanimoku, after he conquered O'ahu, with the right that he could pass it on to his heirs. Later, Kalanimoku passed on the land to his sister Wahinepi'o.

The entire *ahupua'a* of Honouliuli (Land Commission Award 11216, Apana 8; approximately 43,250 acres) was awarded to a granddaughter of Kamehameha I, Mikahela Kekau'nohi, one of the wives of Kamehameha II and daughter of Wahinepi'o (who she likely claimed the land through). Kekau'nohi was awarded land on all of the Hawai'ian Islands including the *ahupua'a* of Honouliuli and Waimalu on O'ahu (LCA records on file at the State of Hawai'i, Bureau of Conveyances; Vol. 9, pg. 659). "About 150 acres of the *ahupua'a* (Honouliuli) were excluded as part of *kuleana* awards to commoners" (Tuggle and Tuggle 1997:34). A total of 72 awards were made all of which appear tò be in or adjacent to Honouliuli Gulch (Tuggle and Tuggle 1997:34), which is not within or near the project area.

By the 1850's cattle ranching was firmly established at 'Ewa with an estimated 12,000 head of cattle. By 1877, James Campbell was said to have some 32,000 head of wild cattle (Briggs 1926, quoted in Kelly 1991: 162). The sugar industry in Hawai'i began to rapidly expand in the 1890's and severely altered the appearance of the ''Ewa Plain and the rest of the islands. Construction for the O'ahu Railway & Land (OR&L) railroad began in 1889 and eventually went around the island. This opened up ''Ewa and the rest of O'ahu for sugar, pineapple, and eventually military use.

In 1888, Benjamin F. Dillingham's company O'ahu Railway and Land Company began construction of the OR&L railroad that was to extend westward from Honolulu. By 1890 it extended to Pearl City, by 1895 it extended to Waianae, and by 1899 it extended to Kahuku, the farthest point form Honolulu. The railroad carried both passengers and freight. The railroad was instrumental in the development of several sugar plantations ('Ewa Plantation Company, Kahuku

Plantation Company, O'ahu Sugar Company, and the ~~Wailua~~ *Waialua* Agricultural Company) as well as James Dole's pineapple efforts in central O'ahu. During World War II, the O'ahu Railway, as it became to be known, transported supplies, munitions, troops, and defense workers. At its height, the O'ahu Railway consisted of 175 miles of track. After World War II, railroad business declined dramatically – in 1947 all operations outside of Honolulu were abandoned, a pineapple shuttle from Pier 34 to the cannery ceased operation in 1972. A portion of the railroad right-of-way between Nanakuli and Honouliuli was placed on the National Register of Historic Places.

In 1893 the first sisal or *malina* (*Agave sisalana*) plants were imported from Florida (approximately 20,000 plants) and experimentally planted in an area southeast of Pu`u o Kapolei. The Hawai'ian name, *malina,* means marine, indicating that the plant was used in the manufacturing of marine ropes (Neal 1965: 225). The Hawai'ian Fibre Company was established in 1898 to utilize the sisal grown on the 300 acre plantation in 'Ewa (Tuggle and Tuggle 1997: 37). The production of sisal in 'Ewa continued into the 1920's.

By the 1920s, Honouliuli was used almost exclusively for sugar cultivation and ranching. The 'Ewa Plantation Company controlled approximately 12,000 acres which included sugar cane, a sisal plantation, residential areas for several thousand people, and a limestone quarry. The O'ahu Sugar Company controlled 3,000 acres although not all of it was planted in sugar. Honouliuli Ranch, the largest landholder, controlled approximately 20,000 acres with much of it considered waste because it contained gullies and rocks. Six thousand acres were reportedly planted in pineapple, or forest and wetland.

Frierson (1973) indicates that the 'Ewa Plantation Company drastically altered the landscape in an attempt to increase the amount of fertile agricultural land. Prior to the rainy season, the plantation excavated drainage ditches from the lower slopes of the Wai'anae range down to the lowlands. Vertical channels were cut into the adjacent slopes to encourage erosion. Frierson writes that "enough soil was washed down the ditches and deposited on the plain to reclaim 373 acres in a few years" (Frierson 1973:17). "By 1931, 'Ewa Plantation had seventy artesian and four surface wells with eighteen pumps (Wilcox 1996: 107).

The 'Ewa Plantation was acquired by O'ahu Sugar Company in 1970. The O'ahu Sugar Company operated two mills in 'Ewa and Waipahu. Sugar cultivation along the 'Ewa Plain began a slow and steady decline in the 1970's. The O'ahu Sugar Company with the demise of sugar ceased operations at 'Ewa in 1994. Real estate development has flourished including the creation of Kapolei, touted as O'ahu's "second city."

5.1.2 Archaeological Background

The first archaeological sites identified on 'Ewa were recorded by J. Gilbert McAllister (1933) in the 1930's. McAllister identified several sites on the 'Ewa Plain. Among these were Site 138, Site 139, Site 141, Site 145 and Site 146. *None of these are on the Ewa Makai project site.*

Site 138. Puu Kapolei Heiau, on Puu Kapolei hill, Honouliuli.

The stones from the heiau supplied the rock crusher which was located on the side of this elevation, which is about 100 feet away on the sea side. There was formerly a large rock shelter on the sea side where Kamapuaa is said to have lived with grandmother (McAllister 1933:108).

Site 139. Kalanamaihiki fishing shrine at Kapapapuhi, Honouliuli.

Near the end of the small tongue of land that juts out opposite Laulaunui Island in the west loch of Pearl Harbor, are two large rough stones about 2.5 feet in size, with six or seven smooth stones averaging 1 foot in size in a small pile adjoining the larger stones. The entire site is covered with akulikuli and would not be noticed or considered if the Hawai'ians did not know of its former sacredness (McAllister 1933:108).

Site 141. Kaihuopalaai.

The site is named for Kaihuopalaai, said to be the daughter of Konikonia and his wife Hinaaimalama. Fornander (37, vol5, p. 270) writes " on O'ahu, Kaihuopalaai saw a goodly man by the name of Kapapaapuhi (site 139) who was living at Honouliuli, 'Ewa; she fell in love with him and they were united, so Kaihuopalaai has remained in 'Ewa to this day. She was changed into that fishponds in which mullet are kept and fattened, and this fish is used for that purpose to this day" (McAllister 1933:108).

Site 145. Puuloa.

Puuloa, site where the first breadfruit in Hawai'i is said to have been planted. As noted by Thrum: Tradition credits the introduction of the breadfruit trees in these islands to Kahai, a son of Moikeha, who brought a species from Upolu, in the Samoan Group, on his return voyage from Kahiki, and planted same at Puuloa, O'ahu (McAllister 1933:109).

Site 146. The 'Ewa Coral Plains.

Site 146, 'Ewa coral plains, throughout which are remains of many sites. The great extent of old stone walls, particularly near the Puuloa Salt

Works, belongs to the ranching period about 75 years ago. It is probable that the holes and pits in the coral were formerly used by the Hawaiians. Frequently the soil on the floor of the larger pits was used for cultivation, and even today one comes upon bananas and Hawai'ian sugar cane still growing in them. They afford shelter and protection, but I doubt if previous to the time of Cook there was ever a large population there (McAllister 1933:109).

5.1.3 Previous Archaeology

A vast number of archaeological studies have been conducted on the 'Ewa Plain in recent years. These investigations are related to the expansive development that has taken place on the 'Ewa Plain in the last 20 years. Only a limited number of investigations will be presented here. For a complete synthesis of the cultural resources recorded on the 'Ewa Plain prior to 1995, the reader is directed to Tuggle and Tuggle (1997). Additional information can be obtained from Haun (1991) and Tuggle (1995).

In 1975, Clark and Connolly (1975) conducted an archaeological reconnaissance survey for the Honouliuli Sewage Treatment plant and ocean outfall. They surveyed the entire parcel proposed for the facility. No sites were identified. Clark and Connolly did not survey the corridor that extended makai from the plant to the ocean since it passed through sugarcane fields. However, they did survey the beach portion where the outfall would be located. No cultural features were identified. They concluded that if any significant cultural resources would be impacted, it would be located on the beach and not on the plain itself.

In 1978 A. Sinoto (1978) of the Bishop Museum conducted archaeological test excavations at Barbers Point. While excavating limestone sinkholes, Sinoto recovered the remains of numerous fossil bird bones "including the skeletal remains of many extinct species, such as large flightless geese, eagles, ibises, finches" (Kirch 1985:117). Later studies have indicated that human alteration of the environment (i.e. land clearing of the native vegetation) and direct predation may have led to the extinction of these species.

In 1979, Bert Davis (1979) conducted archaeological investigations in an area totaling approximately 1,099 acres. This area was previously surveyed by Jourdane (1979) for the proposed 'Ewa Marina Community Development. The survey resulted in the identification of 18 previously unrecorded archaeological sites (State Site Numbers 3201-3218) composed of 107 features including sinkholes, mounds, platforms, and enclosures. A second survey, performed in an area previously utilized for sugar cane cultivation, did not identify any archaeological sites.

In 1983, Hommon and Ahlo (1983) conducted archaeological subsurface testing at the proposed 'Ewa Marina Community Development Area (TMK 9-1-12:2-3, 5-17, 23, 28). The project area is located south of the area previously surveyed by Davis (1979) and Jourdane (1979). A total of five trenches were excavated. No cultural remains were identified.

In 1987, Paul H. Rosendahl, Inc, (Dicks et al. 1987) conducted an archaeological reconnaissance survey with subsurface testing on a 216-acre parcel for the proposed West Loch Estates Golf Course and parks. A total of seven archaeological sites were identified (State Sites 3318 to 3324). These sites consisted of prehistoric and historic burials and habitation sites located on H'ae'ae Point and on the slopes and uplands surrounding the Honouliuli Stream floodplain. Other sites recorded were remnants of an agricultural system including: irrigated pondfield cropping of the floodplain, and dryland cultivation in the surrounding slopes and uplands.

Also in 1987, Rosendahl (1987) conducted an archaeological surface survey with subsurface testing immediately adjacent to area mentioned above (Dicks et al. 1987) as part of the Environmental Impact Statement. The survey resulted in the identification of four archaeological sites including a small cemetery related to the sugarcane industry, a historic surface artifact collection area that pre-dates the sugarcane industry and a probable exposed midden pit.

In 1988, The Bishop Museum (Davis 1988) conducted archaeological testing for the 'Ewa Gentry project at Honouliuli (the current project area). The project area was situated in an area previously utilized for sugar cane cultivation. A surface survey previously conducted by Kennedy (1988) for the same area failed to identify any archaeological sites. No archaeological sites were identified during testing.

Cultural Surveys Hawai'i (Hammatt et al. 1990) conducted archaeological investigations for the proposed 'Ewa Villages project site, immediately north of the Honouliuli Sewage Treatment Plant. A total of 616 acres were surveyed and a total of nine sites were identified, all associated with the sugar cane industry and the supporting plantation. Site types identified were: a historic cemetery, reservoir, a communal bathhouse, OR&L tracks, village store and saimin stand, and a roundhouse.

In 1990, Archaeological Consultants of Hawai'i, Inc (Kennedy et al. 1991) conducted an archaeological inventory survey for the then proposed Puuloa Golf Course (now the New 'Ewa Beach Golf Club)(TMK: 9-1-01:27&6). The project area was bounded is at the south end of Fort Weaver Road and to the north of The Pacific Tsunami Warning Center. The survey resulted in the recording of 72 prehistoric, historic and modern sites. Most of the sites were sinkholes containing cultural material, C-shapes, enclosures and mounds. Kennedy and Denham

(1992) conducted data recovery at sites slated to be impacted during construction of the golf course. It was concluded that initial occupation of the area occurred between A.D. 1020-1480. Three of the sites (3910, 3921 and 3770) were judged no longer significant following data recovery. All other sites slated for data recovery were considered significant and recommended for preservation.

In 1991, The Bishop Museum (Goodman and Cleghorn 1991) conducted an archaeological surface survey in conjunction with a historical documents and literature search for the Laulani Fairways Housing project at Pu'uloa (TMK 9-1-10: por. 7; 9-1-12:por.5). The project area is located to the south Honouliuli Sewage Treatment Plant and to the east of Barbers Point Naval Air Station and is approximately 300 acres in size (this is the current project area). No surface cultural remains were identified during the survey.

In 1991, the Applied Research Group (Jayatilaka et al. 1992) conducted an archaeological survey with subsurface testing on a 270-acre parcel for the then proposed Hawai'i Prince Golf Course (also the current project area)(TMK 9-1-10). No surface archaeological remains were identified during the survey. Eleven backhoe trenches and four backhoe scrapes were excavated. No cultural remains were identified and no further work was recommended.

In 1993, Pantaleo and Sinoto (1993) conducted an archaeological inventory survey for a proposed offsite drainage system at the 'Ewa Gentry in Honouliuli. Only one historic site was identified, a concrete drainage ditch that measured 4,600 feet long, 150 feet wide and between 20 and 25 feet deep. No other significant cultural remains were recorded.

Also in 1993, the Bishop Museum (Goodman et al. 1993) conducted an archaeological reconnaissance survey of a proposed commercial project. The project area is located south and east of the Honouliuli Sewage Treatment Plant, and to the west of Fort Weaver Road, surrounded to the north, south and west by former sugarcane fields (the current project area) (TMK 9-1-69:por. 5). No cultural remains were identified.

In 1996, Scientific Consultant Services (Spear 1996) conducted an archaeological survey for an area north of the Honouliuli Treatment Plant, and west of the Tenney and Varona plantation villages. The survey concentrated on two short, shallow gulches present in an area formerly used for sugarcane cultivation. No archaeological sites were identified during the survey.

Tuggle and Tuggle (1997) authored a synthesis of cultural resource studies conducted on the 'Ewa Plain. Although the manuscript was prepared for the Barbers Point Naval Air Station, it examines the prehistory and history, the previous archaeology, and the natural resources found on the 'Ewa Plain. Their manuscript was used in the preparation of this document and proved to be invaluable. It is highly recommended for anyone planning to work in the region.

Paul H. Rosendahl conducted three archaeological data recovery projects (1988, 1989, and 1990) at West Loch Estates Residential Increment I, Golf course and Shoreline Park located in Honouliuli, 'Ewa District, Island of O'ahu (Wolforth et al. 1998). This "work included excavations at Sites 3319, 3320, and 3321; backhoe trenching at Sites 3322 (buried fishpond) and 3324 (extensive pondfield system); and monitoring of construction activities " (Wolforth et al. 1998:ii). The other sites identified were an artifact concentration, human skeletal remains and temporary habitations. Excavations uncovered ash lenses, midden deposits, possible postholes, rock alignments, and a segment of the OR&L railway. Radiocarbon dates obtained from test excavations indicates that the pondfields were in use between 10th and 17th *Century* A.D.

5.1.4 Site Predictability

Due to the impacts of residential and road development, ranching, sugarcane cultivation, and military activities, prehistoric surface remains were not expected within the project area. However, it is possible that excavations will expose sinkholes that have been filled in by alluvium moving downslope, numerous cultivation activities and by various residential and commercial developments. These sinkholes often contain archaeological deposits (i.e. human remains, hearths and extinct bird bones). Numerous sinkholes have been recorded on Barbers Point Naval Air Station and at other areas in 'Ewa. Human burials may also be uncovered during the course of pipeline excavations. Sinkholes and human burials are the most probable site types that may be encountered during the course of the project.

5.1.5 Methods and Results

The archaeological survey was conducted on May 17, 2001. A vehicular survey was conducted around the outer edges of the project area. When areas of interest were identified the archaeologists conducted a pedestrian survey. Given the vast amount of visibility in the area, spacing between archaeologists was between 25-35 m. The project area was photo documented using a digital camera.

The archaeological survey determined that the entire project area had undergone significant impacts from agricultural and developmental use. In fact, evidence of irrigation lines were still present in a large portion of the project area. The entire project area was devoid of any natural features or contours. No archaeological resources were present within the project area.

The area south of the Coral Creek Golf Course contains a large drainage area. This drain apparently serves for runoff purposes of the golf course. The drainage

consists of an excavated area approximately 40 m wide and 3-4 m deep. The entire face of the drain is coral and limestone. A check of the wall of the drain failed to identify any exposed subsurface features.
The survey also determined that parcels adjacent to the current project area are currently being developed for residential housing. This area located along the far eastern end of the project area was previously surveyed by Jayatilaka et al. (1992). See Appendix for additional photographs of the modified nature of the project area.

Existing Conditions

The archaeological survey determined that no archaeological sites are present within the current project area. The archival research and a review of previous archaeological studies on the 'Ewa Plain demonstrate that the area has undergone dramatic and extensive alterations over its long land use history. A review of the previous archaeology for the area indicated that the project area was previously surveyed by Davis (1988) Jayatilaka et al. (1992) and Goodman and Cleghorn (1991) and Goodman (1993). None of these surveys identified any cultural resources within the project area. This fact was confirmed when the current survey also failed to locate any cultural resources within the current project area (See Appendix for photographs).

Anticipated Impacts and Mitigative Measures

Given that the project area was under sugar cane cultivation for approximately 100 years, it seems unlikely that any subsurface cultural materials are still present within the project area. While there are no surface archaeological sites, there is the possibility of encountering subsurface resources in the form of sinkholes containing cultural materials and possibly human burials. These features could be as deep as 3 feet below ground surface. It is recommended that an archaeologist be retained on an on-call basis to assist the contractor in the event that subsurface archaeological resources are encountered.

5.1.6 Cultural Resources

As part of the environmental impact statement process, Pacific Legacy, Inc., conducted a Cultural Impact Assessment for the proposed 'Ewa Gentry Makai development project. The study is attached as Appendix I to this environmental impact statement.

5.1.7 Kupuna Informants

Individuals and organizations knowledgeable about the area and/or cultural practices or features relating to the area were identified and contacted. Oral history interviews and consultations were conducted. In addition, archival research was undertaken to identify additional cultural features in the area and traditional practices that may have been conducted in the area.

5.1.8 Traditional History

Pre- and early post-contact histories of the research area convey a setting that usually refers to the entire ‘Ewa Coral Plain as a unit rather than the individual *ahupua‘a* of Honouliuli or Puuloa. The ‘Ewa plain is relatively flat and inclines slightly to the coastline (south, east, and west), with topography varying little. Coral sinkholes and the volcanic cone Pu‘u o Kapolei are the main topographic deviation.

Pu‘u o Kapolei is a traditional landmark with a rich legendary history, noted from the time of the earliest of ancient settlements in Hawai‘i. Historic activities, however, have destroyed much of the area and its ancient Hawaiian cultural features. The numerous cultural coral sinkholes on the plain - which includes the project area - were filled-in and plowed over during the historic cattle-grazing and later sugarcane production.

Tuggle and Tomonari-Tuggle (1997) have provided a synthesis of the ‘Ewa Plain cultural environment. This information will not be restated here, however, culturally informative themes within their synthesis include: environment, vegetation and fauna, landform subdivisions, archaeology, subsistence resources, cultivation potential, important places, traditions, resources, traditional themes and pre and post-historical documentation. The reader is directed to this report for additional information.

The environment in the research area is documented in numerous historic descriptions as being barren, desolate, and generally unpopulated. Ancient oral histories also refer to the area as barren, however, in considering the flora and avifauna depicted in ancient chants and oral history accounts such as those above, the references to *barren* may have much to do with the relative comparative island environments. Archaeological investigations, reported in the next section, show that sinkholes on the plain were utilized for agricultural purposes. It is likely that any ancient and pre-contact permanent habitations were close to the coastline or stream outlets, at least for those who did not rely on tribute subsistence.

Following the contact years, the area attracted a minimal number of foreign settlers. Only those that could use the area as commercial investment desired land in this area. Initially, the salt-works and cattle (grazing) industries dominated the land, and later sugar cane agriculture extended *makai* into the plain beyond the current project area.

Discussion

The archival and oral historical research conducted indicates that the project parcel is located on the -‘Ewa Coral Plain within an area traditionally referred to as the plain of Kaupea - the barren place for mischievous wandering spirits called *ao ku*‘ewa . Further distinction places the project parcel in an area named Kelea.

This area is documented as having been a main thoroughfare for travelers to the settlements on the western coastline. A trail is documented in oral history as having passed between Pu'u o Kapolei and Pu'u o Palailai.

Any permanent Hawai'ian residents of the coral plains, during both pre- and post-contact years, would have had an arduous time of acquiring subsistence resources, particularly during drought. Resources within the *ahupu'a* of Honouliuli and Puuloa included access to marine resources, and fertile coastline and stream gulch area agricultural lands. The abundant forest resources, mentioned above, were located north of the Honouliuli *ahupua'a*. Avifauna was also available on the plain.

Although the project parcel and surrounding area did not support a large human settlement area, it has a rich cultural history and legendary fame. The area is referred to in many chants and oral histories. The importance of Pu'u o Kapolei as a seasonal solstice landmark related to an ancient cultural viewing event, of which the project area lies in the direct path, is of particular cultural importance. The traditional place name Kaupea, and its cultural significance as the "earthly place for wandering mischievous *ao ku*'Ewa " who did not make it to the desired afterlife realm, identifies the area as an important part of the ancient Hawai'ian belief system.

Anticipated Impacts and Mitigative Measures

The only archaeological sites documented in the project parcel area thus far are the coral sinkholes, which were used for agriculture. The traditional surface for these sites have long been destroyed, with in-fill during the cattle grazing years and plowing during clearing for sugarcane agriculture.

It does not appear that the proposed development will have any adverse effect to traditional cultural activities in the area. The project is not located near the above referenced locations.

5.2 Roadways and Traffic

A traffic impact analysis titled, Traffic Impact Analysis, 'Ewa by Gentry Makai Development, was prepared by Parsons Brinkerhoff for the project. The full study is provided in Appendix J. ~~A schedule of roadway improvements is provided in Table 1~~. *A revised Traffic Impact Analysis Report (TIAR) is forthcoming for review by the Department of Planning and Permitting during the zoning process. The text changes shown in the FEIS will be reflected in the revised TIAR.*

5.2.1 Introduction to Traffic Impact Analysis

The traffic impact analysis documents the assumptions and methodology used and summarizes the findings and recommendations of a traffic impact assessment study for the proposed 'Ewa by Gentry - Makai development in 'Ewa, Oahu, Hawai'i. Existing and projected Year 2010 traffic conditions at key roadway intersections located within the project study area were evaluated. Figure ~~12~~ *14* shows the general location the proposed project, and Figure ~~13~~ *15* illustrates ~~a~~

~~conceptual development~~ *the proposed transit routes* plan for the proposed project. As shown in Figure ~~14~~, *15* the study area is defined by the entrance to the Hawai'i Prince Golf Club to the south, Geiger Road to the north, Keaunui Drive to the east, and Kalaeloa to the west.

The proposed project will include single and multi-family residential development, light industrial uses, and recreational and public facilities. The land for the project is proposed to be re-designated from agricultural to urban use through the State Land Use District Boundary Amendment (SLUDBA) process with the State Land Use Commission. After re-designation, the land will also need to be rezoned for the proposed uses. Figure ~~13~~ *24* illustrates the boundaries of the land proposed for SLUDBA re-designation action.

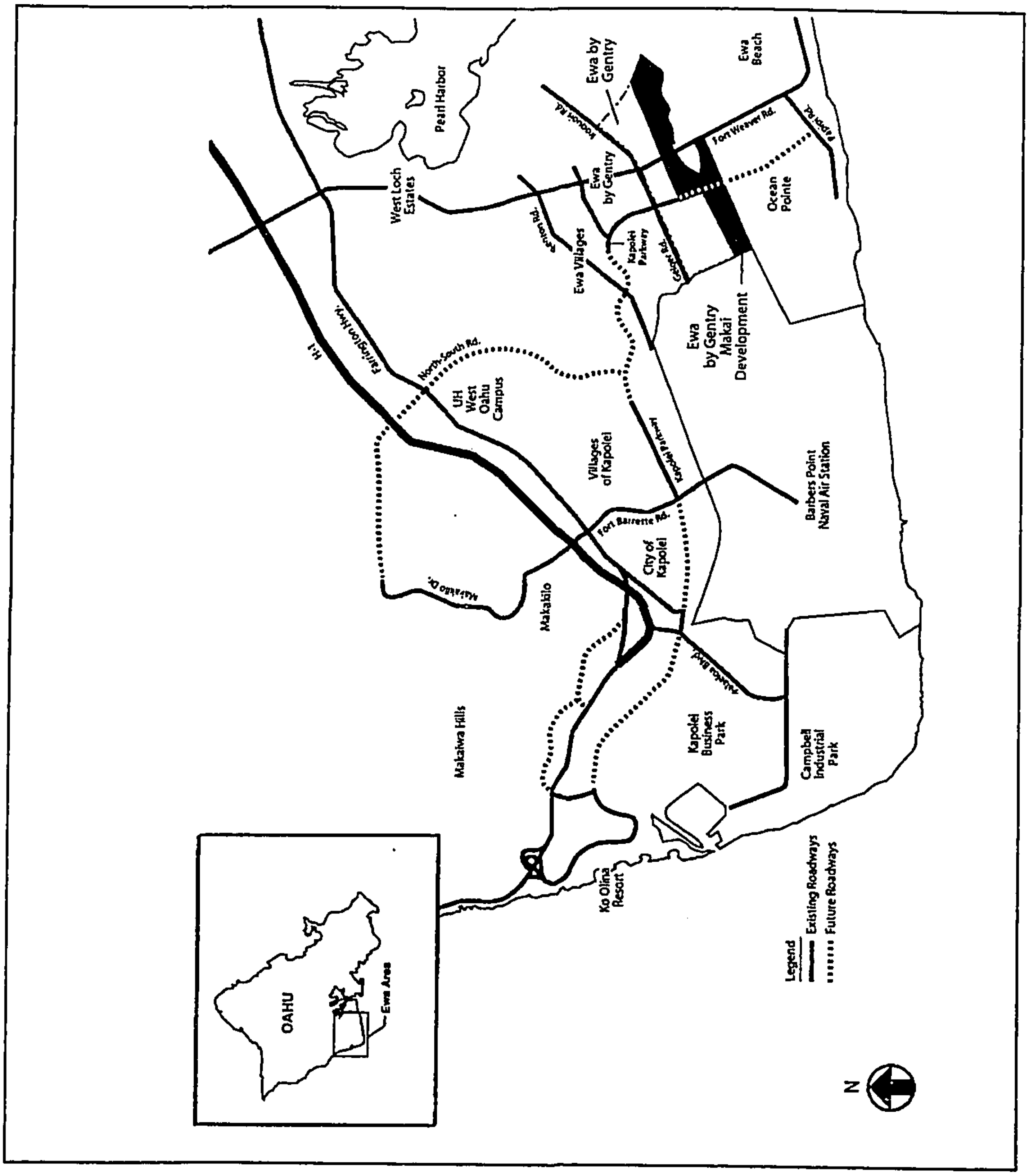
'Ewa by Gentry - Makai is the logical extension of the 'Ewa by Gentry Development currently under development in 'Ewa, Oahu, Hawai'i. A significant proportion of the homes planned to be within 'Ewa by Gentry has already been constructed. Within this development, the new Holomua Elementary School and the Coral Creek Golf Course are complete. As part of the 'Ewa by Gentry development, the segment of Kapolei Parkway between the Oahu Railway and Land (OR&L) right-of-way and 'Ewa by Gentry property line, south of Geiger Road, has been constructed to its ultimate cross-section by Gentry Homes, Ltd.

The proposed 'Ewa by Gentry - Makai project will add 550 singe-family and 1329 multi-family residential units, about 30 acres of light industrial uses, a community recreational center, a new middle school site, two church sites, and two neighborhood park sites. Kapolei Parkway will be extended from Geiger Road south to the 'Ewa by Gentry - Makai property line.

5.2.2 Existing Roadway System

Interstate H-1, Farrington Highway, and Fort Weaver Road/Kunia Road provide regional and sub-regional access to the 'Ewa by Gentry - Makai Development study area. Within the study area, Geiger Road/Iroquois Point Road provides the primary east-west circulation. Fort Weaver Road, Kapolei Parkway, and Keaunui Street provide north-south circulation. Launahele Street, located between Fort Weaver Road and Kapolei Parkway, provides north-south access to existing development. Figure 14 shows the existing roadway lane configurations described in this section.

Fort Weaver Road/Kunia Road (State of Hawaii)
Currently, Fort Weaver Road is the principal north-south arterial roadway serving 'Ewa and 'Ewa Beach. It provides access to Interstate H-1 and Farrington Highway. North of Farrington Highway, it becomes Kunia Road. The southern terminus is east of the 'Ewa Beach International Golf Club where it merges with Cormorant Avenue, leading into the Iroquois Point Naval Housing. Fort Weaver



Gentry 'Ewa Makai

Traffic Vicinity Map

Prepared by: Parsons Brinkerhoff
Source: Parsons Brinkerhoff

Figure 14
Page 5-12

EWA MAKAI CIRCULATION MAP

Gentry Homes, Ltd.

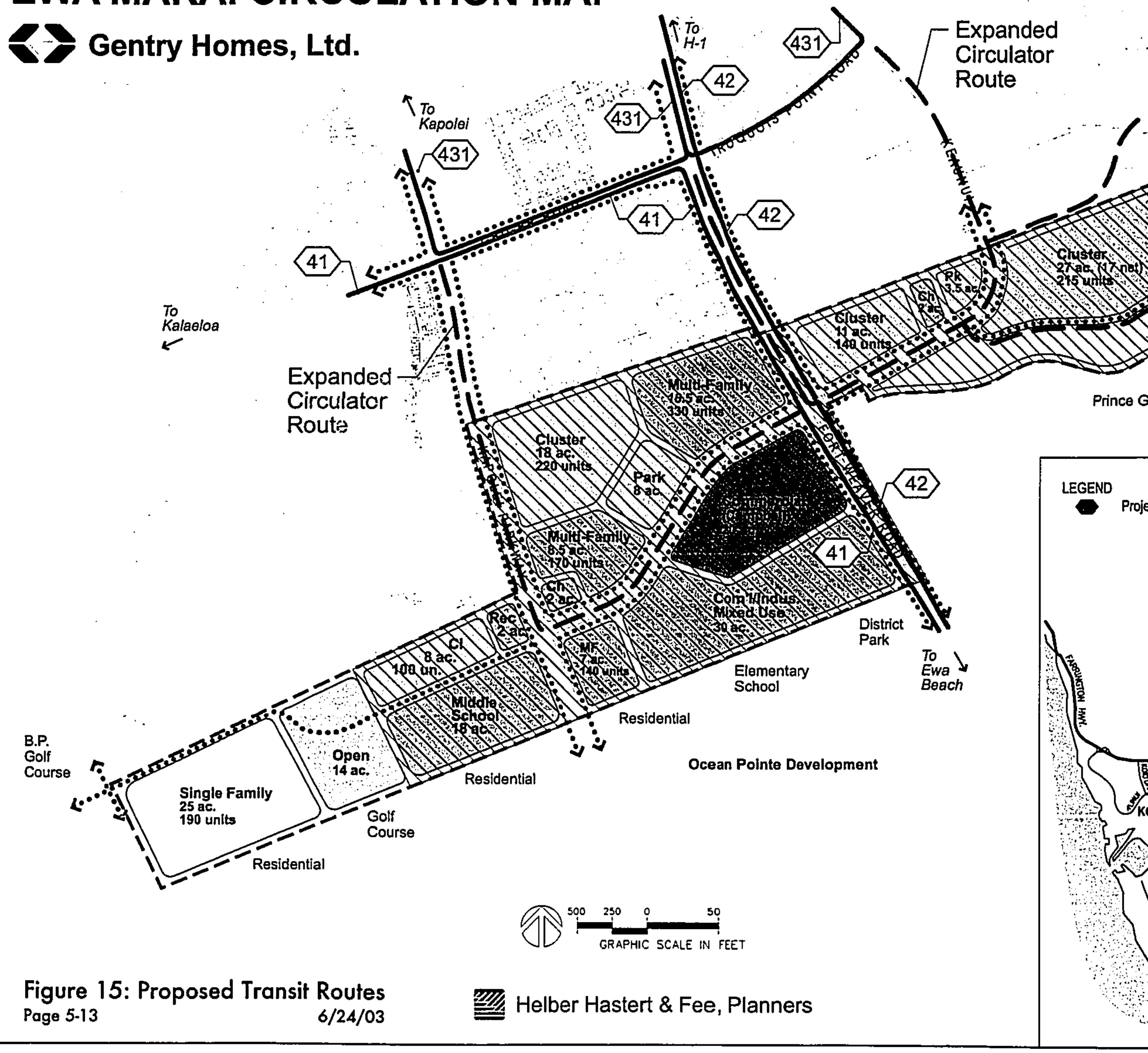
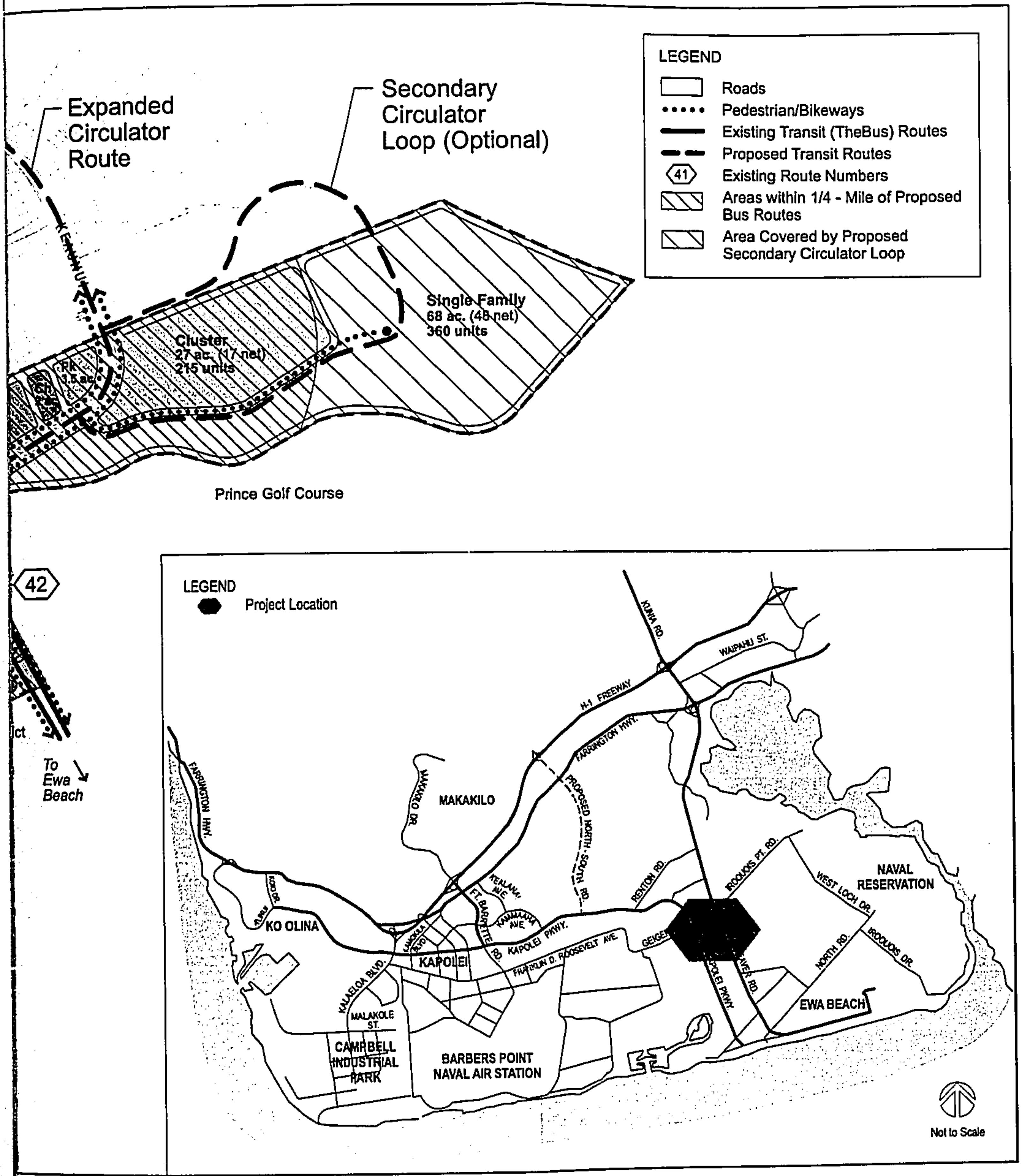
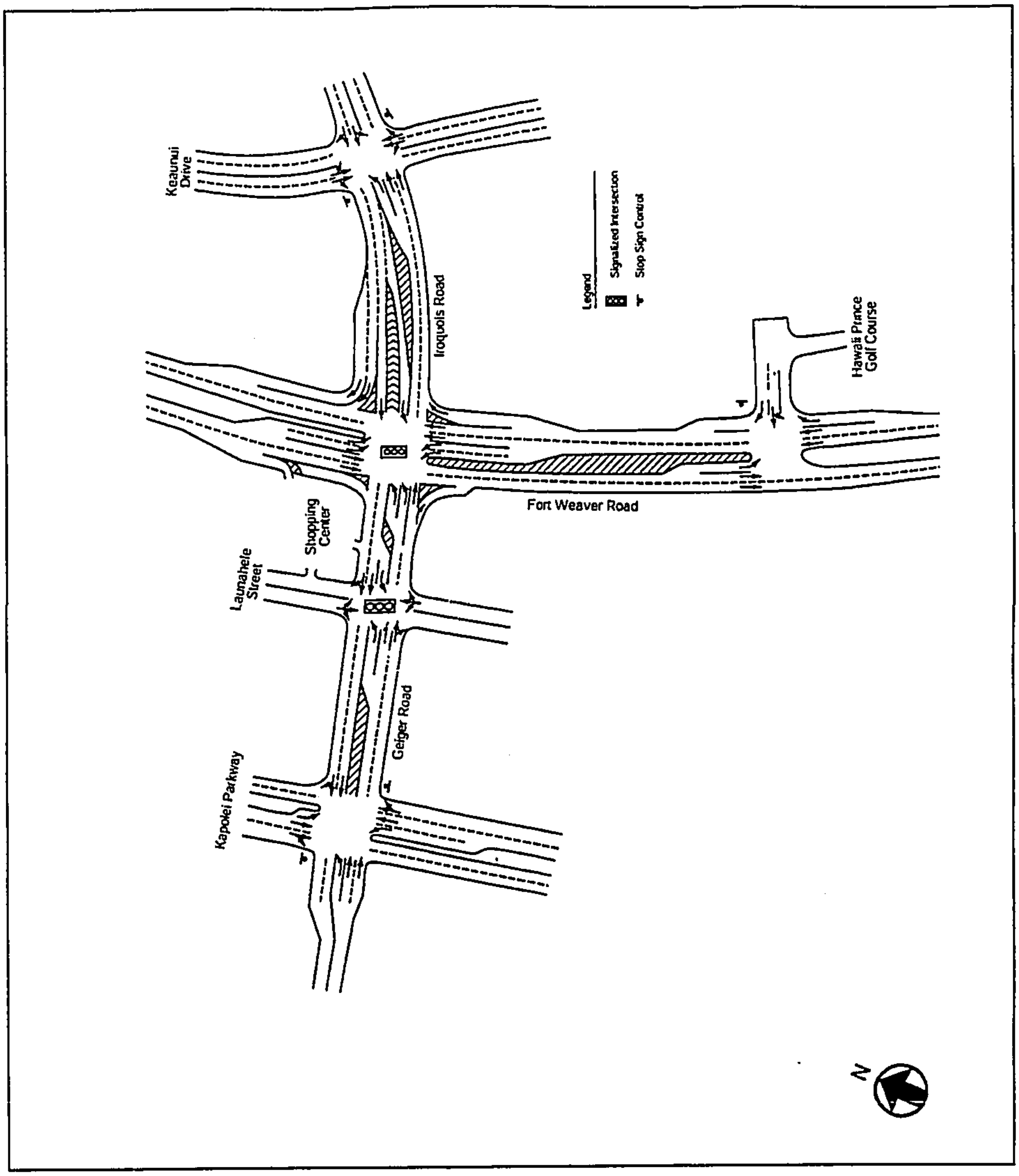


Figure 15: Proposed Transit Routes

Page 5-13 6/24/03

Helber Hastert & Fee, Planners


LEGEND
Roads
Pedestrian/Bikeways
Existing Transit (TheBus) Routes
Proposed Transit Routes
41
Existing Route Numbers
Areas within 1/4 - Mile of Proposed Bus Routes
Area Covered by Proposed Secondary Circulator Loop
Expanded Circulator Route
Secondary Circulator Loop (Optional)
Single Family
68 ac. (48 net)
360 units
Cluster
27 ac. (17 net)
215 units
Prince Golf Course
42
To Ewa Beach
LEGEND
Project Location
KUNIA RD.
WAIPAHU ST.
H-1 FREEWAY
FARRINGTON HWY.
MAKAKILO
PROPOSED NORTH - SOUTH RD.
RENTON RD.
IROQUOIS PT. RD.
WEST LOCH DR.
NAVAL RESERVATION
KO OLINA
KAPOLEI
KAPOLEI PKWY.
FRANKLIN D. ROOSEVELT AVE.
FT. BARRETTE RD.
KALAELOA BLVD.
MALAKOLE ST.
CAMPBELL INDUSTRIAL PARK
BARBERS POINT NAVAL AIR STATION
NORTH RD.
IROQUOIS DR.
EWA BEACH
Not to Scale



Gentry 'Ewa Makai

Existing Lane Configurations

Prepared by: Parsons Brinkerhoff
Source: Parsons Brinkerhoff

Figure 16
Page 5-14

Road/Kunia Road is a six-lane expressway between Interstate H-1 and Farrington Highway with interchanges at H-1 and Farrington Highway. It is a four-lane principal arterial from Farrington Highway to North Road and a two-lane minor arterial through the rest of 'Ewa Beach.

Within the project study limits on Fort Weaver Road, there is a signalized intersection at Geiger Road/Iroquois Road and an unsignalized intersection with the access to the Hawai'i Prince Golf Club. The posted speed limit on Fort Weaver Road is 45 mph at the intersection with Geiger/Iroquois Road and 35 mph at the Hawai'i Prince Golf Club access. The Hawai'i Prince Golf Club access intersection is where the proposed Keaunui Street extension would intersect Fort Weaver Road.

Kapolei Parkway (City and County of Honolulu)
Kapolei Parkway is a divided arterial roadway, currently ~~open to traffic~~ *constructed* between the south end of 'Ewa by Gentry property line and the OR&L right-of-way. Ultimately it will be a major arterial providing north-south mobility within the 'Ewa and 'Ewa Beach communities. ~~Currently, because only a portion of~~ Kapolei Parkway is open to traffic *between Launahele and Kolowaka Streets. Gentry has completed the Parkway to its ultimate width between the makai end of 'Ewa by Gentry and the OR&L right-of-way.* ~~it is striped as a 4-lane arterial, and parking is permitted~~ *Parking is restricted* on both sides of the roadway *except for a short segment near Geiger Park between Geiger Road and Kahiuka Street.* Future plans call for it to be striped as a 6-lane arterial with no on-street parking. The currently posted speed limit is 30 mph.

Geiger Road/Iroquois Road (State of Hawaii)
Geiger Road is a collector road providing east-west mobility and circulation within the study area. To the west of Fort Weaver Road, it crosses Kapolei Parkway and continues into Kalaeloa (formerly Barber's Point). Between Fort Weaver Road and Kapolei Parkway, Geiger Road is a four-lane roadway with left-turn lanes at intersections. West of Kapolei Parkway, Geiger Road is, currently, a two-lane, undivided roadway. To the east of Fort Weaver Road, this roadway is named Iroquois Point Road and continues into the U.S. Naval Magazine - Lualualei West Loch Branch. Closer to Fort Weaver Road, this segment also provides access to Keaunui Drive and Holomua Elementary School. It is a four-lane roadway with left-turn lanes at intersections from Fort Weaver Road to a point just east of Keaunui Drive. It then transitions to a two-lane, undivided roadway. The posted speed limit is 30 mph within the 'Ewa by Gentry study area.

Launahele Street (City and County of Honolulu)
Launahele Street is, primarily, a north-south collector roadway providing access to Geiger Road. It currently serves multi-family residential development located north of Geiger Road along Hanapouli Circle. South of Geiger Road, it serves a single-family, residential development, curving to the west and eventually becoming an east-west street that intersects Kapolei Parkway. Launahele Street is a signalized intersection with Geiger Road, and its posted speed limit is 25 mph.

Keaunui Drive (City and County of Honolulu)
Keaunui Drive is a north-south residential collector roadway that provides access to Iroquois Point Road and Kolowaka Drive. Holomua Elementary School is located adjacent to and obtains its access directly from Keaunui Drive. It currently services single-family and multi-family residential development north and south of Iroquois Point Road. Keaunui Drive forms an unsignalized intersection with Iroquois Road, and its posted speed limit is 25 mph.

5.2.3 Public Transit

The City and County of Honolulu Department of Transportation Services - Public Transit Division currently provides an island-wide public bus transit system called TheBus. TheHandi-Van provides para-transit service for semi-ambulatory and non-ambulatory persons with disabilities. Both systems are operated by Oahu Transit Services (OTS), and carries over 80 million passengers annually.

The following bus routes serve the 'Ewa area:

- Route 42 - This route travels between 'Ewa Beach and Waikiki via Fort Weaver Road, Farrington Highway, Kamehameha Highway, Nimitz Highway, Dillingham Boulevard, King/Beretania Streets, and Ala Moana Boulevard.
- Route 431 - This route provides circulator service between 'Ewa Beach and the Waipahu Transit Center. Within 'Ewa/'Ewa Beach, it provides service to development along Geiger Road, Keaunui Drive, Kolowaka Drive, and Renton Road.
- Route 421 - This route provides circulator service within 'Ewa Beach. It connects Pohakupuna/Papipi with Fort Weaver/Popoi areas passing through the 'Ewa Beach Transit Center located near the intersection of Fort Weaver Road and North Road.
- Route 41 - This route travels between the City of Kapolei and 'Ewa Beach via Kamokila Boulevard, Farrington Highway, Fort Barrette Road, Roosevelt Avenue, Geiger Road, and Fort Weaver Road.
- Routes 91 and 101- These are express routes that operate only during weekdays in the morning and afternoon peak periods. The routes travel from specific residential areas within 'Ewa/'Ewa Beach to downtown Honolulu.

  Additionally, the CityExpress! Route A and other express buses operate out of the Waipahu Transit Center, accessible to 'Ewa and 'Ewa Beach riders through Route 431.

5.2.4 Existing Intersection Geometry and Control

Existing traffic conditions were observed and documented, and operations of study area signalized and unsignalized intersections were analyzed. The existing intersection operational characteristics established base conditions for comparison to future operations with and without the project.

Traffic-related data were collected for each of the five study intersections. Traffic turning movement volumes, field observations of intersection operations, and general intersection characteristics were noted. Geometric lane configurations, intersection traffic control, and traffic signal phasing and timing data were collected. Intersection geometry inventory included the following:

- Number of lanes and lane widths,
- Crosswalk locations,
- Unsignalized intersection control,
- Signalized intersection locations,
- Entrance and driveway locations,
- and Posted speed limits.

These data were used as inputs into the intersection analyses. The existing lane configurations are illustrated in Figure ~~14~~ *16*.

5.2.5 Existing Traffic Volumes

Traffic turning movement counts were conducted at the following intersections on Wednesday 8 May 2002 for the PM peak hour and Thursday 9 May 2002 for the AM peak hour.

- Geiger Road and Kapolei Parkway,
- Geiger Road and Launahele Street,
- Fort Weaver Road and Geiger Road,
- Iroquois Road and Keaunui Road.

The AM and PM peak hours were found to occur from 7:00 to 8:00 AM and from 4:00 to 5:00 PM, respectively. Existing traffic count data can be found in the Appendix.

5.2.6 Existing Intersection Operations

The intersections were analyzed using the methodologies for unsignalized and signalized intersections outlined in the *2000 Highway Capacity Manual (HCM).* Operating conditions at an intersection by approach are expressed as a qualitative measure known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with low delay, while LOS F represents congested conditions with relatively high delay. The overall intersection LOS is a weighted average of the LOS of individual traffic movement groups. The Appendix has more detailed definitions of intersection LOS. Field observations were performed at selected intersections to verify the results of the intersection analyses.

5.2.7 Results of Unsignalized Intersections

Left turn and through movements from Kapolei Parkway experience delay during both morning and evening peak hours due to through traffic demand on Geiger Road. This through traffic is the result of the opening of Kalaeloa (Barber's Point) to non-military traffic. The southbound left-turns from Kapolei Parkway onto eastbound Geiger Road experience the highest delay during both peak hours. This condition occurs around 7:30 A.M. for a concentrated 10 to 15 minute period and a less intense situation occurs around 4:30 P.M. Mitigating this condition somewhat are gaps in the westbound traffic flow on Geiger Road created by the adjacent traffic signal at Launahele Street.

The left-turn movement from the Hawai'i Prince Golf Club access road to southbound Fort Weaver Road does not have a high demand, but vehicles attempting to execute this movement during the peak hours experience delay due to high traffic volumes on Fort Weaver Road. Observations show that the left-turn movement is currently accomplished in two steps. First, a vehicle crosses the northbound lane on Fort Weaver Road and then stops in the median area. Second, the vehicle merges into the southbound traffic flow. These steps reduce the delay because the vehicle does not have to wait for an acceptable gap in both the northbound and southbound traffic on Fort Weaver Road.

5.2.8 Results of Signalized Intersections

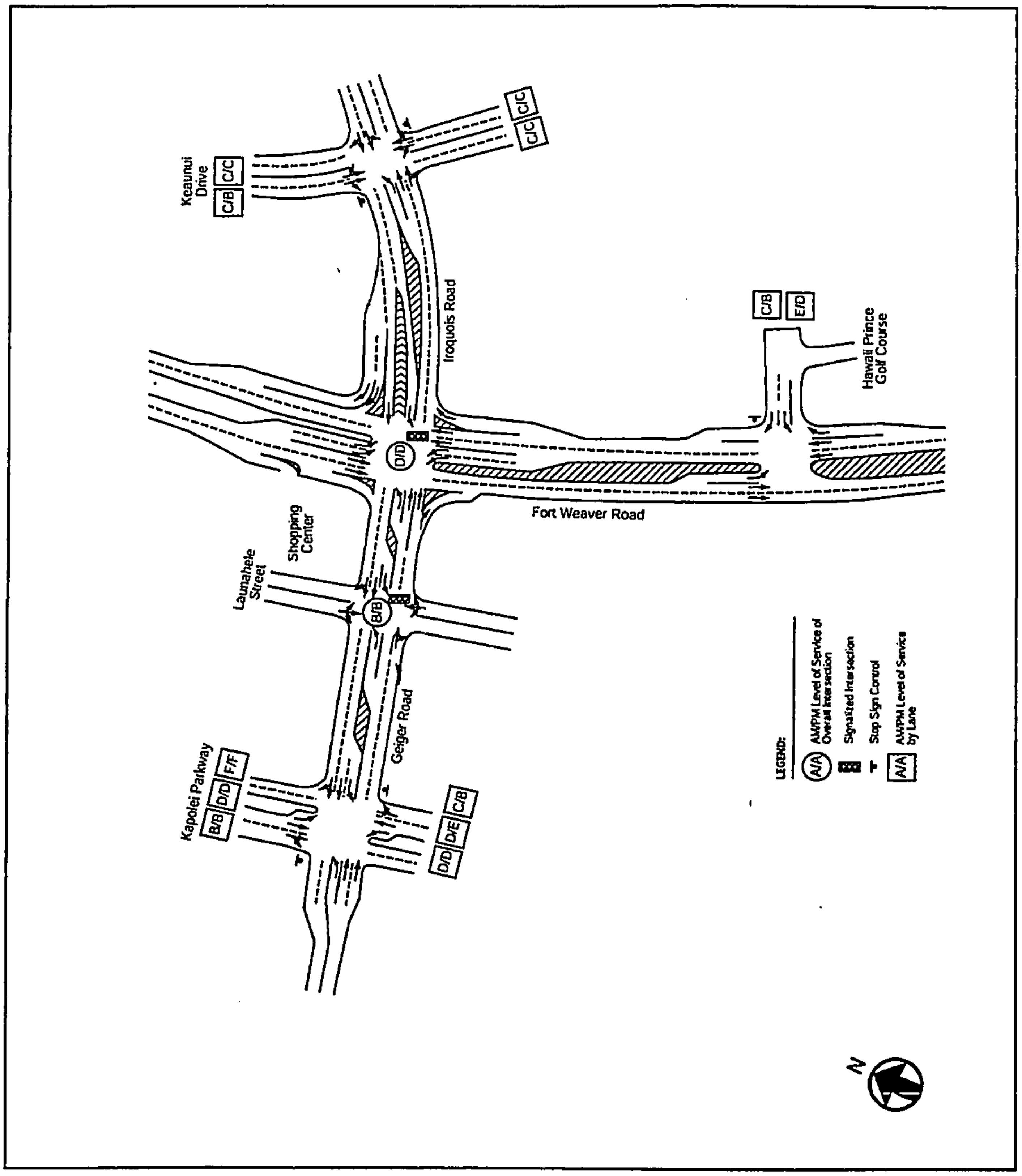
Two signalized intersections are located within the study area, Fort Weaver Road/Geiger Road/Iroquois Point Road intersection and Geiger Road/Launahele Street. Cycle length at Fort Weaver/Geiger varies from 120 to 150 seconds, while cycle length averages about 60 seconds at Geiger/Launahele.

At the intersection of Fort Weaver Road and Geiger/Iroquois Point Road, the southbound approach experiences traffic delays during the A.M. peak because of the long signal cycle length and the large amount of green time allocated to traffic turning from eastbound Geiger Road onto northbound Fort Weaver Road. Significant green time is also allocated to the northbound to eastbound left-turn movement, adding to the delay for southbound traffic. Still, the overall intersection operates at an accepted LOS D for peak hour conditions.

Figure ~~15~~ *17* summarizes the existing intersection levels of service. For detailed analysis information, the Appendix includes intersection capacity analysis worksheets.

5.2.9 Summary of Results

In summary, most traffic movements at the intersections along Geiger Road and Iroquois Road operate acceptably during both peak hours. There are selected



Gentry 'Ewa Makai | **Summary of Existing Levels of Service**

Prepared by: Parsons Brinkerhoff
Source: Parsons Brinkerhoff

Figure 17

movements at the intersections of Geiger Road/Kapolei Parkway, Fort Weaver Road/Geiger Road/Iroquois Point Road, and Keaunui Drive that experience delays.

Field observations during the morning peak hour confirmed an average six to seven vehicles queued for the southbound left-turn movement and one to two vehicles for the northbound through movement on the intersection of Kapolei Parkway/Geiger Road. This delay is caused by the existing through volumes on Geiger Road. The northbound through volume performing this movement is less than ten vehicles per hour (vph) during peak hours. As a result this delay affects only a few vehicles. The queued vehicles were also allowed time to discharge onto Geiger Road from the adjacent signal at Launahele Street/Geiger Road which create gaps in the westbound flow allowing time to for vehicles to execute their movements.

Vehicles queued in the southbound and northbound left-turn movements on Fort Weaver Road and through movements on Iroquois Point Road during AM peak hour. This delay is caused by the magnitude of the left-turning volume from eastbound Geiger Road onto northbound Fort Weaver Road.

The westbound left turns from the Hawai'i Prince Golf Course entrance to southbound Fort Weaver Road experience delays in both peak hours due to the high volume of traffic on Fort Weaver Road. However, the volume of traffic performing this left-turn movement is less than five vehicles per hour (vph) during the peak hours, and, therefore, this delay affects only a few vehicles. This left-turn movement is also helped by traffic signals at the adjacent intersections on Fort Weaver Road, which create gaps in the Fort Weaver Road traffic flow, allowing merging the left-turns to execute.

With respect to the capacity of the Fort Weaver Road and the H-1 Kunia Interchange On-Ramp, both the Ewa Highway Master Plan Year 2010 Highway Plan and the Transportation for Oahu Plan – TOP 2025 studies identify the capacity constraints of Fort Weaver Road and H-1 Kunia Interchange On-Ramp and use them as justification for improvements such as the North-South Road, the H-1 North-South Road Interchange, and the Kapolei Parkway.

5.2.10 Year 2010 Traffic Conditions

The Year 2010 was used as the basis for future traffic analysis. This time frame was used because it is the time frame used to develop the 'Ewa Impact Fee Ordinance (Chapter 33A, Revised Ordinances of Honolulu). This chapter sets forth a regulatory scheme for the assessment and collection of impact fees to be borne on a pro-rata share basis by landowners, developers, home builders, and others who directly contribute to expanding the population and increasing economic activity in the 'Ewa region through new land development activities.

The proposed 'Ewa by Gentry - Makai develop is estimated to take 15 to 20 years to be completed, but assuming that the entire development is complete by 2010 would be conservative is concentrating its impacts within a relatively short time frame.

5.2.11 Future Roadways and Public Transit

Future roadway improvements assumed for the Year 2010 time frame were based on a judgment of which roadway improvements described in the *Oahu Regional Transportation Plan (ORTP),* approved April 6, 2001 by the Policy Committee of the Oahu Metropolitan Planning Organization (OMPO), would be implemented. The ORTP describes future roadway improvements for a Year 2025 horizon. The *'Ewa Transportation Master Plan* and the *North-South Road Corridor Study* were also consulted.

5.2.12 Regional Roadways

Several improvements will be made to Interstate H-1, Farrington Highway, and Fort Weaver Road, and Kapolei Parkway and North-South Road are planned for completion by the Year 2010.

<u>H-1 Freeway</u>

Interstate H-1 improvement is assumed to occur by the analysis year:

- North-South Road Interchange - New interchange on H-1 Freeway constructed.

<u>Fort Weaver Road</u>

- Fort Weaver Road widened to six lanes between Geiger Road and Farrington Highway.

<u>Fort Weaver Contra-Flow Lane</u>

- *The widening of Fort Weaver Road is currently under final design and is on track to be constructed by 2006. Initial studies have indicated that contra-flow operation would not be desirable to implement with the existing four-lane configuration. The widening project will incorporate the ability to contra-flow traffic once Fort Weaver Road has been widened to six lanes.*

<u>North-South Road</u>

- New north-south arterial roadway constructed between H-1 Freeway and Kapolei Parkway. The new North-South Road will provide alternative access to H-1 Freeway for 'Ewa and 'Ewa Beach areas. Within the year 2010 time frame, it may be *initially* implemented as a ~~2~~ 3-lane roadway *(one north, south and reversible) and a half diamond interchange at H-1 Freeway to permit access to H-1 east and south bound* with the ultimate cross-section being 4 to 6 lanes.

<u>Kapolei Parkway</u>

- Kapolei Parkway completed from Papipi Road to Fort Barrette Road in Kapolei. Much of this roadway is completed today. The City and County of

Honolulu is currently moving forward on the segment between the OR&L right-of-way and Renton Road. This leaves the segment between Renton Road and the drainage bridge near Kapolei Middle School as a key link to be finished for Kapolei Parkway to fulfill its arterial function to provide enhanced mobility within the 'Ewa plain. Additional segments makai of the current terminus near Geiger Road are also assumed to be completed. Part of the makai segment would be constructed as part of the 'Ewa Gentry – Makai development, while the other makai segment would be constructed by Haseko as part of the Ocean Pointe development.

- *Gentry Homes has already constructed Kapolei Parkway to its ultimate cross-section between a point south of Geiger Road to the OR&L right of way. The City & County of Honolulu has awarded construction contract for the segment of Kapolei Parkway between the OR&L right of way and Renton Road. Construction should be complete by summer of 2004. The segment of Kapolei Parkway between Renton Road and the future North-South Road will be needed as part of the access to the Hawaiian Home Lands residential parcels. The segment of Kapolei Parkway between Renton Road and North-South Road is currently under design, and this segment is expected to be constructed within the 2006 to 2007 time frame. Current plans of the State of Hawaii Department of Transportation calls for an initial three-lane North-South Road and half-diamond intersection on H-1 Freeway by the same 2006 to 2007 time frame. The time schedule for implementation of segments of Kapolei Parkway are based on telephone conversations between the applicant and the City and County of Honolulu Department of Design and Construction on February 20, 2003. These schedules are consistent with the assumption in the Traffic Impact Analysis Study (TIAR) for the Ewa by Gentry Makai Development, December 2002, that these improvements would be completed by the year 2010. When warranted, North-South Road will be expanded to its ultimate 6-lane cross-section and full diamond interchange will be constructed on H-1 Freeway. This ultimate configuration is assumed to occur by Year 2025 in the current Regional Transportation Plan.*

<u>Farrington Highway</u>

- Farrington Highway widened to four lanes from Kapolei Golf Course Access Road to Fort Weaver Road. Farrington highway is already four lanes wide from the Kapolei Golf Course Access Road to Kamokila Boulevard.

5.2.13 Transit Service

The current bus routes reflect a "hub and spoke" system implemented recently. As population grows, the bus fleet is assumed to grow to handle the transit demand placed on the bus system. A new bus maintenance facility recently opened in Pearl City and there have new transit centers and bus stop improvements implemented. Through the *Primary Corridor Transportation Project*, the City and County of Honolulu is planning improvements that would increase the transit carrying capacity between the 'Ewa region and urban Honolulu. *Figure 15 shows the proposed bus routes within the project.*

5.2.14 Trip Generation

The *Institute of Transportation Engineers (ITE), Trip Generation, 6th edition* (1998) was used to estimate the number of trips generated by the 'Ewa by Gentry - Makai Development based on land uses identified in the conceptual development plan.

The conceptual development plan identifies the boundaries of the parcel proposed for re-designation from agricultural to urban. Also included in this conceptual development plan are future development parcels for the 'Ewa by Gentry development that have already received zoning approvals. These are treated as background traffic. The site-generated traffic acknowledges only the development contained in the area undergoing re-designation from agricultural to urban. Table 3 summarizes the trips generated by the proposed 'Ewa by Gentry - Makai Development. The parcel numbers correspond to the parcel numbers in the conceptual development plan shown in the report.

The ITE codes and land use descriptions are shown for each parcel. Table 3 summarizes the total trips generated by the 'Ewa by Gentry - Makai Development. Traffic created along adjacent streets from the middle school was assumed to be negligible during PM peak hour. During the assignment phase of the travel demand estimation analysis, adjustments were made to these total trips to account for trips that are projected to occur between land uses located within the 'Ewa by Gentry - Makai Development. Examples are trips traveling between residential development and future middle school Parcel 6A. Appropriate adjustments were made to eliminate double counting of trips. A similar adjustment was made to trips between residential uses and future commercial retail Parcel 4A being developed by others.

5.2.15 Trip Distribution And Assignment

The traffic generated by the proposed 'Ewa by Gentry-Makai Development was directionally distributed and assigned to the future roadway network.

A summary of regional travel patterns entering and exiting the 'Ewa area was created from the Oahu Metropolitan Planning Organization (OMPO) travel demand model. Table 4 summarizes the distribution patterns of the generated volumes entering and exiting the 'Ewa area.

Traffic within Gentry was distributed to middle school, light industrial, and commercial retail development. These trips were assigned to the roadway network and are reflected in the projected traffic turning volumes. These trips within Gentry were distributed from residential development to non-residential uses as follows: In the AM peak approximately twenty-three percent to commercial retail, thirty-eight percent to light industrial, and thirty-nine percent to

Table 3
Trip Generation Summary

Parcel	Land Use	ITE Code	Intensity	Units	AM Peak Hour Trips		PM Peak Hour Trips	
					Enter	Exit	Enter	Exit
17 & 34 A	Single Family	210	190	Units	34	102	117	66
1A	Single Family	210	360	Units	65	194	221	124
2A	Cluster	220	100	Units	8	42	38	19
2B	Cluster	220	220	Units	18	93	84	41
2C	Cluster	220	140	Units	11	59	53	26
2D	Cluster	220	215	Units	17	91	82	40
34G	Drainage	N/A	14	Acres	0	0	0	0
3A	Multi Family	220	140	Units	11	59	52	26
3B	Multi Family	220	170	Units	14	72	63	31
3C	Multi Family	220	330	Units	26	139	123	60
5A	Light Industrial	130	30	Acres	257	53	67	251
6A	Middle School	522	700	Students	184	138	0	0
6B	Rec Center	412	2	Acres	0	0	0	0
6C	Community Facilities	412	2	Acres	0	0	0	0
6D	Community Facilities	412	2	Acres	0	0	0	0
7A	County Park	412	8	Acres	0	0	0	0
7B	County Park	412	3.5	Acres	0	0	0	0
Total					645	1042	900	684

*The PM peak hour traffic volumes are negligible

Table 4
Trip Distribution of 'Ewa by Gentry Makai Trips

Direction: Exiting	Origin: 'Ewa Gentry Makai	
	AM Peak	PM Peak
Mauka	45%	35%
Makai	15%	15%
Kapolei Pkwy	25%	25%
Roosevelt Ave	5%	5%
Within Gentry	10%	20%

Direction: Entering	Destination: 'Ewa Gentry Makai	
	AM Peak	PM Peak
Mauka	35%	45%
Makai	15%	15%
Kapolei Pkwy	20%	25%
Roosevelt Ave	5%	5%
Within Gentry	25%	10%

the middle school development and in the PM peak approximately seventy percent to commercial retail and thirty percent light industrial development.

5.2.16 Year 2010 Background Traffic

The Year 2010 background traffic volumes were derived from the computerized travel demand model being used to update the *'Ewa Transportation Master Plan.* This model is also being used for the *North-South Road Corridor Study* currently completing the planning phase for a new arterial roadway in the 'Ewa plain. The travel demand model accounts for projected regional traffic patterns.

The future Year 2010 background traffic assumes significant completion of both the 'Ewa by Gentry Development and the Ocean Pointe Development (Haseko) currently under construction. These two developments account for the majority of future background traffic generated in the study area. Additionally, it was assumed that the commercial retail parcel proposed by the Estate of James Campbell at the Keaunui/Fort Weaver Road intersection was fully developed. In areas where greater detail was necessary, background traffic was estimated using rates documented in *Trip Generation, 6th Edition*. Traffic volumes forecasted by the *'Ewa Transportation Master Plan Update* computerized travel demand model were used as control totals to develop a future Year 2010 peak hour assignment for the study area.

5.2.17 Intersection Operations Analysis Results

Key intersections were analyzed using the methodologies for unsignalized and signalized intersections outlined in the *2000 Highway Capacity Manual (HCM)*. Operating conditions at an intersection are expressed as qualitative measures known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with low delay, while LOS F represents congested conditions with relatively high delay. The approach LOS is a weighted average of the LOS of individual traffic movement groups. Appendix B has more detailed definitions of intersection LOS. Field observations were performed at selected intersection to verify reasonableness of the analysis results.

5.2.18 Projected Operations at Unsignalized Intersections

Three intersections were analyzed as unsignalized intersections:

- Kapolei Parkway/Launahele Street/Entrance A (Access Road to Area 14 &12);
- Kapolei Parkway/Entrance B (Access Road to Parcel 34~~D~~, *Areas 14, 38 and 39*);
- Geiger Road/Entrance C (Access to Parcels 16, 17 *and Area 44*).

Table 5 displays the projected Year 2010 peak hour unsignalized intersection level of service without and with the 'Ewa by Gentry - Makai Development. As shown in Table 5, the unsignalized intersections generally operate well. The left-turn movement out of the side street tends to experience some delay during the peak hours because of the magnitude of through traffic on the main road. The left-turn movements projected to experience delays occur at the following locations:

- Eastbound left turn out of Entrance A to northbound Kapolei Parkway;
- Westbound left turn out of Launahele Street (Entrance A) to southbound Kapolei Parkway;
- Eastbound left turn out of Entrance B to northbound Kapolei Parkway;
- Westbound left turn out of Entrance B to southbound Kapolei Parkway;
- Northbound left turn out of Entrance C to westbound Geiger Road.

The left-turn movements at entrances A and B along Kapolei Parkway are projected to experience delays during the peak hour time periods. There is significant traffic volume traveling along Kapolei Parkway, but future adjacent traffic signals at Geiger Road and at Keaunui Drive Extension would create gaps in traffic on Kapolei Parkway, providing time for vehicles turning from side streets to complete their desired movement.

At Entrance C on Geiger Road, left-turn movements out of the access would experience delays due to projected through volumes on Geiger Road. It is recommended to provide median storage in Geiger Road for the left-turn movement out of Entrance C, so that vehicles could accomplish the movement in two steps: first a turn out of the access to the median and second, a merge movement from the median into westbound Geiger Road.
Projected Operations at Signalized Intersections

5.2.19 Projected Operations of Signalized Intersections

Table 6 summarizes the projected Year 2010 peak hour intersection level of service (LOS) for the signalized intersections. As depicted in Table 6, all intersections analyzed are projected to operate at overall LOS D or better during the peak hours, without or with the 'Ewa by Gentry - Makai Development. The main street approaches along Kapolei Parkway and Fort Weaver Road are projected to operate at LOS D or better. There are selected movements that are projected to operate at LOS E, due primarily to the long cycle lengths used at these intersections.

Observations of existing conditions indicate that during peak periods, the traffic signals on Fort Weaver Road operate with cycle lengths approaching 240 seconds. This expedites the mainline Fort Weaver traffic, but creates delays for the side streets. Side street queues were found to clear within one phase, however, and queue lengths on Geiger Road appeared reasonable, not exceeding 10 vehicles per lane. Similar conditions are projected for the future.

Table 5
Year 2010 Without and With 'Ewa by Gentry Makai
Level of Service Summary
Unsignalized Intersections

Intersection	With Project				Without Project			
	AM		PM		AM		PM	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Kapolei Pkwy/ Entrance A	**Unsignalized**				**Unsignalized**			
Entrance A Eastbound Left	C	23.1	E	43.7	B	14.4	C	21.5
Entrance A Eastbound Right	B	10.1	B	11.8	A	9.4	B	10.1
Entrance A Westbound Left	D	25.3	E	38.0	B	14.8	C	20.9
Entrance A Westbound Right	B	11.0	B	10.8	A	9.6	A	9.8
Kapolei Pkwy Northbound Left	A	8.4	A	9.8	A	7.9	A	8.5
Kapolei Pkwy Southbound Left	A	9.1	A	9.2	A	8.1	A	8.4
Kapolei Parkway/Entrance B	**Unsignalized** 11.8				**Unsignalized** 11.6			
Entrance B Eastbound Left	C	23.1	C	23.5	B	13.3	C	16.5
Entrance B Eastbound Right	B	10.2	B	10.2	A	9.5	B	10.1
Entrance B Westbound Left	E	44.9	D	32.8	No Entrance			
Entrance B Westbound Right	B	10.8	B	11.0				
Kapolei Pkwy Northbound Left	A	8.5	A	8.6	A	8.0	A	8.5
Kapolei Pkwy Southbound Left	A	8.9	A	9.0	No Entrance			
Geiger Road/ Entrance C	**Unsignalized**				**Unsignalized**			
Geiger Road Westbound Left	A	8.3	B	10.6	A	8.2	A	9.6
Entrance C Northbound Left	C	18.3	D	29.2	C	16.7	C	20.7
Entrance C Northbound Right	C	15.5	C	15.7	B	12.9	B	13.8

In these analyses, Fort Weaver Road was assumed to be a four-lane facility. There is a project sponsored by the State of Hawai'i Department of Transportation (HDOT) that will widen Fort Weaver Road to a six-lane facility between Farrington Highway and Geiger Road. It is currently in the design phase. Construction funds have not been programmed yet, but HDOT indicates that the project is expected to proceed into construction within the next five years. Assuming a four-lane facility makes the intersection analyses conservative by overestimating the impacts during the peak periods.

The Keaunui Drive/Iroquois Point Road intersection is projected to warrant signalization by the year 2010. The left-turn movements from Keaunui Drive at the Iroquois Point Road/Keaunui Drive intersection are projected to experience delay in the future due to the increase left-turning vehicles traveling towards Fort Weaver Road and Kapolei Parkway. It is recommended to monitor this intersection and, when warranted, signalize the intersection.

5.2.20 Summary of Results

Intersections analyzed are projected to operate acceptably for peak hour conditions without or with the 'Ewa by Gentry - Makai Development. Implicit in these analysis results are specific roadway and intersection Improvements, and these are summarized in the following chapter of this report.

5.2.21 Recommended Roadway Improvements

Gentry Homes, Ltd. has already implemented major roadway improvements as part of the 'Ewa by Gentry Development such as Kapolei Parkway between the OR&L right-of-way and a point south of Geiger Road, widening Geiger Road/Iroquois Point Road between Kapolei Parkway and Keaunui Drive, construction of Kolowaka Drive, construction of part of Keaunui Drive, signalization of the Geiger Road/Fort Weaver Road intersection, signalization of Kolowaka Drive/Fort Weaver Road intersection, and signalization of Launahele Street/Geiger Road intersection.

As they progress into the 'Ewa Gentry – Makai Development, Gentry Homes, Ltd. will continue internal roadway and intersection improvements. Additionally, the Honolulu City Council has passed, and the Mayor of Honolulu is expected to sign an ordinance that would establish a mechanism for collecting roadway impact fees in the 'Ewa region for major roadway improvements. Improvements covered by the impact fee ordinance include widening of Fort Weaver Road between Farrington Highway and North Road, completion of Kapolei Parkway between Papipi Road and Ko Olina, and the proposed North-South Road and interchange. The 'Ewa Gentry Makai property is included within the influence area of the impact fee ordinance and will, therefore, contribute to the improvement fund.

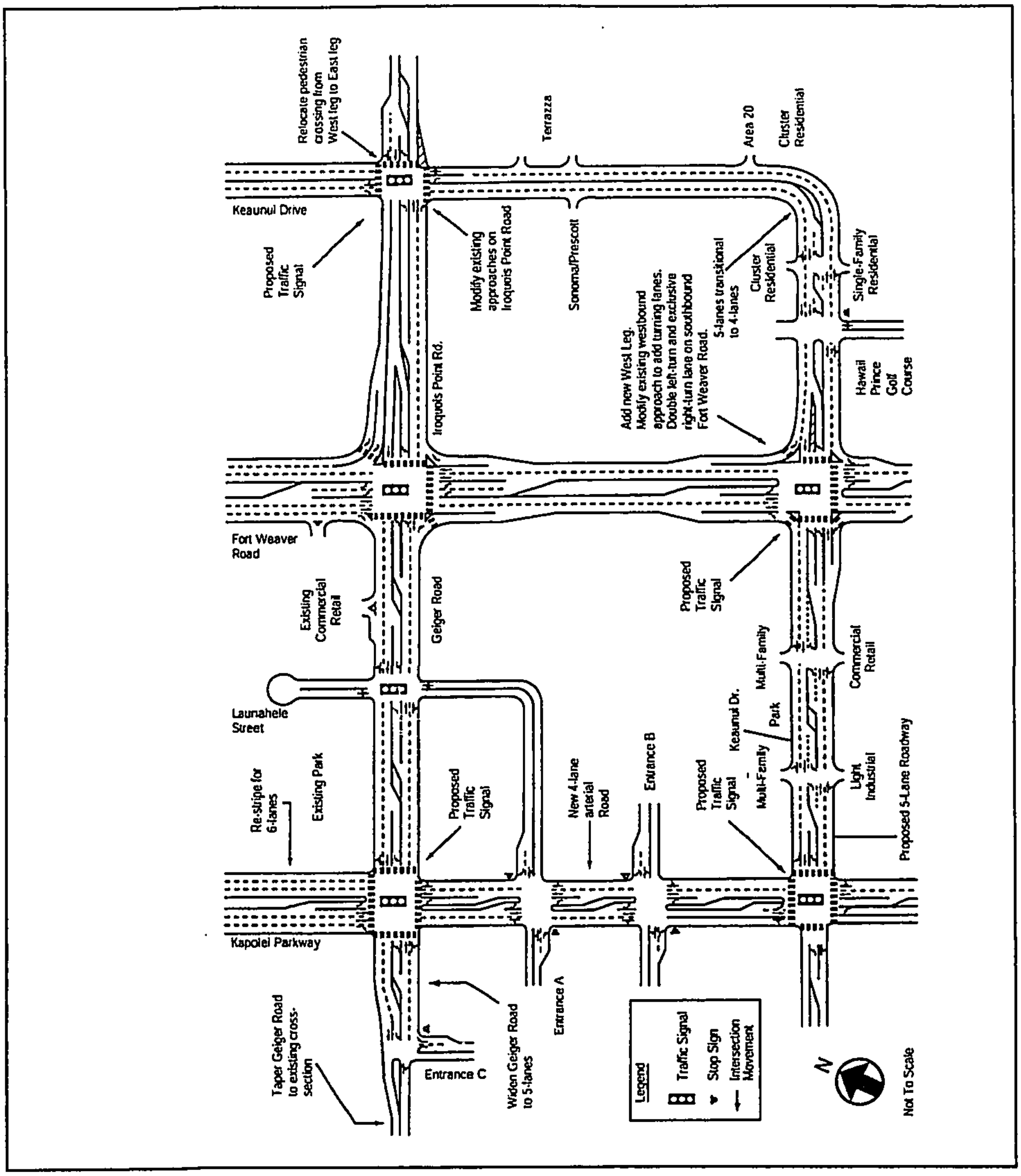
This section of the report serves to identify roadway improvements that are not covered under the impact fee ordinance. These improvements would be the responsibility of Gentry Homes, Ltd. Figure 18 summarizes the improvement recommendations.

<u>Keaunui Drive</u>
As part of the 'Ewa by Gentry - Makai Development, the existing Keaunui Drive will be extended south and west so that it forms a continuous roadway from

Table 6

Year 2010 Without and With 'Ewa by Gentry Makai
Level of Service Summary
Signalized Intersections

Intersection/Approach	Without 'Ewa by Gentry Makai				With 'Ewa Gentry Makai			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Ft Weaver Rd/ Geiger Rd	**D**	**40.7**	**C**	**34.0**	**D**	**50.8**	**D**	**49.2**
Eastbound	D	42.4	D	37.9	D	48.8	D	43.3
Westbound	C	32.9	C	32.7	D	37.5	C	33.0
Northbound	D	52.3	D	38.3	E	76.7	D	46.5
Southbound	C	31.5	C	30.8	C	29.3	E	55.7
Geiger Rd/ Launahele St	**B**	**11.6**	**B**	**11.3**	**B**	**11.8**	**B**	**11.6**
Eastbound	B	11.5	B	10.7	B	11.8	B	11.0
Westbound	B	11.9	B	11.0	B	12.0	B	11.6
Northbound	B	10.4	B	10.5	B	10.4	B	10.5
Southbound	B	12.1	B	13.4	B	12.1	B	13.4
Geiger Rd/ Kapolei Pkwy	**C**	**23.5**	**C**	**21.4**	**C**	**25.3**	**C**	**22.9**
Eastbound	C	21.2	C	20.2	C	22.2	C	21.5
Westbound	C	29.0	C	24.2	C	29.6	C	24.5
Northbound	C	21.2	C	20.3	C	23.7	C	21.5
Southbound	C	20.0	C	20.3	C	24.9	C	23.4
Keaunui Drive Ext./ Kapolei Pkwy	**A**	**8.5**	**A**	**9.5**	**C**	**27.3**	**C**	**27.1**
Eastbound	No Driveway				D	35.3	C	32.8
Westbound	B	12.2	B	12.9	C	22.4	B	19.3
Northbound	A	9.0	A	8.7	C	26.9	C	25.8
Southbound	A	7.4	A	8.4	C	28.8	C	32.9
Ft Weaver Rd/ Keaunui Dr.	**D**	**38.5**	**C**	**32.3**	**D**	**37.8**	**C**	**33.0**
Eastbound	D	37.2	C	34.0	D	40.9	D	37.8
Westbound	D	35.7	D	36.0	D	38.0	C	32.9
Northbound	D	46.8	C	27.0	D	47.5	C	27.1
Southbound	C	29.0	C	35.8	C	27.1	D	35.5
Iroquois Rd/ Keaunui Dr.	**C**	**25.5**	**B**	**15.9**	**C**	**25.6**	**B**	**16.1**
Eastbound	B	19.6	B	10.4	B	19.6	B	10.4
Westbound	C	33.8	C	30.6	C	33.8	C	30.6
Northbound	C	34.8	C	25.8	C	34.5	C	25.8
Southbound	B	15.5	B	10.1	B	15.9	B	11.5



Gentry 'Ewa Makai

Recommended Roadway and Traffic Improvements

Prepared by: Parsons Brinkerhoff
Source: Parsons Brinkerhoff

Figure 18

Iroquois Road to Kapolei Parkway. This extension will intersect Fort Weaver Road at the existing Hawai'i Prince Golf Course access road location.

This intersection has existing median left-turn bays and acceleration and deceleration lanes for right-turning traffic on Fort Weaver Road. It is proposed to signalize this access when warranted. The extension of Keaunui Drive will help to distribute traffic and reduce traffic demand at the Geiger Road/Iroquois Road approaches to Fort Weaver Road.

The Keaunui Extension is recommended to have a 5-lane cross-section from Kapolei Parkway to a point just east of the Hawai'i Prince Golf Course entrance. It would then transition to a 4-lane, undivided roadway and maintain this cross-section up to Iroquois Point Road. It is also recommended that the segment of the Keaunui Extension located between Fort Weaver Road and the existing Hawai'i Prince access road be kept free of accesses to reduce potential conflict with traffic turning onto Keaunui Extension from Fort Weaver Road.

It is recommended that the westbound Keaunui approach to Fort Weaver Road have one through lane, an exclusive right-turn lane, and an exclusive left turn lane. The eastbound approach would be similar except two exclusive left-turn lanes would be provided. The southbound Fort Weaver Road approach already has a southbound to eastbound median left-turn lane. A southbound to westbound right-turn deceleration lane and a southbound acceleration similar to the configuration at the Geiger Road/Iroquois Point Road intersection is also recommended for eastbound to southbound right turning vehicles. The northbound Fort Weaver Road approach would be configured with an exclusive northbound to westbound median left-turn lane in addition to the existing northbound right-turn lane deceleration lane.

Pedestrian crosswalks would be provided on the west, south, and east legs, similar to the configuration used at the Fort Weaver/Geiger intersection.

Accesses on Keaunui Drive Extension
A painted median similar to that on Geiger Road is proposed for the Keaunui Drive Extension between Kapolei Parkway and Fort Weaver Road. At least three full-movement accesses are proposed for this segment of roadway. One would be located approximately 400 to 500 feet east of Kapolei Parkway and would serve a church parcel to the north and a multi-family residential parcel to the south. The second would be located approximately 800 to 1000 feet east of Kapolei Parkway and would serve a multi-family residential parcel to the north and a commercial/light-industrial subdivision to the south. The third would be located approximately 800 feet west of Fort Weaver Road and would serve a park, mutli-family and single-family residential parcels to the north and a commercial/retail parcel proposed by others to the south.

The segment of Keaunui Drive located between Iroquois Point Road and Fort Weaver Road is partially constructed. Accesses exist south of Iroquois Point Road for the Terrazza and the Sonoma and Prescott subdivisions. Starting at the other end from Fort Weaver Road, accesses are proposed at a point opposite the Hawai'i Prince Golf Course Driveway and at two more locations to the east.

Geiger Road
West of Kapolei Parkway, Geiger Road is currently a 2-lane roadway. 'Ewa Gentry –Makai traffic could be accommodated by a 3-lane cross-section, with the third lane providing a median turn lane. Currently, traffic pressures from traffic using Roosevelt Avenue through Kalaeloa to travel between 'Ewa Beach and Kapolei dominate this segment of roadway. The completion of Kapolei Parkway between Fort Barrette Road and 'Ewa Beach would relieve this pressure, but as Kalaeloa develops trips generated from Kalaeloa itself will restore this pressure. Because the time frame for the development of Kalaeloa is uncertain, the following recommendation for Geiger Road is provided.

Geiger Road, west of Kapolei Parkway is recommended to be widened to a 3-lane cross-section between Kapolei Parkway and the Access to Entrance C, the roadway that provides access to parcels 17 and 34-A. The median lane would provide left-turn protection at the Coral Creek Golf Course entrance and at Entrance C. West of Entrance C, Geiger Road would transition back to its existing 2-lane cross-section. Acknowledging the potential for major development of Kalaeloa, it is recommended to dedicate enough right-of-way to allow Geiger Road to be widened to a four-lane roadway with median at sometime in the future.

At the approach to Kapolei Parkway, a median left-turn lane should be created so that Geiger Road west of Kapolei Parkway matches the cross-section of Geiger Road east of Kapolei Parkway. Also, an exclusive eastbound to southbound right-turn lane is recommended. This intersection should be monitored and, when warranted, a traffic signal should be installed. It appears from the analyses that peak hour traffic signal warrants would be met by the Year 2010 time frame.

Iroquois Point Road
Iroquois Point Road currently is configured as a 5-lane cross-section between Fort Weaver Road and Keaunui Drive. This cross-section transitions to a 2-lane roadway just east of Keaunui Drive. The eastbound approach to the Keaunui intersection is configured with an exclusive left-turn lane, a through lane, and a through/right lane. The westbound approach to this intersection is the same, although it achieves this cross-section only about 200 feet before Keaunui Drive.

It is recommended to widen the segment of Iroquois Point Road from Keaunui to the eastern boundary of the 'Ewa by Gentry development. The median area would be extended to the entrance driveway into the Area 23/24 parcel (Suncrest, Shores, Lombard Way and Avalon developments), then tapered out to return to the 2-lane, undivided cross-section, east of the 'Ewa by Gentry development. This median area would provide left-turn lanes for traffic movements turning into the Area 23/24 driveway and for traffic movements turning from westbound Iroquois Point Road to southbound Keaunui Drive. One through lane would be provided in each direction between the entrance into Area 23/24 and Keaunui Drive. About 500 feet east of Keaunui Drive, a westbound to northbound right-turn lane would be created.

It is recommended to signalize this intersection when warranted. It appears from the projected traffic volumes that peak hour traffic signal warrants would be met by the Year 2010 time frame. The proposed signal should be coordinated with the existing signal at Fort Weaver Road/Geiger Road intersection. The northbound approach would be reconfigured as an exclusive left-turn lane and a shared left-through-right-turn lane and the southbound approach to be reconfigured as an exclusive right-turn lane and a shared left-through lane. Signal timing is recommended to be split phase and coordinated with the signals at Fort Weaver Road and Iroquois Point Road.

In conjunction with the signalization of the intersection of Keaunui Drive and Iroquois Point Road, it is recommended to relocate the crosswalk from its existing location on the west leg to the east leg of the Keaunui Drive/Iroquois Point intersection. This would lessen the potential vehicle-pedestrian conflicts between pedestrians crossing Iroquois Point Road and traffic turning from Keaunui Drive to westbound Iroquois Point Road. Existing curb ramps associated with the existing crosswalk need to be removed. Curb ramps already exist on the east side of the intersection but need to be checked for consistency with current ADA guidelines.

The proposed geometric modifications to Iroquois Point Road, the proposed traffic signal, and the proposed pedestrian crossing improvements have been discussed with both the State of Hawai'i Department of Transportation – Highways Division-Traffic Engineering Branch and the City & County of Honolulu Department of Planning and Permitting-Site Development Division-Traffic Review Branch. Both agencies have indicated that the concept is workable, subject to review of detailed design.

Kapolei Parkway

The existing segment of Kapolei Parkway between the OR&L right-of-way and the 'Ewa by Gentry property line south of Geiger Road is expected to connect to North-South Road and eventually to Interstate H-1 Freeway by the Year 2010. When the connection is made, this segment of Kapolei Parkway north of Geiger Road is recommended to be re-striped as a 6-lane arterial roadway with no on-street parking allowed. In this configuration, the outside lanes will serve as shared through/right lanes.

South of Geiger Road, Kapolei Parkway is ultimately planned to be extended to Papipi Road. As part of the 'Ewa by Gentry – Makai development, it will be extended to the makai Gentry property line. Kapolei Parkway could be configured as a 4-lane arterial roadway in this segment.

Accesses on Kapolei Parkway

South of Geiger Road, intersections on Kapolei Parkway are proposed at the existing Launahele Street, the proposed Road B, and the proposed Keaunui Drive Extension. The intersections at the existing Launahele Street and proposed Road B are proposed to be unsignalized with STOP-sign control on the side street approaches. Median left-turn lanes and separate lanes for right and left turn/through lanes are recommended at the unsignalized accesses.

The Kapolei Parkway/Keaunui Extension intersection is proposed to be signalized when warranted. It is recommended that the Middle School site (Parcel 6A) access Kapolei Parkway opposite the proposed Keaunui Drive Extension. This would minimize the number of accesses on Kapolei Parkway and eventually provide the school with a signalized access from Kapolei Parkway. The Keaunui Drive Extension approach is recommended to have exclusive left, through, and right-turn lanes. The Middle School approach is recommended to have an exclusive left-turn lane and a through/right lane.

5.2.22 Future Transportation Buffer and Noise Attenuation

Gentry Homes, Ltd. currently provides a 10-foot wide landscaped lot along Fort Weaver next to the HDOT right-of-way. These lots are dedicated to the 'Ewa by Gentry Community Association. Additionally, homes are set back either 5' or 10' from the property line. Therefore, residential structures along Fort Weaver Road are set back approximately 15 to 20-feet from the HDOT right-of-way. The current HDOT right-of-way already allows for widening of Fort Weaver Road, so flexibility for future roadway improvements is also provided.

Gentry Homes, Ltd. has implemented appropriate sound attenuation measures to reduce noise levels from vehicular traffic affecting property along Ft. Weaver Road within the existing 'Ewa by Gentry development, more specifically in the Sun Terra, Summer Hill, Lofts, Alii Cove, Carriages, WoodBridge, Sonoma, and Prescott communities along Ft. Weaver Road. These measures include setback of residences from the road travel lanes, a 6' plaster fence, wall insulation with central air conditioning as standard, and substantial landscaping. Similar sound attenuation measures will also be incorporated for homes built in the remainder of Gentry's projects along Ft. Weaver Road as those projects are constructed.

~~5.2.22~~ *5.2.23* Conclusion

Based on the analysis of the proposed 'Ewa by Gentry - Makai Development, it is concluded that with roadway and traffic improvements recommended in this report, the roadway system can accommodate the traffic generated by the proposed land uses.

It should be noted that the analyses contained in this report are very conservative in that both the without and with 'Ewa by Gentry - Makai scenarios include new roadways such as the Keaunui Drive extension between Kapolei Parkway and Fort Weaver Road and between Fort Weaver Road and Iroquois Road. Both also include the connection of Kapolei Parkway south to the Ocean Pointe development. With these new roadways, that will be constructed as part of the 'Ewa by Gentry Makai development, traffic conditions on Fort Weaver Road are projected to better than conditions without these roadway improvements. It is, therefore, possible to say that the 'Ewa by Gentry Makai development enables the completion of a supporting roadway system that helps to distribute traffic demand in a way that increases mobility in the 'Ewa area.

5.2.24 Regional Traffic Improvement Summary

Table 7 provides a summary timetable for all planned traffic improvements in the 'Ewa region.

Table 7
Ewa Regional Transportation Projects
Status Report: June 30, 2003

Project Title	Responsible Party	Brief Description	Schedule
Kapolei Parkway, Phase 8A	City and County of Honolulu – Dept. of Design and Construction	Construction of makai side of roadway between OR&L Railroad tracks to Renton Road (approx. 2,400 ft.)	Construction: Fall 2003 to Fall 2004
Kapolei Parkway, Phase 8B	City and County of Honolulu – Dept. of Design and Construction	Construction of makai side of the roadway between Renton Road and the City/State property line at the western boundary of Ewa Villages (approx. 3600 ft.)	Construction: Complete Summer 2004
Kapolei Parkway, Phase 8C	City and County of Honolulu – Dept. of Design and Construction	Construction of mauka side of roadway between the OR&L Railroad tracks and the City/State property line at the western boundary of Ewa Villages (approx. 6,000 ft.)	Design: Complete Summer 2004
Kapolei Parkway – Sun Terra to Haseko's Ocean Pointe Project	Gentry Homes, Ltd.	Construction of a four-lane divided roadway from existing Kapolei Parkway improvements to the makai boundary of the Laulani parcel, including bike path and sidewalks (approx. 2,283 ft.)	Design: Complete End of 2004 Construction: 2005 to Mid 2006
Kapolei Parkway - Ocean Pointe from Keoneula Boulevard Mauka to Gentry Boundary	Haseko Homes, Inc.	Construction of a four-lane roadway, which will include a median, sidewalks and landscaping. (approximately 950 ft.)	Construction: 2004 to 4th Qtr. 2005
Kapolei Parkway – Ocean Pointe from Keoneula Boulevard Makai to Papipi Road	Haseko Homes, Inc.	Construction of a four-lane roadway, which is 60' in width and will include sidewalks. The road is currently in construction and the portion that still needs to be completed is approximately 660 ft.	Construction: 2003-2006
Kamokila Boulevard Extension	City and County of Honolulu – Dept. of Design and Construction	Approximately 1/5 mile four-lane road to connect Kamokila Boulevard to Roosevelt Avenue	1. Resolution 03-81 amends Ewa DP to add symbol to Public Infrastructure Map 2. #2002205 Street Improvements – Roosevelt Ave. to Kamokila Blvd included in FY04 City Budget
North-South Road – First Phase	State of Hawaii – Dept. of Transportation	The first phase will consist of three lanes (one northbound, one southbound, and one possibly reversible) and a half diamond interchange with H-1 (only town bound on-ramp and Waianae bound off-ramp	Design: Possible Design Build Project Construction: Start by end of 2004
North-South Road – Second Phase	State of Hawaii – Dept. of Transportation	The second phase will consist of expansion to six lane roadway and a full diamond interchange with H-1	Not currently available
Fort Weaver Road Intersection Improvements, Vicinity of	State of Hawaii – Dept. of Transportation	Project will include widening of Fort Weaver from 4 to 6 lanes from Farrington Highway to Laulaunui Street and	Design: Jan. 2002-Aug. 2003 Construction: Mar. 2004-Mar.

Tentative and subject to change. Source: Data compiled from entities responsible for projects.

Table 7 (continued)
Ewa Regional Transportation Projects
Status Report: June 30, 2003

Laulaunui Street		various improvements to Laulaunui Street	2005
Fort Weaver Widening, Vicinity of Aawa Drive to Geiger Road	State of Hawaii – Dept. of Transportation	Project will widen Fort Weaver from 4 to 6 lanes from Aawa Drive to Geiger Road	Design: Start June 2002 On hold, consultant out of business
Fort Barrette Road Widening – Farrington Highway to Barber's Point Gate	State of Hawaii – Dept. of Transportation	Project will widen Fort Barrette to 4 lanes and include other improvements: bike lanes, sidewalks, etc.	Design: May 2004-April 2008 Construction: Start 2008
Kalaeloa Road Improvements – Roosevelt Avenue	State of Hawaii – Dept. of Transportation	Upgrades and improvements to Roosevelt Avenue, including reconstructing/rehabilitating the existing roadway, drainage systems, curbs, gutters, and sidewalks	Design: Early 2004-Early 2006 Construction: Early 2007
Palailai Interchange – Modification (H-1)	State of Hawaii – Dept. of Transportation	Minor modifications to existing interchange	Planning: 2004-2006 Design: 2006-2008
Makakilo Interchange – Modification (H-1)	State of Hawaii – Dept. of Transportation	Project will add two more ramps on Waianae side of interchange (on ramp from Makakilo Drive toward Waianae and off-ramp from Waianae to Makakilo Drive)	Planning: 2004-2006 Design: 2006-2008
Kapolei Interchange (H-1)	State of Hawaii – Dept. of Transportation	Construction of new H-1 Interchange at vicinity of Kapolei Bus Transit Center	Planning: 2004-2006 Design: 2006-2008

Tentative and subject to change. Source: Data compiled from entities responsible for projects.

5.3 Noise Environment

A study titled *Acoustic Study for the 'Ewa by Gentry – Makai Development* was conducted for the project by Y. Ebisu and Associates, Inc. to assess the noise impacts on and within the proposed development. This study can be found in its entirety in Appendix K. A summary of the study is provided in this section.

Existing Conditions

5.3.1 Existing Noise Levels

The existing background ambient noise levels in the vicinity of the proposed 'Ewa By Gentry - Makai Development project are controlled by motor vehicle traffic along Fort Weaver Road and fixed wing aircraft landing at Honolulu International Airport. The noise from aircraft operating at Kalaeloa Airport and the natural sounds of birds, insects, wind, and foliage are also audible. Traffic, aircraft, and background ambient noise measurements were obtained at various locations shown in the appendix. These locations included sites at the southeast corner of Barbers Point Golf Course; the south end of Kapolei Parkway; the west end of Keoneula Boulevard; the entrance to the Hawai'i Prince Golf Course; the east end of Geiger Park; the entrance to Kaimiloa School; the entrance to Kapolei High School; and the entrance to Kapolei Middle School. Ambient traffic noise was measured at two locations at Geiger Park fronting Kapolei Parkway and Geiger Road; and two locations near the entrance road to the Hawai'i Prince Golf Course.

It was recorded that the noise events from motor vehicle traffic tend to occur more frequently, with the duration of each event generally less than 10 seconds. The noise events from aircraft tend to occur less frequently, with the duration of each event being longer than 10 seconds. Aircraft noise events tend to be as loud as the noisiest auto or heavy truck at 60 to 85 feet. While traffic noise levels diminish due to distance and shielding effects from structures, aircraft noise levels (due to the high altitude of the aircraft) are less affected by distances along the ground or shielding effects from structures.

Motor Vehicle Traffic Noise

The dominant contributors to the existing back- ground ambient noise levels within the project area are motor vehicles traveling on Fort Weaver Road and Geiger Road. The typical hourly variations in noise levels within the project area are also influenced by motor vehicle traffic along the other roadways in the area such as Kapolei Parkway, Geiger Road, and Iroquois Road. Traffic noise levels tend to be lowest during the early morning hours between 2 and 4 AM, and tend to be highest during the AM and PM peak commuting hours. Traffic noise levels are relatively constant during the daytime period between the AM and PM peak commuting hours.

The Base Year (1998) traffic volumes and their noise contributions at 50, 100, and 200 feet setback distances from the centerlines of the roadways servicing the project were calculated for the noise study. Based on the results of this analysis it was concluded that existing background noise levels in the project environs currently exceed 65 DNL at essentially all buildings which front Fort Weaver Road and Geiger Road, which have unobstructed lines of sight to the traffic lanes, and which are not shielded by sound attenuating walls. These homes are located in areas which are in the significant Exposure - Normally Unacceptable noise exposure category. For those buildings which are shielded from the road traffic, existing traffic noise levels are 5 to 10 DNL units less than those units along the roadways' Rights-of-Way. Along the first row of homes which front Fort Weaver and Geiger Roads, roadway traffic noise is the dominant noise source.

Aircraft Noise

Existing aircraft noise levels during 2000 and 2001 (prior to September 11, 2001) were estimated using previously measured aircraft noise levels, aircraft schedules and operations forecasts for the 12-month period in 2000 and 2001 (prior to September 11, 2001), the aircraft flight tracks, a standard glide slope of 3 degrees (except for the special approach profile used by the F-15 aircraft) and modeling with the FAA INM Version 6.0. Average daily landings over the project site by various aircraft categories were estimated to be as follows: 13.1 B-747; 16.5 DC-10/L-1011; 21.2 B-757/767; 14.4 B-737 (200); 1.5 DC-9 (50); 10.6 B-717 (200); 1.5 C-130; 2.0 C-141; 1.4 KC-135R; 0.7 C-5A; 7.5 F-15; and 0.5 KC-10.

The aircraft noise contours developed suggest that the proposed land uses in the 'Ewa By Gentry - Makai Development project should be compatible with the aircraft noise levels associated with Honolulu International Airport. The proposed land uses should be acceptable and in compliance with the land use compatibility recommendations, and aircraft noise levels over the project site should not place constraints on the locations of the proposed land uses.

The results of the aircraft noise level measurements in the immediate vicinity of the project site indicate that the loudest aircraft noise events were typically associated with overflights by military jet aircraft. The number of overflights by military aircraft are significantly lower than the number of overflights by civilian jet aircraft. However, because the DNL system used to construct the aircraft noise contours uses a cumulative (or energy) averaging methodology, the louder noise events will tend to control the final DNL values. This has been and is still a typical characteristic of the aircraft noise environment in the project area.

5.3.2 Future Noise Environment

Traffic Noise

Predictions of future traffic noise levels were made using the traffic volume assignments with and without the proposed project. The increase in future traffic noise attributable to project traffic will be moderate and will typically range between 0.8 and 1.6 dB (Leq). Non-project traffic is expected to cause the larger increases in traffic noise along the new roadways in the project area. Increases in future traffic noise due to project traffic are expected to be largest (2.0 to 2.5 DNL) along the new Street A, which is located within the project boundaries.

In CY 2010, the dominant traffic noise sources in the project area will continue to be traffic noise from Fort Weaver Road. Traffic noise along the new sections of Kapolei Parkway south of Geiger Road and the new Street A will also be dominant noise sources within the project boundaries, particularly at those receptor locations which are removed from Ft. Weaver Road.

Essentially all locations which front Ft. Weaver Road, Geiger Road, Kapolei Parkway, Iroquois Road, and Street A will experience relatively high noise levels above 65 DNL. Those receptor locations which are removed from the major roadways as well as shielded by existing and new buildings should experience traffic noise levels less than 65 DNL.

Aircraft Noise

The aircraft noise contours in the project environs for the CY 2020 period were developed using the available forecasts for Honolulu International Airport. The relationship of the CY 2020 aircraft noise contours to the project site were assessed and indicate that the 60 DNL aircraft noise contour could encroach into the project site, and primarily over the commercial and industrial sections of the development. The available CY 2020 forecasts for aircraft noise over the project site indicate that the 60 DNL contour could expand slightly and begin to extend into the project site in the south section of the project alongside Ft. Weaver Road. The residential and school parcels of the development should remain outside the 60 DNL contour. Planned noise sensitive uses of the project have been located outside the 60 DNL contour for CY 2020 in recognition of the existing planning guidelines.

Anticipated Impacts and Mitigative Measures

5.3.3 Traffic Noise Impacts

The increases in traffic noise levels attributable to the project from the Base Year to CY 2010 are predicted to not exceed 1.6 DNL along Ft. Weaver Road, and should not exceed 1.1 DNL along Geiger Road, Iroquois Road, Kapolei Parkway, and Keaunui Drive south of Iroquois Road. A traffic noise level increase of 1.6 DNL is considered to be moderate, but not significant. Traffic noise level increases of 0 to 1.0 DNL are considered to be insignificant and will be difficult to detect, particularly if the increase occurs over a 9 to 12 year period. Larger increases of 2.0 to 2.5 DNL are predicted to occur on new Street A within the project area.

Potential noise impacts from project and non-project traffic are possible in the project environs, both in respect to existing and planned noise sensitive receptors along these roadways. Existing and future residences which are located along essentially all of the major roadways in the project area may be impacted by the future traffic noise along these roadways if their setback distances from the roadway centerlines are less than those shown for the 65 DNL contour (Table 7 of the Appendix). The setbacks of existing homes along Fort Weaver Road, Geiger Road, Iroquois Road, and Kapolei Parkway are not adequate for avoiding future adverse noise impacts from traffic by CY 2010, with or without the project. For this reason, existing homes which front these two roadways are expected to be impacted by traffic noise in the future if they are not shielded by sound walls.

Because traffic noise along public roadways are generated by non-project as well as project traffic, mitigation of off-site traffic noise impacts are generally performed by individual property owners along the roadways' Rights-of-Way or by public agencies during roadway improvement projects. These mitigation measures generally take the form of increased setbacks, sound attenuating walls and/or berms, total closure and air conditioning, or the use of sound attenuating windows. Where adequate setbacks beyond the 65 DNL noise contour are not available, the construction of 6 to 8 feet high sound walls is generally effective for attenuating traffic noise at single story structures, or at the ground floors of multistory structures. If 6 to 8 feet high walls and/or berms are utilized to reduce traffic noise, at least 5 to 10 DNL units of reduction should be possible at ground level units. Second floor units will normally not benefit from the construction of 6 to 8 feet high walls. Whenever mitigation of traffic noise at the upper floors are required, the use of closure and air conditioning, or the use of sound attenuating windows are the more appropriate sound attenuation measures.

5.3.4 Aircraft Noise Impacts

The siting of future noise sensitive developments within the 60 DNL airport noise contour is not recommended by the State Department of Transportation, Airports Division. Residences, schools, churches, health centers, day-care centers, and hotels are included within the noise sensitive land use category. The siting of industrial and commercial uses within the 60 DNL contour is considered to be acceptable, since closure and air conditioning of industrial and commercial office spaces is the rule rather than an exception. The siting of these types of uses (or other non-noise sensitive land uses) within the high noise areas is usually encouraged, since it tends to preclude future development of noise sensitive uses on the same lands.

By siting planned noise sensitive uses outside the existing and forecasted 60 DNL noise contours for Honolulu International Airport, risks of adverse aircraft noise impacts have been reduced to acceptable levels.

5.3.5 Combined Traffic and Aircraft Noise

When applying for FHA/HUD financial assistance on residential developments, sound attenuation measures are normally required if total exterior noise levels exceed 65 DNL. Traffic noise levels will exceed 65 DNL along the highway corridors and major thoroughfares which service the project. If the traffic noise level equals 65 DNL and the aircraft noise level equals 57 DNL at a project dwelling, the total noise level will be 66 DNL, which exceeds the FHA/HUD standard of 65 DNL. Where existing and forecasted aircraft noise levels over the project site do not exceed 55 DNL, combined traffic and aircraft noise levels should not exceed 65 DNL when traffic noise levels are less than 65 DNL. Where traffic noise levels exceed 65 DNL, the combined noise levels will be identical to the traffic noise levels and will not be dependent upon the levels of aircraft noise, as long as aircraft noise levels remain at least 10 DNL units below the traffic noise levels.

Aircraft noise contours for CY 2010 (the same year as the traffic noise predictions) were not constructed because detailed aircraft operations forecasts for Honolulu International Airport were not available. However, if the worst case CY 2020 aircraft noise contours are combined with the CY 2010 traffic noise contours, the following changes in the CY 2010 setback distances to the 65 DNL contours are predicted for locations within the 55 DNL contour areas:

a. Ft. Weaver Road north of Street A: Increase from 265 feet to 287 feet.
b. Kapolei Parkway north of Entrance A: Increase from 232 feet to 249 feet.
c. Kapolei Parkway south of Entrance A: Increase from 230 feet to 253 feet.
d. Kapolei Parkway north of Entrance B: Increase from 230 feet to 260 feet.
e. Kapolei Parkway south of Entrance B: Increase from 227 feet to 256 feet.
f. Kapolei Parkway north of Street A: Increase from 227 feet to 256 feet.
g. Kapolei Parkway south of Street A: Increase from 190 feet to 209 feet.
h. Street A east of Kapolei Parkway: Increase from 146 feet to 182 feet.
i. Street A west of Fort Weaver Road: Increase from 183 feet to 227 feet.
j. Golf Course Road east of Fort Weaver Road: Increase from 70 feet to 83 feet.

5.3.6 Construction Noise

Audible construction noise will probably be unavoidable during the entire project construction period. During periods of construction, it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. The noise sensitive properties which are predicted to experience the highest noise levels during construction activities on the project site are the existing residences north and adjacent to the project site. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 feet distance), and due to the exterior nature of the work (grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site, and heavy truck and equipment staging areas should be located away from the existing residences to the north. The incorporation of State Department of Health construction noise limits and curfew times, which are applicable on the island of O'ahu, is another noise mitigation measure which can be applied to this project. Noisy construction activities are not allowed during the nighttime hours, or on Sundays and holidays under the DOH permit procedures.

5.4 Air Quality

A study titled *Air Quality Study for the Proposed 'Ewa by Gentry Makai Development* was conducted for the proposed development by B.D. Neal and Associates. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate. Potential impacts on the project from nearby industrial sources are also examined. The air quality study can be found in Appendix L.

Existing Conditions

5.4.1 Ambient Air Quality Standards

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawai'i air quality standards are more stringent than the comparable national standards except for those pertaining to sulfur dioxide and particulate matter.

5.4.2 Regional and Local Climatology

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the 'Ewa Plain area is very much affected by its Leeward and coastal situation. Winds are predominantly trade winds from the east-northeast except for occasional periods when Kona storms may generate strong winds from the south or when the trade winds are weak and landbreeze-seabreeze circulations may develop. Wind speeds typically vary between about 5 and 15 miles per hour providing relatively good ventilation much of the time. Temperatures in the Leeward O'ahu area are generally very moderate with average daily temperatures ranging from about 65°F to 84°F. The extreme minimum temperature recorded at the nearby (former) 'Ewa Plantation is 47°F, while the extreme maximum temperature is 93°F. This area of O'ahu is one of the drier locations in the state with rainfall often highly variable from one year to the next. Monthly rainfall has been measured to vary from as little as a trace to as much as 15 inches. Average annual rainfall amounts to about 21 inches with summer months being the driest.

5.4.3 Present Air Quality

The present air quality of the project area appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawai'i Department of Health suggest that all national air quality standards are currently being met, although occasional exceedances of the more stringent state standard for ozone may occur. It is also possible that the more stringent state standards for carbon monoxide are exceeded at times near congested roadway intersections.

5.4.4 Short-Term Air Quality Impacts

If the proposed project is given the necessary approvals to proceed, it may be inevitable that some short- and/or long-term impacts on air quality will occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

5.4.5 Long-Term Air Quality Impacts

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, an air quality modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at intersections in the project vicinity and to predict future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are within both the state and the national ambient air quality standards. In the year 2010 without the project, carbon monoxide concentrations were predicted to increase at some locations and decrease at others, but concentrations would likely remain within the national and state standards at all locations studied. With the project in the year 2010, carbon monoxide concentrations were estimated to either remain unchanged or increase slightly at some locations compared to the without-project case; worst-case concentrations should remain within both national and state standards. Due to the small impact the project is expected to have, implementing mitigation measures for traffic-related air quality impacts is probably unnecessary and unwarranted.

At this time, the specific tenants of the commercial/industrial area associated with the project have not been identified, but the types of facilities that are expected to locate there are not significant sources of air pollution. Before any air pollution sources can be built anywhere in the state, an application must be submitted to the Department of Health for a permit to construct the facility, and detailed information concerning any air pollution emissions will need to be provided in the application.

5.4.6 Impacts from Local Sources

In evaluating the proposed project, it may be appropriate to consider not only impacts created by the project but also potential impacts on the project from nearby industrial sources. ~~Due to the relatively close proximity of industries located at Campbell Industrial Park (CIP), occasional impacts on the project from emissions emanating from these facilities may occur in conjunction with coincidental~~

~~occurrences of industry malfunctions and westerly winds, both of which are relatively infrequent events.~~ Increased scrutiny by the Department of Health, an air quality task force mandated by the state legislature, and the modernization by some industrial park tenants should help to mitigate future impacts on the proposed project.

Anticipated Impacts and Mitigative Measures

5.4.7 Air Quality Conclusions and Recommendations

The major potential short-term air quality impact of the project will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of windscreens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program and to adjust the program if necessary.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After the proposed project is completed, any long-term impacts on air quality in the project area due to emissions from project-related motor vehicle traffic should be small. Worst-case concentrations of carbon monoxide should remain within both the state and the national ambient air quality standards. Implementing any air quality mitigation measures for long-term traffic-related impacts is probably unnecessary and unwarranted.

Any long-term impacts on air quality due to indirect emissions from supplying the project with electricity and from the disposal of waste materials generated by the project will likely be insignificant based on the relatively small magnitudes of these emissions. Nevertheless, indirect emissions from project electrical demand could likely be reduced somewhat by incorporating energy-saving features into project design requirements. This might include the use of solar water heaters; designing building space so that window positions maximize indoor light without unduly increasing indoor heat; using landscaping where feasible to provide afternoon shade to cut down on the use of air conditioning; installation of insulation and double-glazed doors to reduce the effects of the sun and heat; providing movable, controlled openings for ventilation at opportune times; and possibly installing automated room occupancy sensors. Solid waste related air pollution could likely be reduced somewhat by the promotion of conservation and recycling programs within the proposed development. This could reduce solid waste volumes, which would in turn reduce any related air pollution emissions proportionately.

At this time, sufficient detail is not available describing the facilities that may be located within the commercial/industrial area included in the project to perform any quantitative impact assessments. However, the types of facilities currently being considered do not emit significant amounts of air pollution. In any case, before any air pollution sources can be built anywhere in the state, an application must be submitted to the Department of Health for a permit to construct the facility, and detailed information concerning any air pollution emissions will need to be provided in the application. If deemed necessary, the Department of Health may require the applicant to assess the air quality impact of the proposed emissions.

Due to the relatively close proximity of industries located at CIP, occasional impacts on the project from emissions emanating from these facilities will probably be unavoidable. Such impacts may occur in conjunction with the coincidental occurrences of industry malfunctions and westerly winds, both of which are relatively infrequent events. Increased scrutiny by the Department of Health, a special task force mandated by the state legislature to assess and monitor emissions in the area, and the upgrade of some of the industries located at CIP, such as Chevron, should help to mitigate future impacts on areas adjacent to CIP.

5.5 Visual Resources

Existing Conditions

The project area presently consists of fallow lands that are clear of any structures or significant landscape. Various weedy species are found throughout the project site. The western project area is offers views of the Waianae Range towards Makakilo from Fort Weaver Road. While open in character, the site is not considered characteristic of the surrounding communities which provide extensive landscaping along Fort Weaver Road. View in the western direction could be considered unsightly due to the overgrowth of weedy species.

Views to the east are dominated by dust screens that have been erected along Fort Weaver Road. While some views of the Koolau Range are visible, they are considered insignificant due to the distance to this view horizon.

Anticipated Impacts and Mitigative Measures

Development of the 'Ewa Makai project is expected to significantly enhance the existing views through the addition of extensive landscaping that is consistent with the urban models found within the 'Ewa by Gentry project and other new communities lying to the north and south.

5.6 Social Characteristics

The *'Ewa Makai Social Impact Assessment* was prepared for the proposed project by Earthplan. The report, which assesses the population and social environment impacts of the project, is attached as Appendix M.

Existing Conditions

5.6.1 Profile of the Existing Community

Overall Study Area

The Overall Study Area for this report is the 'Ewa Development Plan region, which covers the entire 'Ewa plain, includes the coastline between West Loch and Kahe Point, and extends to the mauka areas. Formerly, virtually this entire region comprised the 'Ewa Neighborhood Board No. 23 area. To accommodate the current and anticipated population growth, the City divided the previous Neighborhood Board area into two Boards: the 'Ewa (No. 23) area and Makakilo/ Kapolei/ Honokai Hale/ Nanakai Gardens Neighborhood Board (No. 24) area.

The Makakilo/ Kapolei/ Honokai Hale/ Nanakai Gardens Neighborhood Board area encompasses the western portion of the 'Ewa Development Plan area. A focal point of this western half is the City of Kapolei, which forms the region's new commercial and government center.

Honokai Hale and Nanakai Gardens form a contiguous residential community containing approximately 290 residences. The Villages of Kapolei is a cooperative housing development between the government and several private developers. Currently being developed in phases, the project will include eight residential villages and support facilities on approximately 890 acres of land at full build-out. Located on the southern foothills of Wai`anae Range, the development of Makakilo began in the early 1960s as a planned hillside residential project of Finance Realty. When completed, the entire development should include about 6,200 homes.

Primary Study Area

The Primary Study Area for this report is the 'Ewa Neighborhood Board area, which is generally the eastern portion of the 'Ewa Development Plan area. The Primary Study Area includes the existing communities of 'Ewa Beach, 'Ewa Villages, West Loch Estates, 'Ewa by Gentry and Ocean Pointe.

The name and existence of the present town of 'Ewa comes from the founding of the 'Ewa Plantation, incorporated in early 1890[1]. By 1877, James Campbell had acquired approximately 41,000 acres of arid ranch lands on the 'Ewa plain. With the need for water apparent, Campbell arranged for the drilling of Hawai'i's first artesian wells, an effort that proved successful and made available water reserves for the area. In 1889, the Honouliuli lands were leased to B.F. Dillingham, who later subleased a portion of those lands to W.R. Castle who, with Castle and Cooke, organized the 'Ewa Plantation Company. A merger of 'Ewa Plantation with O'ahu Sugar occurred in 1970.

According to written reports, the lands of 'Ewa Beach were once part of the Magoon, Parish, and Dowsett Estates and used for seafront summer homes. In 1948, approximately 200 people lived in the area. The 'Ewa Beach Community Association formed in 1950. By 1958, the population had grown to 300. Of those, approximately 70 percent were families of personnel from the nearby Barbers Point Naval Air Station. Today, the community contains residential subdivisions, shopping areas, schools, churches, and all the public and private amenities associated with small towns that exist throughout the island.

'Ewa Villages was at one time home to nearly 3,000 'Ewa Plantation sugar workers and their families. Today, efforts to restore many of the historic structures and houses from the villages of Tenney, Renton, and Varona are being undertaken through the City and County of Honolulu's Revitalization Program. In addition to restoration, over 1,000 new homes will be constructed at market and affordable prices. The community includes an 18-hole municipal golf course and commercial space.

West Loch Estates, a City and County of Honolulu master-planned community, includes 1,600 residential units on approximately 500 acres of land acquired from the Estate of James Campbell. The first phase, completed in 1990, contains 593 homes. The second phase, completed in 1994, contains approximately 700 residential units. The development also includes an 18-hole municipal golf course, a shoreline park, and units designed for senior living.

'Ewa by Gentry, an ongoing development of the Gentry companies, began selling homes in their Soda Creek project in 1988. The 1,000-acre master-planned community, located on both sides of Fort Weaver Road, will include approximately 7,200 homes. Approximately ~~5,000~~ *5,400* units have been completed thus far.

Population Trends

Designated the Secondary Urban Center by the City and County of Honolulu, the 'Ewa region has been undergoing many changes over the last two decades. As more residential units are being built, the population of this region has increased from 38,324 in 1980, to 42,983 in 1990 and to 68,718 persons in 2000.

In terms of average annual growth rates, these increases mean that the Study Area has been growing at rates much higher than that of the City and County of Honolulu. From 1980 to 1990, the O'ahu-wide population grew from 762,534 to 836,231 persons; this represents an average annual growth rate of 0.9 percent. By 2000, the O'ahu-wide population grew to 876,156 persons, which represents an average annual growth rate of 0.5 percent from 1990 to 2000.

In the 'Ewa Development Plan area, the average annual growth rate between 1980 and 1990 was 1.2 percent. As development activity increased, the growth rate increased significantly, as indicated by the 5.9 percent average annual growth rate from 1990 to 2000.

The Total Study Area is expected to increase its proportion of the total islandwide population. In 2000, the 'Ewa Development Plan area accounted for 7.8 percent of the total O'ahu population. By 2010, it is projected that 'Ewa will comprise nine percent of O'ahu's population; by 2020, ten percent.

Total and Primary Study Areas

The Total and Primary Study Areas tend to be younger than the O'ahu population. When compared to the islandwide community, both had relatively higher proportions of people 17 years old and younger, and lower proportions of people 65 years and older.

In terms of median age, the Total and Primary Study Areas consistently had lower median ages than the islandwide community. The O'ahu 1990 median age was 32.2 years; for 2000, 35.7 years. The 1990 median ages for the Total and Primary Study Areas were 27.5 and 27.8 years, respectively. The 2000 median ages for the Total and Primary Study Areas were 31.2 and 30.8 years, respectively.

From 1990 and 2000, the Total Study Area experienced a slight increase in youngsters 17 years and younger (from 31 to 32 percent), a decrease in those 18 to 64 years (64 to 62 percent), and an increase in the 65 years and older category (five to seven percent).

Between 1990 and 2000, the Primary Study Area experienced stability in all categories. Both census years indicated similar proportions of people 17 years (33 percent), 18 to 64 years (61 percent) and 65 years and older (from six to seven percent).

Ethnicity

A detailed analysis of ethnic trends is not possible due to the methodology differences in gathering information between the 1990 and 2000 census taking. In 1990, census respondents were required to pick a single ethnic category. In 2000, multi-ethnic respondents were allowed to select the appropriate number of categories. Nevertheless this information provides relative ethnic proportions.

When compared to the 2000 islandwide ethnic profile, the Total Study Area tended to have lower proportions of Caucasians (O'ahu 21 percent; Total Study Area 18 percent) and Hawai'ians (O'ahu nine percent; Total Study Area eight percent). The Primary Study Area had proportionally less Caucasians (17 percent), and other/mixed (27 percent) and more Asians (50%) when compared to the Total Study Area. Both O'ahu and the Total Study Area Asian Population amounted to 46 percent of the total population. The proportion of those of other and mixed races was higher in the Total Study Area (28 percent) than on O'ahu (24 percent).

Households and Families

Both the Total and Primary Study Areas had significantly high proportions of family households when compared to the islandwide community. In 1990 and 2000, about 74 and 72 percent, respectively, were family households out of the total household count. In the Total Study area, almost all of the households were family households in 1990, and 84 percent were family households in 2000. In the Primary Study Area, 89 percent of the households were families in 1990, and 85 percent in 2000.

Household and family sizes were higher in the Total and Primary Study Areas than in the O'ahu-wide community. In 1990 and 2000, the O'ahu-wide average household size was three persons. The average household size for the Total Study Area was 3.7 persons in 1990 and 2000. In the Primary Study Area, the average household size was four persons in 1990 and decreased to 3.7 persons in 2000.

The O'ahu-wide average family size was 3.5 and 3.6 persons in 1990 and 2000, respectively. For the Total Study Area, family sizes averaged 3.6 and 4.2 persons in 1990 and 2000, respectively. Average family size in the Primary Study Area was 4.1 persons in 1990 and 2000.

Housing Units

The Total Study Area experienced a 77 percent increase in housing units from 11,721 to 20,804 units from 1990 to 2000. The Primary Study Area housing units more than doubled from 1990 to 2000, from 6,972 to 15,845 units. Both increases were significantly high, when compared to the twelve percent increase experienced on O'ahu from 1990 to 2000.

In terms of housing unit occupancy in 2000, about half of the O'ahu housing supply was occupied by its owners and 41 percent were renter-occupied. Approximately 5.8 percent of the housing units were vacant. The Total and Primary Study Areas experienced an increase in owner-occupied units from 1990 to 2000, and had significantly higher proportions when compared to O'ahu. The 2000 owner-occupancy rate for the Total Study Area was 64 percent; for the Primary Study Area, 63 percent.

Housing vacancy was also high in the Total and Primary Study Areas due to the ongoing construction activity. The Total Study Area had a nine percent housing vacancy rate; the Primary Study Area, ten percent.

Primary Study Area Communities

The City Department of Planning and Permitting has prepared 2000 census information on specific O'ahu communities that is not available in standard census products. In the Primary Study Area, such information is available for 'Ewa Villages / Honouliuli, 'Ewa Gentry / West Loch, 'Ewa Beach / Iroquois Point, and Ocean Pointe.

It is noted that, while these are the major communities within the 'Ewa Neighborhood Board area, which is the Primary Study Area, the boundaries for these individual communities are not inclusive of the entire Neighborhood Board area. Age-wise, the older communities of 'Ewa Villages / Honouliuli had relatively older populations with a median age of 34.1 years. The 'Ewa Beach / Iroquois Point community, also older neighborhoods, has the lowest median age of 30.1 years.

In terms of ethnicity, over half of the 'Ewa Villages / Honouliuli (68 percent) and 'Ewa Gentry / West Loch (55 percent) populations were of Asian ancestry in 2000. In 'Ewa Beach / Iroquois Point and Ocean Pointe, respectively 40 and 44 percent of the population were Asian. Caucasians accounted for only four and 13 percent of the 'Ewa Villages / Honouliuli and 'Ewa Gentry / West Loch populations, respectively. The Caucasian proportions were higher in 'Ewa Beach

/ Iroquois Point and Ocean Pointe, where respectively 24 and 19 percent were in this category. 'Ewa Beach / Iroquois Point had the highest proportion of Hawai'ians and other Pacific Islanders, with eight percent. The lowest proportion was found in Ocean Pointe, at four percent.

The older communities tended to have larger household sizes. The largest households were found in 'Ewa Beach / Iroquois Point where the average household size was 4.24 persons. In 'Ewa Villages / Honouliuli, an average of 3.95 persons lived in each household. These communities also had the highest proportions of family households. Over 90 percent of households in 'Ewa Beach / Iroquois Point were family households. In 'Ewa Villages / Honouliuli, 84 percent were family households. Ocean Pointe had the smallest household and family sizes in 2000, with 2.97 persons and 3.48 persons, respectively.

Generally, housing units in these communities tended to be owner-occupied, with the highest level of owner-occupancy in the new community of Ocean Pointe. Only the 'Ewa Beach / Iroquois Point community had a relatively high proportion of renters. Forty percent of the housing units were renter-occupied and 46 percent were owner-occupied. Housing vacancies were also the highest in this community, with 14 percent of the housing unit supply vacant in 2000.

5.6.2 Major Forces for Change

The Total and Primary Study Areas are expected to undergo major changes regardless of whether the proposed project is implemented. These changes extend the baseline context of the social environment and are outlined in this section. Section 3.1 presents changes advocated by the public sector, and private sector projects are presented in Section 3.2.

'Ewa Development Plan

The City and County of Honolulu guides and directs land use and growth through a three-tier system of policies, planning principles, guidelines, and regulations. The General Plan forms the first tier of this system and comprises statements of objectives and policies. Adopted in 1977, the General Plan has been amended several times, although the basic elements in the original document remain the same.

The second tier of the system includes the Development and Sustainable Communities Plans. There are eight plans that cover the Primary Urban Center, East Honolulu, Central O'ahu, 'Ewa, Waianae, North Shore, Kooloauloa, and Koolaupoko.

The third tier of the system comprises the implementing ordinances, including the Land Use Ordinance and the City's Capital Improvement Program.

The project is in the 'Ewa Development Plan area. The General Plan calls for the Secondary Urban Center to be centered in Kapolei, which is planned as the focus of major economic activity and housing development, and a center for government services. It also encourages development of the Secondary Urban Center at Kapolei, and residential development of the urban fringe areas in 'Ewa.

In keeping with the General Plan, the 'Ewa Development Plan provides a secondary employment center with its nucleus in the City of Kapolei to supplement the Primary Urban Center (PUC). It concentrates primary employment activities at industrial and resort areas, government facilities and higher education centers around the City of Kapolei.

The 'Ewa Development Plan also provides for significant residential development throughout 'Ewa, and calls for a variety of housing types from affordable units and starter homes to mid-size multi-family and single family units.

The 'Ewa Development Plan contains land use policies, principles and guidelines related to open space preservation and development, regional parks and recreation complexes, community-based parks, historic and cultural resources, the City of Kapolei, residential development and non-residential development. The following are social-related policies that are relevant to the proposed 'Ewa Makai.

Residential Development

The 'Ewa Development Plan calls for a housing density of ten to 15 units per acre in aggregate areas zoned for residential use. Low-density areas should have between five to twelve units per acre and medium density areas should have ten to 30 units per acre. High-density areas should have 25 to 90 units per acre. Building heights restrictions include two stories for low density housing, up to three stories for medium density and up to 90 feet for high density.

The 'Ewa Development Plan also calls for:

- A physical definition of neighborhoods,
- A compatible mix of building forms,
- Transit-oriented streets,
- Opportunities for pedestrian and bicycle travel, and
- Integration of linear corridors.

Community-Based Parks

The Development Plan calls for new residential development to include land for open space and recreation at a minimum of two acres per 1,000 residents. Community-based parks include:

- mini parks, with a .25-mile service radius,
- neighborhood parks, with a .50-mile service radius,
- community parks, with a one mile-service radius, and
- district parks, with a two-mile service radius.

Further, the 'Ewa Development Plan notes that the existing deficit to City park stands at almost 40 acres, and that an additional 76 acres of community-based parks and recreation should be developed to meet the needs of the projected 2020 population.

Commercial Centers

The 'Ewa Development Plan identifies four types of commercial centers, based on size and function. These types include neighborhood commercial center (five to ten acres), community commercial center (ten to 30 acres), major community commercial center (up to 50 acres) and regional community center (more than 50 acres). The latter two types of commercial centers are only located in the City of Kapolei, as that region is intended to provide for regional shopping needs.

For the neighborhood and community commercial centers, the Plan provides guidelines for street frontage, floor area, and types of uses. Generally, these commercial centers should be dedicated mostly to retail uses and office uses that provide services to the surrounding community.

Industrial Uses

Industrial centers in the 'Ewa Development Plan region include the Barbers Point Industrial Area and the Honouliuli Industrial Area. Service-oriented industrial uses, such as automobile repair shops, contractor's yards, and businesses serving residential and commercial areas, can be located near the City of Kapolei, in the Kapolei Business Park and on industrial-designated land in the Barbers Point Naval Air Station. Alternatively, a commercial, cultural or recreational entertainment attraction may be permitted in the area fronting the OR&L Historic Railway. An industrial area in Laulani is also included in the 'Ewa Development Plan; it is intended for service oriented light industrial use.

Private Development Efforts

'Ewa is a region in transition and there are major changes which are being undertaken as part of the effort to establish the region as the island's secondary urban core. Kapolei is envisioned as providing an urban center with facilities for commerce, finance, government services, and industrial activities. The major components include several commercial and office complexes, the existing James Campbell Industrial Park, the new 800- acre Kapolei Business Park, Barbers Point

Harbor, Ko'Olina Resort, and the City of Kapolei's numerous residential neighborhoods.

Specific projects underway in the Primary Study Area include the following:

Ocean Pointe
Adjacent to 'Ewa Beach and south of the project site, Ocean Pointe is a planned 1,100-acre community that includes a full-service 1,400-slip marina with a maritime commercial complex. This complex includes light industrial, commercial and retail facilities, as well as ancillary visitor accommodations. The project also includes 4,850 residential units, a golf course and a 20-acre district park.
Developer HASEKO ('Ewa) recently submitted a request to rezone a portion of the project to accommodate drainage system modifications. The proposed changes included reduction of the marina size from 120 to 70 acres, converting the eastern basin to a portion of the golf course, reducing the golf course from 27 to 18 holes, reduction and reconfiguration of the commercial and industrial support area, and incorporating a neighborhood business area. The rezoning request for reconfiguration was recently approved by the Honolulu City Council.

'Ewa by Gentry
Gentry has completed approximately ~~5,000~~ *5,400* housing units in 'Ewa by Gentry, which is located just north of the project site. When development is completed in 2010, there will be approximately 7,200 housing units in six neighborhoods.

'Ewa Villages
The City and County of Honolulu acquired 600 acres northwest of the project site. This area surrounds and includes the former plantation villages, including Tenney, Renton and Varona Villages. Existing structures in 'Ewa Villages are being rehabilitated for reuse, and related affordable and market housing is being developed. A total of 1,900 residential units will be available at full buildout.

5.6.3 Potential Social Impacts

Population Impacts

The 'Ewa Makai development will result in an increase in the residential population due to the increase in residential units. Table ~~7~~ *8* presents the range of potential population impacts.

Table ~~7~~ 8: Range of Potential Impact on Resident Population

Range	Low	Middle	High
Basis	2000 average household size on O'ahu	2000 average household size in 'Ewa by Gentry, a comparable mix of housing types	2000 average household size in Primary Study Area
Average household size	2.95	3.25	3.68
Projected 'Ewa Makai Residential Population	5,502	6,061	6,863

On the low end of the possible range, the proposed project could add 5,500 persons to the region, based on the O'ahu 2000 average family size of 2.95 persons. This is considered the low end of the range because the O'ahu housing supply has a high proportion of medium and high-density units. Further, O'ahu has relatively high proportion of renters and low proportion of family households.

The high end of the possible range is 6,900 persons based on the 2000 Primary Study Area average household size of 3.68 persons. This is considered the high end because the Primary Study housing type mix has a relatively high proportion of single-family units.

The most likely estimate of population impact is the mid-range projection that 'Ewa Makai may add 6,000 persons to the region. This estimate is based on the 2000 average household size in 'Ewa Gentry, a relatively recent community with a mix of units and community amenities similar to that proposed in 'Ewa Gentry.

The projected 'Ewa Development Plan population for 2010 is 88,400 persons. The proposed project would comprise approximately seven percent of this projected population. The projected 'Ewa Development Plan population for 2020 is 100,700 persons. 'Ewa Makai would comprise approximately six percent of the projected population.

Project Relationship to Public Policies and Community Expectations

Public Policies
The proposed 'Ewa Makai is consistent with public policy as set forth in the 'Ewa Development Plan.

Overall growth and residential policy
The project is consistent with public policy to promote residential development in the urban fringe of the 'Ewa Development Plan area. 'Ewa Makai is included in Phase 1 of the Development Plan phasing of 'Ewa development. It is referred to as Laulani Residential, with 1,100 units, and Fairways Residential with 900 units. 'Ewa Makai also offers a variety of housing types, including single-family homes,

townhouses, and residential cluster neighborhoods, which provides for a wide range of affordability for a mixture of household types and sizes.

Residential component
The project is well below the residential density called for in the 'Ewa Development Plan. The residential density for single-family units is 7.5 units per acre, which is within the Development Plan range of five to twelve units per acre. The combined project density for cluster and multi-family units is 15 units per acre, which is within the Development Plan range of ten to 30 units per acre. The project includes 24 acres for community facilities, consistent with the 'Ewa Development Plan residential provision for community facilities including churches, community centers and elderly and child care centers. Further, the developer intends to comply with design and land use guidelines related to building height and form, compatibility and architectural character.

Community-Based Parks
The proposed project may result in a resident population between 5,500 and 6,900 persons. Based on the parks standards set forth by the 'Ewa Development Plan, these population levels would require community park acreage between eleven and 13.8 acres. The proposed project includes 13.5 acres designated for park space, plus 14 acres designated for open space. The 'Ewa Makai project is consistent with the policies related to community-based parks in that the 13.5 acres generally meet the standard that would apply to the high end of the population estimate.

Commercial and Industrial Areas
The Industrial/ Commercial component of 'Ewa Makai is included in the Development Plan phasing of 'Ewa Development Plan, as part of Laulani Commercial. Thirty acres is designated for Industrial use.

Community Reaction
This study included a review of 'Ewa Neighborhood Board actions to assess possible community issues on this project. We reviewed Board minutes of meetings held from June 2000 to May 2002.

This Board deals with issues related to a stable residential community. In terms of proposed community changes, the Board generally tends to support the improvement of existing facilities, such as sidewalks, bus stops, and a Conditional Use Permit to convert a church office space into classrooms. After reviewing project merits, the Board also supported ocean-related projects including a moi farm and a limu restoration project. The Ocean Pointe rezoning request was supported in January 2001.

The Board reviewed park night closure, and its members voted to support the testing of night closure at Geiger Park and eventually supported permanent night closure at that facility. When the Board evaluated uniform park night closures, the Board was divided. Some felt that the consideration should be given to people living adjacent to parks, while others felt that parks should be open to those who want to use them after 10 P.M.

Regarding new development projects, the Board was somewhat supportive, but continue to express concern about infrastructure impacts, particularly those related to roadways and traffic circulation. When the 'Ewa Makai project was discussed in February 2001, the Board discussed a construction moratorium but the motion was withdrawn. The Board voted to not support the rezoning request from 'Ewa by Gentry in Area 20.

In October 2001, the Board voted to support a moratorium on further construction until proper highway improvements are in place. The Board has since worked with the City, State, and private developers, namely Gentry Homes, Ltd. and HASEKO. In February 2002, the Board unanimously voted to withdraw its request for a construction moratorium noting that the private developers have historically completed their share.

The 'Ewa Makai project was discussed in the Planning and Zoning Committee in January 2002. Key issues included:

- Moving the residential units around the planned 14-acre open space area, though this concern was alleviated when it was learned that this is not a designated park
- The adequacy of school facilities, considering the cumulative growth planned for the region
- Infrastructure concerns, namely roads, drainage and schools

In March 2002, the 'Ewa Neighborhood Board passed the following motion:

1. *Support the development of the 'Ewa Makai project, which incorporates the infrastructure development for roads/technology, sewage and the intermediate school site development*

2. *The Department of Education should actively encourage parents of students in overcrowded area schools to apply for geographic exemptions to attend Iroquois Point Elementary*

3. *Do not support any future request for increasing density in the project*

4. *Future legislators need to ensure CIP funding for the development of the new intermediate school*

Public Services and Facilities

Police Protection

The project site is served by the Kapolei Police Station, which is located at 1100 Kamokila Boulevard in Kapolei. There is also a storefront office next to the 7-eleven store at 91-1669 Fort Weaver Road.

The Primary Area, which is the 'Ewa Neighborhood Board area is divided into Police Beats 874, 875, 876, 877, and 879. The project site is located in Police Beats 875 and 876. At any given time, there is a minimum of 14 officers assigned to this region.

Potential project impacts on current services would be a likely increase in calls for police services. It is recommended that the 'Ewa Makai project can mitigate impacts on police protection services through security measures such as on-site security, design measures such as well-lit public areas and walkways, and the establishment of neighborhood watch programs. As an extension of the 'Ewa by Gentry Community, 'Ewa Makai will have on-site security and will be part of an established community watch program.

Fire Protection

In the event of a single alarm fire, the project site would be served by the Waipahu Fire Station. For a multiple alarm such as a structure fire, three engine companies and one ladder company would be sent from the 'Ewa Beach, Waipahu, and Kapolei Fire Stations. The ladder company would originate from the Waipahu Fire Station.

Five firefighters are assigned to the Waipahu Fire Station, with a minimum of four people on call at all times. A minimum of four people would respond in the event of a single alarm incident. In the event of a multiple alarm incident, there would be a minimum of 18 firefighters responding from the three engine and one ladder companies, as well as a fire chief and the assigned driver. The response time to the project site depends on traffic, but is usually from four to six minutes.

If a backup company is needed, the backup company can come from the Waipahu, 'Ewa Beach, and Kapolei Fire Stations. In the event of a second alarm in a multiple incident, two additional engine companies from the Waikele and Pearl City Fire Stations would respond, as well as a ladder company coming from the Kapolei Fire Stations.

The project will increase the demand for fire protection services by adding new structures and approximately 6,000 people to the area.

Emergency Medical Services

The Honolulu Emergency Services Department, hereafter referred to as EMS, is responsible for providing the following:

- an efficient, effective and economical operation of the pre-hospital emergency medical care and emergency ambulance service,
- a comprehensive aquatic safety program at 19 City beach parks, including lifeguard services,
- injury prevention, public education and public health programs, and
- coordination with other agencies and jurisdictions.

In an emergency response, either EMS personnel or the nearest fire station is notified. EMS uses a global tracking system that places each vehicle within 30 feet of its current location.

The 'Ewa area is primarily serviced by two ambulances from St. Francis West and the Waipahu Fire Station. There is also a single Rapid Response Unit based at Kalaeloa. The Rapid Response Unit does not transport patients, however.

Ambulances are staffed by two paramedics, and the Rapid Response Unit is staffed by a single paramedic. If needed, additional EMS vehicles respond from Waianae and Aiea. The average response time to the project site is approximately six to nine minutes.

Public Education

Residents of the 'Ewa Makai community will be served by the Pohakea and 'Ewa Beach Elementary Schools, Ilima Intermediate, and Campbell High School. The current and projected enrollments of these schools are presented below.

Table 8 9. Current and Future Enrollment for Schools Servicing 'Ewa Makai Area

School	Current Student Enrollment	Projected Student Enrollment for 2007
'Ewa Beach Elementary	581	831
Pohakea Elementary School	562	649
Ilima Intermediate School	1,012	1,243
Campbell High School	2,033	2,289

*Personal communication with Sanford Beppu, Facilities Branch, Hawai'i State Department of Education, June 10, 2002.

The proposed project will impact these facilities by increasing the school-aged population. The table below presents the long-term projection for 'Ewa Makai students at full build-out, and as the on-site population stabilizes.

Table ~~9~~ *10*. Long-Term Projected School Population for 'Ewa Makai

Grade Level	Projected Population Estimate
Kindergarten through sixth grade	466
Seventh and eighth grade	205
Ninth through twelfth grade	224
Total	895

Based on personal communication with Keith Kameoka, Statistical Research, Hawai'i State Department of Education, July 8, 2002.

In general, the project's impact on the area's schools fall within the projected 2007 enrollment. The region is targeted for significant residential population growth with or without 'Ewa Makai, however, so it is likely that cumulative growth will exceed projected 2007 enrollment if the project is implemented.

The Gentry Companies has been working with the State Department of Education to determine the developer's contribution to the public education system. As of this writing, the parties have agreed that reserving 18 acres for a new middle school meets the developer's fair share requirement.

5.7 Economic Characteristics

The proposed project is expected to have significant impact to the economy. These impacts were assessed in a fiscal and economic impact study conducted by John Child & Company titled *Proposed 'Ewa by Gentry Makai Development*. The findings from this study are provided in this section.

Existing Conditions

The project site is presently fallow and vacant. While the site was formerly in sugar production and most recently used as grazing land, the site has most recently been found to be vacant with no activity other than service as a construction base yard. No improvements were observed on the site. In its present condition, the site does not provide any economic benefit to the community or state except for property taxes for unimproved property.

Anticipated Impacts and Mitigative Measures

The permanent loss of agricultural lands by the proposed urban use of the site is explained in detail in Chapter 4 of this Final Environmental Impact Statement. It was concluded that the ~~remove~~ *removal* of the subject lands from the agricultural inventory would have little effect on the State's agriculture industry. The development of the site will, however, have significant positive impact to the economy. Upon full development of the project, total construction expenditures are projected to exceed $432 million or an average of $48 million annually.

Employment will also be positively impacted by the creation of 857 construction and construction related jobs during the building period. Long-term operational employment will also be significantly and positively affect by the creation of approximately 1,500 new full-time, part-time and self-employed jobs created by the industrial/commercial component of the project.

Tax revenue generation will also be significant with projected collections during the construction period of: $16.6 million in construction general excise tax, $13.2 million in industrial/commercial sales, $8.5 in construction employment income tax, and $1.25 million in annual operational employment income tax revenues.

5.8 Infrastructure

5.8.1 Water Supply

A long-term water supply study titled Potable Water Mater Plan for 'Ewa by Gentry was prepared by Tom Nance Water Resource Engineering. The study is discussed in Section 4.6 and is also included in this document as Appendix D. This report was reviewed ~~for~~ in January of 2003 for applicability with the proposed 'Ewa Makai plan (Appendix D attachment) by Tom Nance Water Resource Engineering and found to remain valid.

The proposed average demand of potable water was estimated at .5026 MGD by the above referenced report prepared in year 2000. This quantity is based on the proposed scope of development which represents a relatively small portion of the 4.2274 MGD average demand of the entire 'Ewa by Gentry community upon final build out.

Water allocations are determined by the Board of Water Supply on a first come – first served basis. Correspondence the Board of Water Supply has confirmed that an adequate water supply for the 'Ewa region exists. Sources to accommodate this demand will be available through the 'Ewa Shaft, new wells at the Waipahu II and IV Stations, and the proposed desalination facility at Kalaeloa (Appendix E).

5.8.2 Wastewater Collection

Sewer Master Plans for the 'Ewa Makai-East and 'Ewa Makai-West sites were previously accepted by the City and County of Honolulu in 1999. Under these previously accepted plans, wastewater from the project will be accommodated by two separate pump systems that were specifically designed to serve the 'Ewa Makai project. These independent systems are identified as Gentry 'Ewa Makai-

West Wastewater Pump Station and Force Main and the 'Ewa by Gentry-East Wastewater Pump Station and Force Main.

The Gentry 'Ewa Makai-West Wastewater Pump Station and Force Main will be located at the end of the Kapolei Parkway extension road and is designed for an average flow of .816 MGD with a peak flow capacity of 2.760 MGD. The 'Ewa by Gentry-East Wastewater Pump Station and Force Main is planned for construction at the end of Keaunui Drive immediately north of the project site. This facility will have a design average flow of .38 MGD and a peak flow capacity of 1.47 MGD. These systems will ensure the efficient conveyance of Wastewater to the Honouliuli Wastewater Treatment Plant (WWTP).

Since the approval of the Sewer Master Plan, the project scope has changed and revised sewer plans are necessary. Revised sewer plans are presently being developed and will be submitted to the City and County of Honolulu for approval of these revised systems.

5.8.3 Drainage

~~Natural and man-made vegetated drainageways and retention basins are proposed for the project. A drainage way that is part of the Kaloi Gulch Drainage Basin is proposed for the western portion of the project. This system will serve as a connecting link between the Coral Creek Golf Course and Oceanpointe's planned golf course.~~

~~In the eastern portion of the site, a landscaped drainageway, recreation area, and large retention basin will be built as part of the residential subdivision. These drainage facilities will be used to detain or infiltrate storm water flows to reduce their volume and runoff rates and the amounts of sediments and pollutants transported. The retention/detention basins may be developed as part of the landscape walkway that will double as a visual amenity.~~

'Ewa Makai-West

The topography of 'Ewa Makai-West is generally flat, with ground slopes from less than one-half percent to about five percent. The project site is an abandoned sugar cane field that was, until recently, used for grazing. Elevations of the site range from about 18 mean sea level (msl) at the makai boundary to about 30 feet msl at the northwest corner, just below the existing Sun Terra development in 'Ewa by Gentry.

The former Kaloi ditch, which was built above ground and traversed the western end of the site, has been replaced with a drainageway in the form of 14 acres of open space that stretches from the southern boundary of Coral Creek to the planned golf course in Ocean Pointe. This drainageway is part of the Kaloi

Gulch system, and will help to prevent upland areas from flooding during heavy rainstorms. Portions of 'Ewa Makai-West also flow into the 14-acre open channel; the remaining areas of 'Ewa Makai are presently open and naturally drained.

'Ewa Makai-East

As in the 'Ewa Makai-West area, the eastern portion of the project is located on relatively flat lands very similar in topography. Recent development in the area has leveled large portions of the site as staging areas for the construction activities taking place to the west of the site. No structures or significant natural features are located on the site. Existing vegetation is limited to grasses. Three existing sump areas are located on site and hold drainage from the site as well as some drainage from the area immediate to the west. The remainder of the site is naturally drained. The Hawaii Prince Golf Course, which lies immediately to the east, was designed to accept drainage from the 'Ewa by Gentry development.

A diagram the 'Ewa Area Drainage Plan is shown as Figure 19.

Anticipated Impacts and Mitigative Measures

'Ewa Makai-West

'Ewa Makai-West, when developed, will be an extension of the 'Ewa by Gentry community to the north, integrating roadways and utility systems between the two projects. Consequently, ultimate drainage improvements will be planned to provide a coordinated drainage system benefiting all of Gentry's developments within the Kaloi Gulch watershed. Interim drainage measures will be required due to phasing of the development and downstream capacity restrictions at the Ocean Pointe/'Ewa Makai-West boundary; however interim improvements will also be coordinated to allow a logical progression of development.

The drainage system for 'Ewa Makai-West and East will be designed in accordance with the "Storm Drainage Standards" of the Department of Public Works, City and County of Honolulu, May 1988, as may be amended. Permanent regional drainage improvements will be handled by the continuation of the Kaloi Channel through the 'Ewa Makai-West site. The Kaloi Channel through the project will be a wide, grass-lined drainageway connecting the makai end of the Gentry golf course to the mauka boundary of the Ocean Pointe site. The Kaloi Channel will have a bottom width of about 500 feet and 4:1 side slopes. The channel is designed to provide conveyance capacity for the City and County peak flow in accordance with Plate 6 of the Storm Drainage Standards. Runoff entering the channel at the upstream end of the project is estimated to be about 10,000 cfs, with discharge into Ocean Pointe estimated at 10,300 cfs. Depth of flow in the channel for the design peak flow is about 5 feet with a velocity of less *than 5 feet per second. In addition, freeboard in accordance with the Storm Drainage Standards will also be provided. A low flow channel is planned to be incorporated near the center of the drainageway to accommodate runoff from a 10-year storm. It is envisioned that the 14-acre drainageway will be an attractive, landscaped open space that could also provide for recreational activities.*

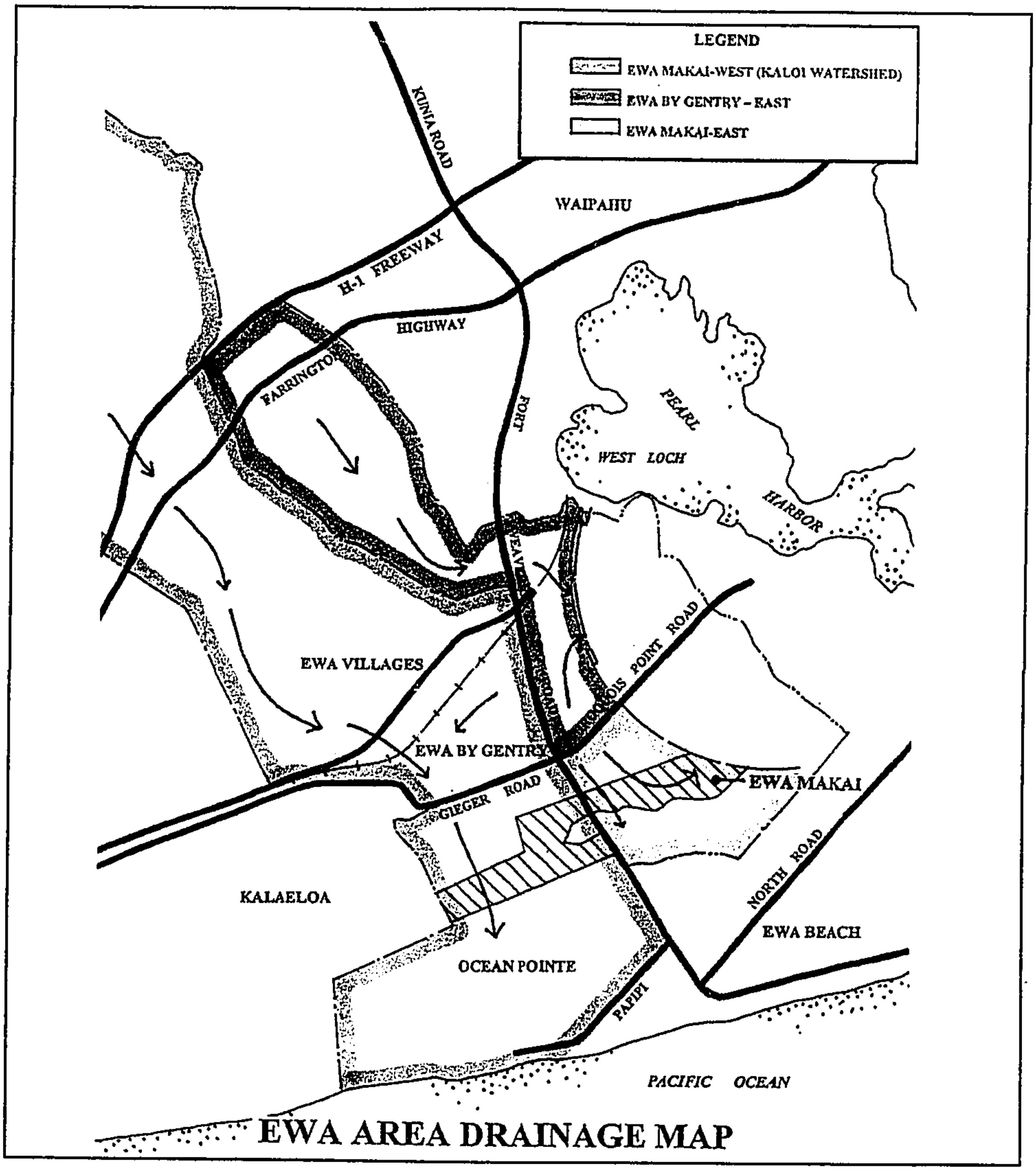
The Kaloi Channel at the 'Ewa Makai-West/Coral Creek Golf Course boundary provides for an ultimate channel invert of 14.0 feet msl. Once adequate conveyance through Ocean Pointe is provided, this invert would be matched by the golf course and the temporary berm removed.

The onsite project drainage system will consist of catch basins/inlets, manholes, and drainpipes located in dedicated roadways. A box culvert is planned to run parallel to the makai property boundary, intercepting and diverting runoff to the Kaloi Channel. The location of the box culverts is shown in Figure 21 which shows the proposed ultimate onsite drainage improvements for 'Ewa Makai West. Multi-family, commercial/industrial, and public facility developments will likely have private drainage systems connecting to the roadway drainage systems. Onsite drainage systems will be designed for the 10-or 50 year storms. Detailed hydraulic analyses of the onsite system will be submitted to the City and County of Honolulu for approval during the design phase of the project.

The lack of adequate conveyance capacity makai of the 'Ewa Makai-West site will require phasing of development (see Figure 20) similar to the 'Ewa by Gentry project. The 14-acre drainageway, plus an additional 9 acres of adjacent land may need to be excavated to provide for a temporary retention/detention basin. Excavation of the temporary retention/detention basin may be done in phases, coinciding with the rate of development and the volume of runoff generated for a 100-year, 24-hour storm. The invert of the interim basin will be excavated to the ultimate inverts, and the water surface elevation limited to the ultimate water surface elevation (18' msl) so that permanent drainage facilities can be constructed accordingly.

Makai-East

'Ewa Makai-East will incorporate a separate drainage system that will serve areas east of Fort Weaver Road between Iroquois Point Road and the Hawaii Prince Golf Course. A drainage master plan for the area mauka of the project site between the 'Ewa Makai-East area and Iroquois Point was approved by the City and County of Honolulu in July of 1997. The concept of the previously approved drainage master plan was based on having the storm runoff from



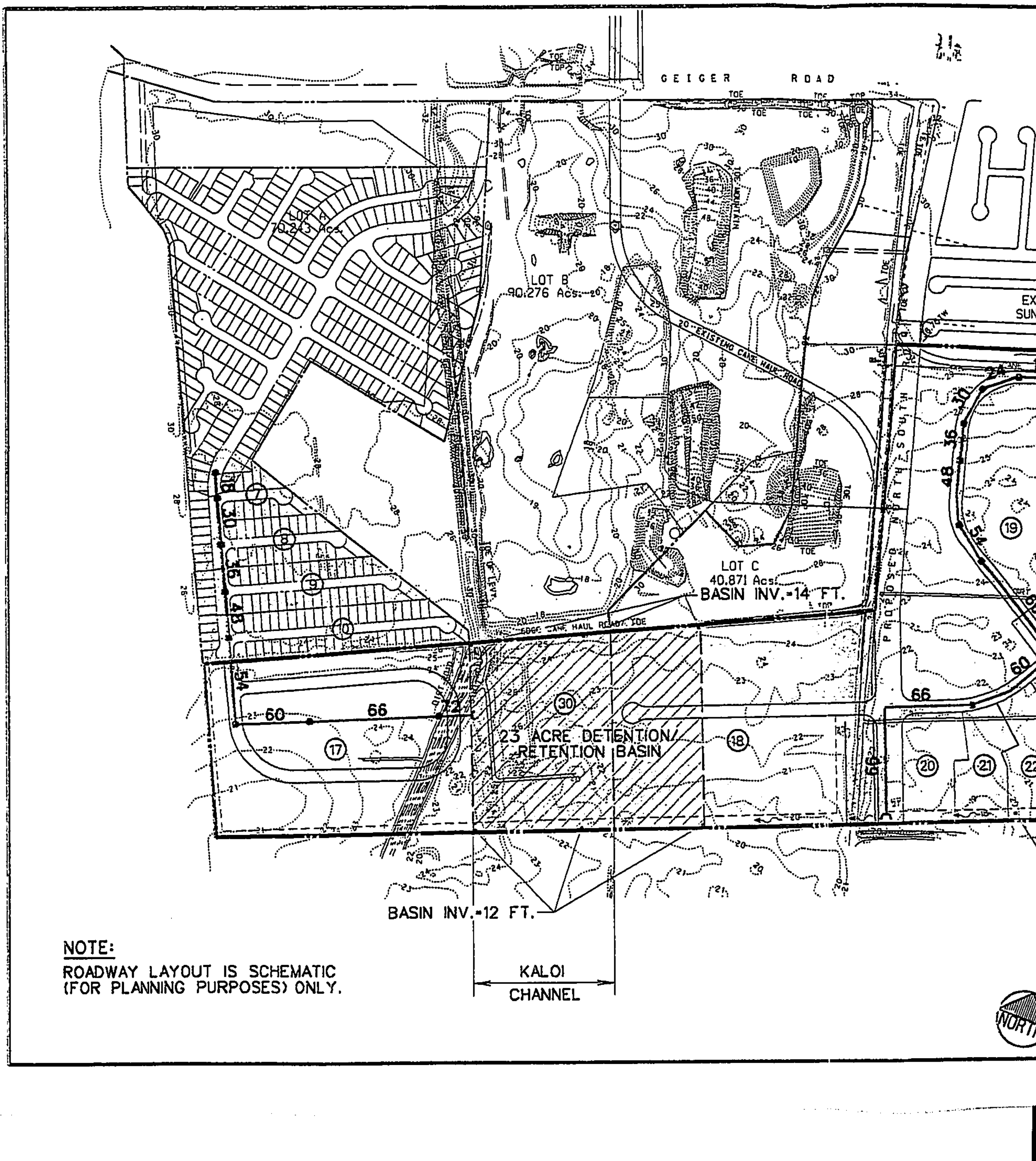
Gentry 'Ewa Makai

'Ewa Area Drainage Plan

Prepared by: Environmental Communications, Inc.
Source: Gentry Homes, Ltd

Figure 19

P:\DGN\EWAWEST\INTERIM.DGN



NOTE:

ROADWAY LAYOUT IS SCHEMATIC (FOR PLANNING PURPOSES) ONLY.

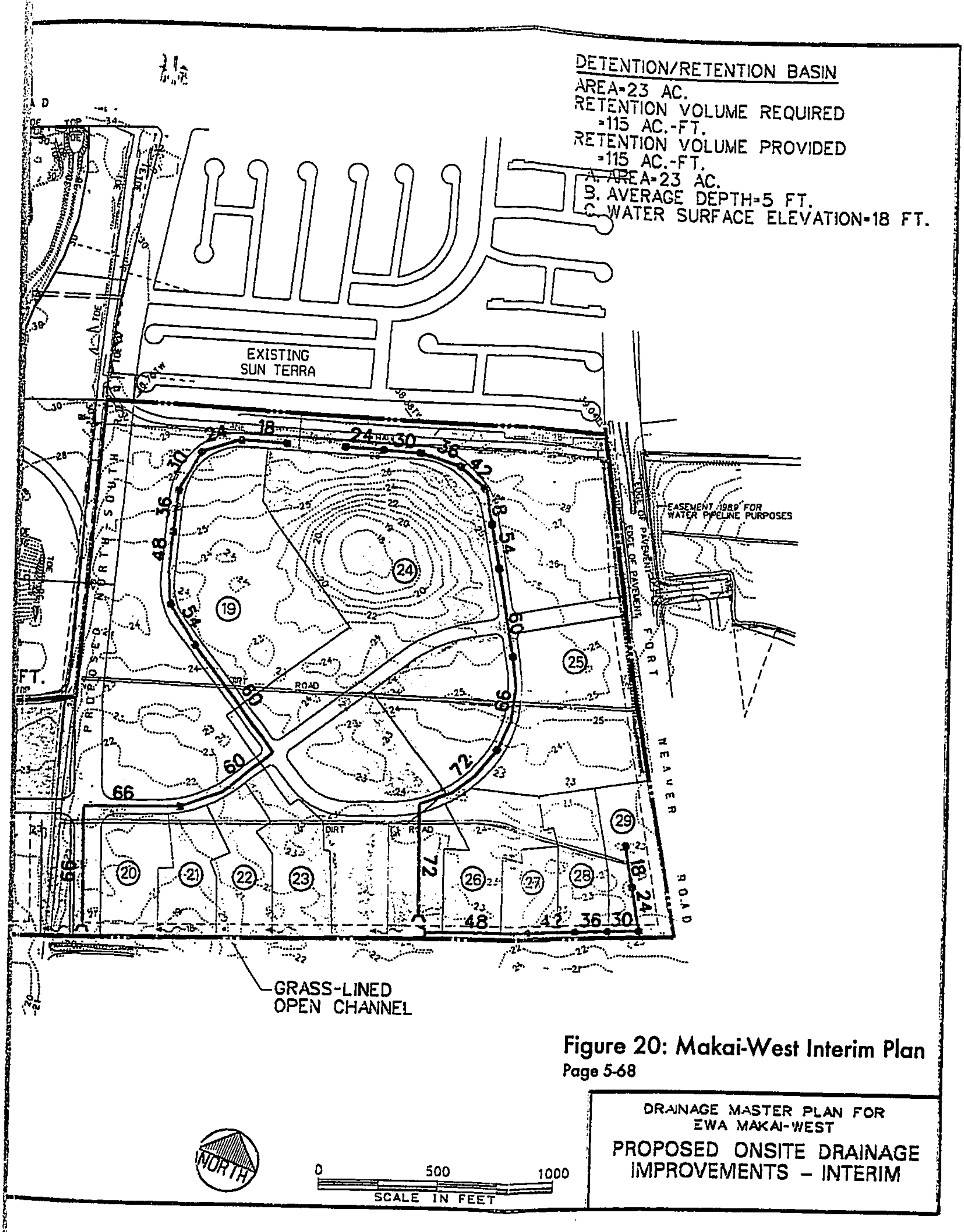
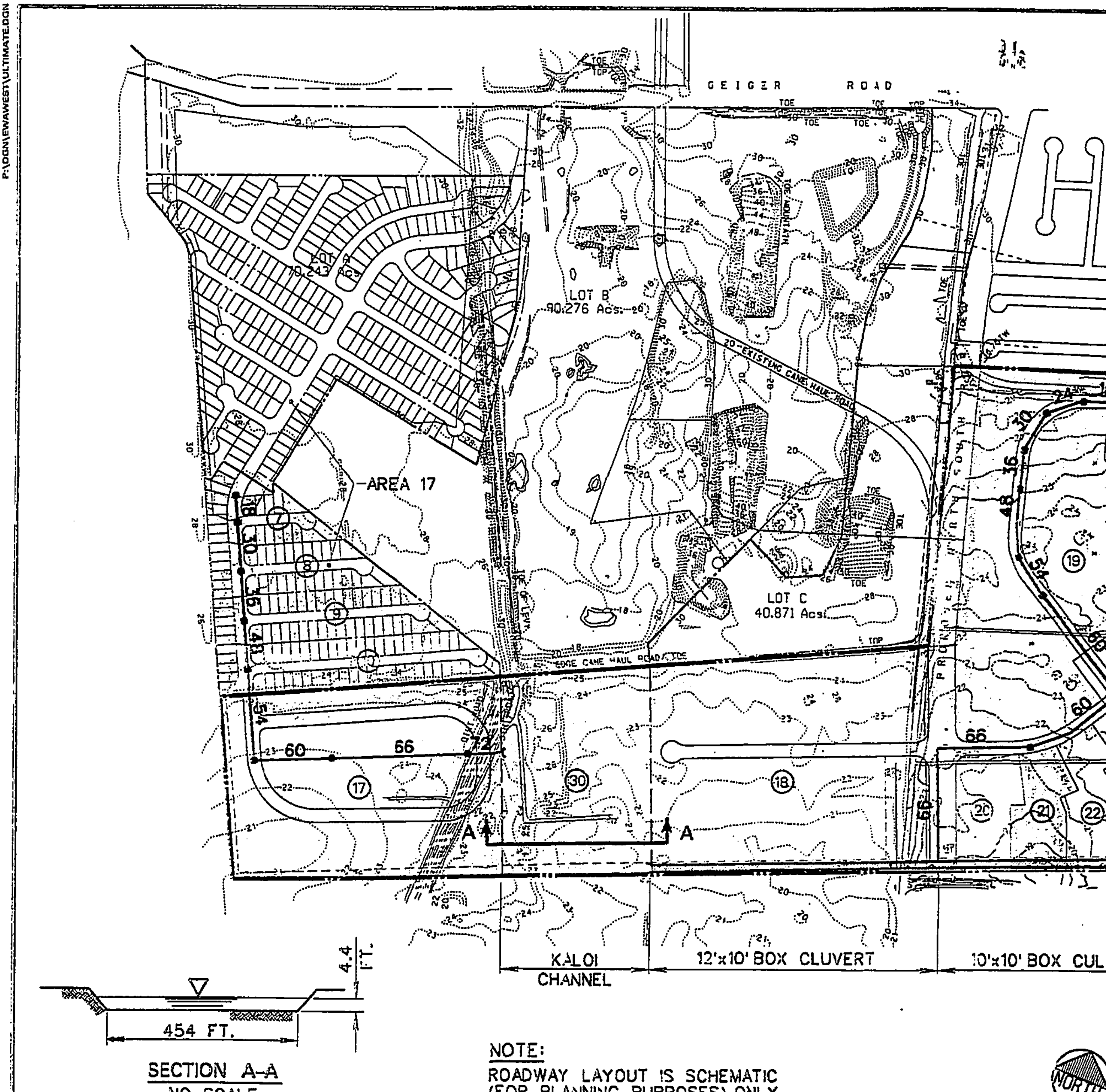


Figure 20: Makai-West Interim Plan

Page 5-68

DRAINAGE MASTER PLAN FOR EWA MAKAI-WEST

PROPOSED ONSITE DRAINAGE IMPROVEMENTS – INTERIM



P:\DGN\EWAWEST\ULTIMATE.DGN
GEIGER ROAD
LOT A
70.243 Acs
LOT B
90.276 Acs.
LOT C
40.871 Acs.
AREA 17
EXISTING CANE HAUL ROAD
EDGE CANE HAUL ROAD
KALOI
CHANNEL
12'x10' BOX CLUVERT
10'x10' BOX CUL
4.4 FT.
454 FT.
SECTION A-A
NO SCALE
NOTE:
ROADWAY LAYOUT IS SCHEMATIC
(FOR PLANNING PURPOSES) ONLY.
NORTH

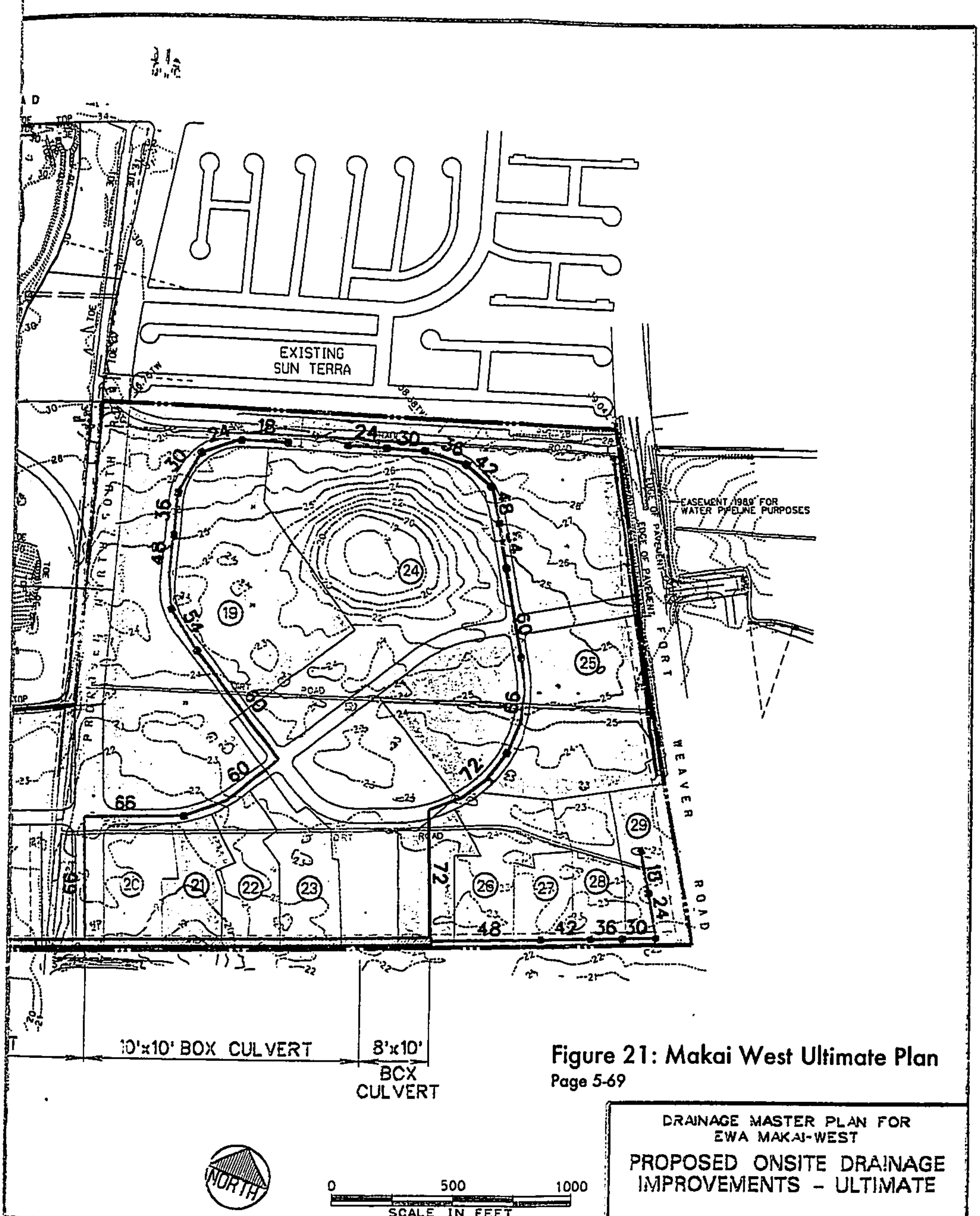
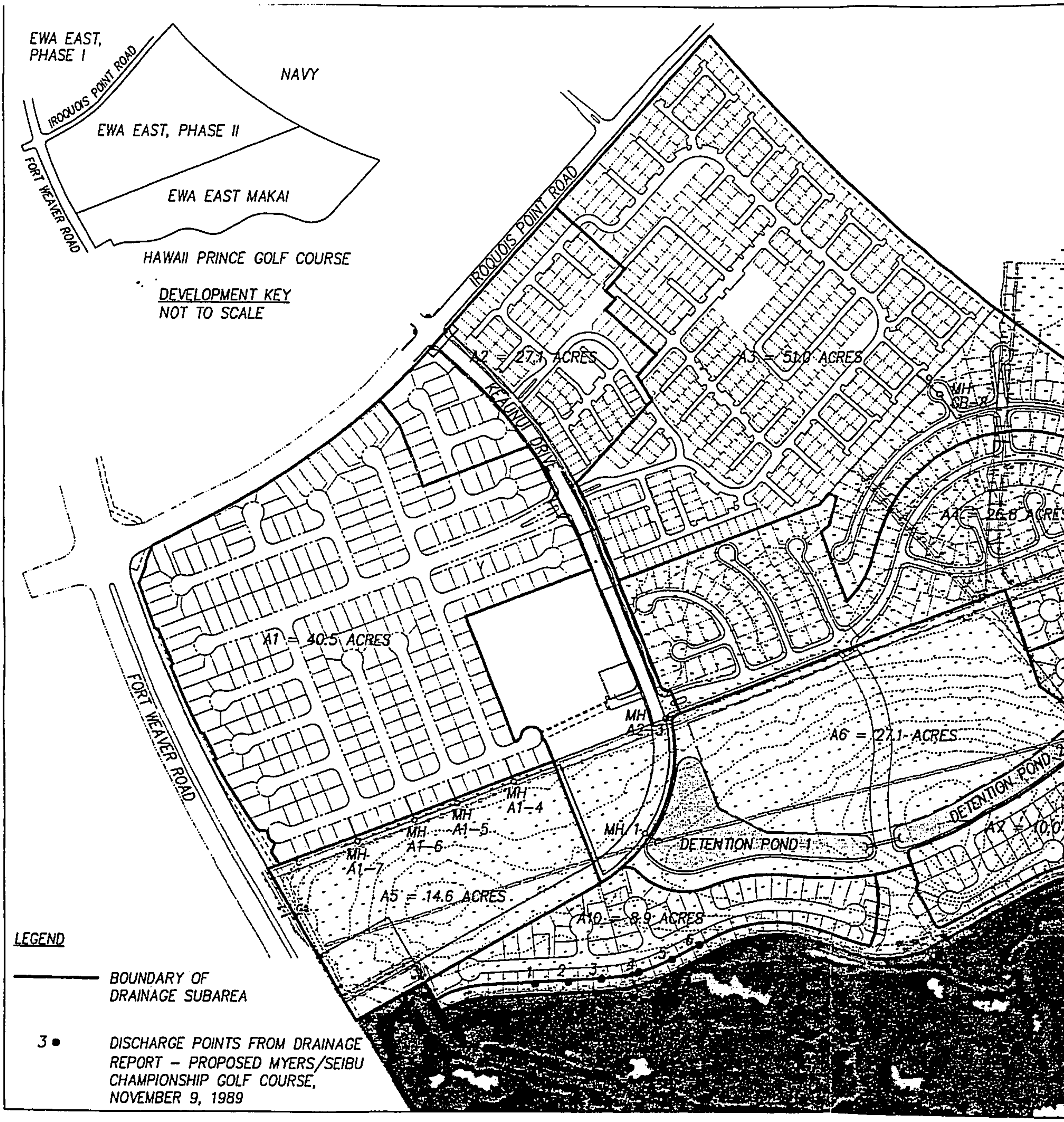


Figure 21: Makai West Ultimate Plan

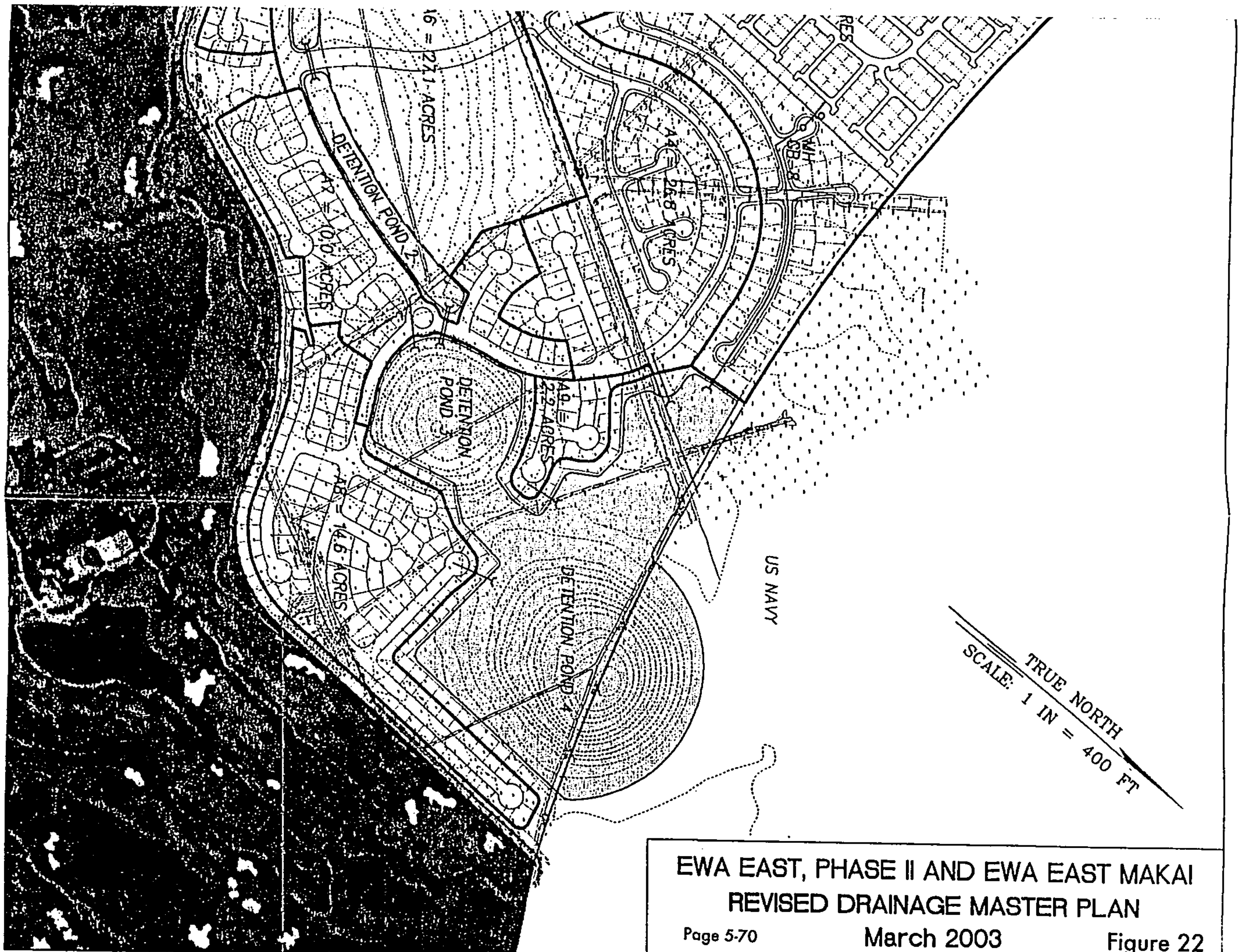
Page 5-69

DRAINAGE MASTER PLAN FOR
EWA MAKAI-WEST

PROPOSED ONSITE DRAINAGE
IMPROVEMENTS – ULTIMATE



EWA EAST, PHASE I
IROQUOIS POINT ROAD
NAVY
EWA EAST, PHASE II
FORT WEAVER ROAD
EWA EAST MAKAI
HAWAII PRINCE GOLF COURSE
DEVELOPMENT KEY
NOT TO SCALE
IROQUOIS POINT ROAD
A2 = 27.1 ACRES
A3 = 51.0 ACRES
KEAUNUI DRIVE
A4 = 26.8 ACRES
A1 = 40.5 ACRES
FORT WEAVER ROAD
MH A2-3
A6 = 27.1 ACRES
DETENTION POND 2
MH A1-4
MH A1-5
MH A1-6
MH A1-7
MH 1
DETENTION POND 1
A5 = 14.6 ACRES
A10 = 8.9 ACRES
LEGEND
BOUNDARY OF DRAINAGE SUBAREA
3 •
DISCHARGE POINTS FROM DRAINAGE REPORT - PROPOSED MYERS/SEIBU CHAMPIONSHIP GOLF COURSE, NOVEMBER 9, 1989



EWA EAST, PHASE II AND EWA EAST MAKAI
REVISED DRAINAGE MASTER PLAN

Page 5-70 March 2003 Figure 22

portions of the development adjoin the east side of Fort Weaver Road conveyed, by underground piping, into the Hawaii Prince Golf Course (the drainage report for the golf course takes into account the runoff from the 255 acres located between Iroquois Point Road and the golf course in designing the golf course retention basin).

Since the acceptance of the 1997 report, the 'Ewa Makai project has been ~~programmed and the additional contribution of drainage waters was been provided for in a revised drainage master plan which was completed in March of 2003.~~ redesigned, necessitating a revised drainage master plan for Ewa Makai-East, the concept of which is currently being reviewed by the City.

In general, the overall drainage concept for the project remains the same. However, the proposed revisions call for reducing the area of the project that will drain via piping into the golf course and reconfigure the onsite sump, in size and location.

Under the revised drainage plan, a smaller portion of the 'Ewa Makai-East site will continue to drain into the golf course in one or more of the coordinated points of discharge. Areas immediately adjacent to the golf course will flow either by sheet flow or by small pipes into the golf course.

The existing drainage sumps will provide an opportunity to route stormwater from the post development areas through a series of detention ponds such that the discharge onto the downstream property will be equal or less than the pre-development runoff.

Phasing of the drainage improvements for the 'Ewa Makai-East section will be constructed in phases. The master planned drainage sumps will be constructed into their ultimate configuration with the development of the remainder of 'Ewa East, Phase II and 'Ewa Makai-East. During the interim, sufficient sump volume will ~~must~~ be maintained to keep the outflow at the downstream boundary equal to or less than the pre-development flow.

Figure 22 shows the revised drainage master plan concept for the 'Ewa Makai-East portion of the project.

5.8.4 Solid Waste

~~Sold~~ *Solid* waste handling and disposal will be coordinated with the City Department of Environmental Services, Refuse Division, with written notification submitted in advance of when the refuse service is expected to begin. The design of residential communities with ''Ewa Makai will comply with the Division's requirements in order to enable refuse pick-up.

Currently, the City's Waimanalo Gulch Sanitary Landfill will have capacity to May 2008. The City has indicated in a letter dated June 25, 2003, that it will be able to satisfy the solid waste collection and disposal requirements of the 'Ewa Makai project.

At full build-out, the residential homes will generate an estimated 3,728 tons of solid waste per year, based on a projected population of 6,061 persons at build-out. (Sources: City Department of Environmental Services, June 2003, and 'Ewa Makai Social Impact Assessment, September 20020.Solid waste handling and disposal will be coordinated with the City Department of Environmental Services, Refuse Division, with written notification submitted in advance of when the refuse service is expected to begin. The design of residential communities within 'Ewa Makai will comply with the Division's requirements in order to enable refuse pick-up. Refuse collection will be provided by either automated collection for single-family and duplex homes or front-end loading collection for multi-family homes. The site improvement construction drawings for any non-city standard improvements will be forwarded to the City's Department of Environmental Services for review and approval if City service is expected.

Construction Waste Management and Recycling of Materials: The large quantities of waste and construction by-products that will be generated by the project will be stored, handled, and disposed of properly so as to prevent adverse impacts to the surrounding area and the environment. Chapter 11-58, Solid Waste Management Control, Title 11, State Administrative Rules, requires that the property owner/ developer be responsible for ensuring that grub material, demolition waste and construction waste generated by the project are disposed of in a manner or at a site approved by the DOH. Gentry will continue to comply with these rules, and has developed and implemented a trash management and recycling program to maintain clean construction sites, maximize material recycling, minimize disposal truck traffic impacts, and minimize impacts to the local landfill. All grub material is hauled to the permitted landfill area. Excess concrete is crushed and reused for gravel and deep fill. Some coral boulders are used for walls and landscape rocks, while other boulders are crushed and reused for gravel and deep fill. Wooden pallets are mulched by Hawaiian Earth Products for reuse. Gentry will continue to work with recycling companies like Hawaiian Earth Products so that framing lumber cut-offs and other wood scraps can be reused. All of Gentry's waste goes to a DOH-approved site.

5.8.5 Electrical Service

Electrical service lines are presently located along Fort Weaver Road. It is anticipated that service will be available for the proposed project and the Hawaiian Electric Company will be kept informed of the project requirements to ensure that appropriate service and infrastructure development is provided.

5.8.6 Telephone/Communications

Telephone and cable service are also located along Fort Weaver Road. Communication service providers will be kept informed of project developments and will be coordinated as early as practicable in the project design process to ensure timely infrastructure development and service are provided to the project.

Anticipated Impacts and Mitigative Measures

It is not anticipated that significant adverse impacts on infrastructure systems will be experienced. Demand for water service has been determined to be adequate. Wastewater facilities are available nearby and are expected to have adequate capacity to accommodate the project's Wastewater demands. Drainage will continue to use planned drainageways and natural detention areas to minimize runoff while providing visual amenities.

Solid wastes are expected to be served by municipal systems without adverse effect. *The City has begun the procedure to find a replacement landfill site, and is also expanding its H-POWER (Honolulu Program of Waste Energy Recovery) facility to increase capacity and improve reliability. The City is also investigating alternate technologies such as the plasma arc process to handle solid waste and to reduce the need for landfill space. Materials that can be reused onsite will be recycled wherever possible and other recyclables will be disposed of in DOH-approved sites.*

Electrical and communications systems are also expected to be available to serve the community. In each case, appropriate agencies will be contacted early in the project design process to ensure that appropriate plans and facilities are made available for the 'Ewa Makai project.

5.9 Public Services

Existing Services

5.9.1 Schools

Public schools in the vicinity of the project site include 'Ewa Beach Elementary, 'Ewa Elementary, Holomua Elementary, Pohakea Elementary, Ilima Intermediate and the James Campbell High School.

Recognizing that the growing community will create additional demand, the applicant and the developer of the adjacent Ocean Pointe planned community have reserved sites for future school use. The Gentry 'Ewa Makai program allots 18 acres of land along the Kapolei Parkway extension for a Department of Education middle school. This facility will be built as need arises and as State funding permits. Further east, within easy walking distance, a future elementary school site has been reserved within the Ocean Pointe community. These facilities will provide for the long-term educational needs of this community. James Campbell High School, which is located approximately 1 and 1/4 mile away in 'Ewa Beach town is anticipated to have adequate capacity to accommodate the population increase from the growing community.

5.9.2 Police Protection

The project area is regularly patrolled by Honolulu Police Department officers on beats 875 and 876. These patrols are based at the regional Kapolei Police Station.

5.9.3 Fire Protection and Emergency Medical Service

The project site is well served with three engine companies serving the area. Engine 24 is located at 91-862 Pohakupuna Road and is located approximately 1.7 miles from project site. This station consists of a single pump engine.

Engine 12 is located in Waipahu at 94-121 Leonui Street. This unit consists of a pump engine, a combination ladder and pump engine, and an ambulance. This facility is located approximately 3.5 miles from the project site.

Engine Station 40 is located at 2020 Lauwiliwili Avenue in Kapolei. This facility consists of a pump engine, a combination ladder and pump engine, and a hazmat unit. The station is located approximately 4.7 miles from the site.

5.9.4 Health Care Facilities

Currently, comprehensive medical centers in the area are available at the St. Francis West facility, located northeast of the project area, and the Pali Momi Medical Center located in Pearl Ridge. Closer to the west lies the recently opened Kapolei Medical Park which offers a concentration of major health care services.

5.9.5 Recreational Facilities

Recognizing the need for recreational facilities within the proposed Gentry 'Ewa Makai project, a significant amount of park and open space areas have been planned for the development. These include a 3.5-acre park in the eastern portion of the site (that will be part of a larger 10.3 acre park), an 8-acre site within the central site, and a 14-acre open space located with the western portion of the site. In addition, a 2-acre area is reserved for a recreation/community facility adjacent to the middle school site. It is also anticipated that portions of the school property will be available for public use during non-school hours. In total, 25.5 acres of recreational and open space are provided within the Gentry 'Ewa Makai master plan significantly exceeding city planning requirements. Mini parks may also be developed with the neighborhoods providing even greater open space. It should also be noted the adjacent Ocean Pointe development will include a district park that provide even greater recreational opportunities within the area.

5.9.6 Public Transportation

As an extension of the 'Ewa by Gentry master planned community, the project will support pedestrian and bicycle use through the development of sidewalks and bike paths within the community and along Fort Weaver Road. 'Ewa Makai will also be designated to accommodate City bus service along its main streets, and will be located in proximity to a ferry service that is currently in the planning stages.

Anticipated Impacts and Mitigative Measures

Demand for public services will increase with the additional population increases resulting from implementation of the proposed development. These impacts have been discussed in detail in Section 5.6.3. The applicant and other regional community developers have collaborated in a collective approach to address regional issues. To this extent, the applicant has made a commitment to provide a pro-rata share of infrastructure and public facilities support to ensure the well being of the regional community.

The demand for new schools has been recognized by the applicant and consequently, an 18-acre middle school site has been planned for the project. Within the same general area, the adjacent Ocean Pointe community will provide a new elementary school site. These new facilities will ensure that the educational needs of the regional community are addressed.

The demand for police, fire and emergency medical care are readily available as the project area is already well served. Medical centers are also readily available and should not be burdened by the additional residents that project will create.

A significant amount of recreational and open spaces are planned for the project. This will minimize the demands on outside parks and may, if fact, draw users from outside communities to the proposed development.

The project site will be planned with an emphasis on convenient public transportation and internal circulation routes that will promote non-vehicular use. This will decrease the impacts associated with vehicles and will enhance the value of the community.

5.10 Summary of Potential Impacts

In respect to traffic, the applicant has participated in the coordinated effort among state, county, federal and other private entities which objective is to providing a transportation system that is consistent with and will accommodate planned growth objectives throughout the State. As a designated growth area, transportation improvements must be made to the greater Kapolei region to accommodate the current and future growth patterns. The applicant, along with all regional developers and major landowners are continuing to study the transportation requirements, cost estimates, and timing for transportation improvements throughout the 'Ewa region. Some of those improvements have already been put in place; others are yet to be built. Using as its basis the recently-completed 'Ewa Region Highway Transportation Master Plan, funding sources will be identified and pursued

5.11 Summary of Proposed Mitigation Measures

Mitigation measures for impacts related to demand for services are essentially met by the addition of services to meet these demands. This is an ongoing effort and is principally dictated by service standards and community need. While not the direct responsibility of the applicant, contributions to meet the demand for services are generally provided by taxes, dedication of lands and capital improvements, or fees. The applicant has provided for these potential demands through the contribution of lands for schools and community facilities, dedication of infrastructure improvements, and participation in regional efforts in providing for the long-term vision of the 'Ewa region.

6.0 Conformance to Federal, State and City Planning Policies

6.0 CONFORMANCE TO FEDERAL, STATE AND CITY PLANNING POLICIES

6.1 State Plans and Policies

6.1.1 State Land Use Law

A reclassification of the subject property from "Agricultural" to "Urban" District is being sought. Pursuant to §15-15-24, Hawai'i Administrative Rules (HAR), any and all uses permitted by the counties, either by ordinance or rules may be allowed within the Urban District. Because the 'Ewa Makai project has already been designated within the Urban Growth Boundary on the 'Ewa Development Plan Map, and because its planned uses have been approved under City Ordinance 96-06, the proposed uses within the 'Ewa Makai project would be considered "allowable uses" under the proposed reclassification to the Urban District. The project would also be in conformance with the standards for determining Urban District boundaries under §15-15-18, HAR, as discussed below.

1) ***Lands characterized by "city-like" concentrations of people, structures, streets, urban level of services, and other related land uses.***

'Ewa Makai will be an extension of the 'Ewa by Gentry community, considered a part of O'ahu's growing Kapolei region where more than 450 businesses provide over 16,000 jobs - a number that is expected to more than double by 2010. Schools, parks, medical services, shopping and entertainment centers, restaurants and recreation facilities service a growing population of nearly 68,000 people, a number that is expected to reach more than 89,000 in 2010.

'Ewa by Gentry in itself is a growing community consisting of about ~~5,000~~ *5,400* existing homes in a planned development that will consist of an estimated 9,100 homes at build-out (including 'Ewa Makai). Parks, walkways and bike paths, landscaped roadways, an elementary school, an 18-hole championship golf course, a neighborhood shopping center, and a planned light industrial park are elements that contribute to 'Ewa by Gentry's "city-like" characteristics. With similar types of amenities as those offered in the existing 'Ewa by Gentry, 'Ewa Makai would also have "city-like" characteristics.

2) ***Takes into consideration the following specific factors:***

   a) *Proximity to centers of trading and employment except where the development would generate new centers of trading and employment.*

'Ewa Makai would not only be in proximity to centers of trading and employment (Kapolei, Waipahu, 'Ewa by Gentry, 'Ewa Beach, Barbers Point, Campbell Industrial Park, military installations), it would also generate new centers of employment. A 30-acre industrial-commercial center, a middle school, and two church/day care center sites are being proposed for development in 'Ewa Makai.

b) Availability of basic services.

The Subject Property is, or upon the completion of necessary offsite and onsite infrastructure will be, adequately serviced by schools, parks, wastewater systems, solid waste disposal, drainage, water, transportation systems, public utilities, and police and fire protection.

c) Sufficient reserve areas for foreseeable urban growth.

The Subject Property is located in an area with sufficient reserves for foreseeable urban growth.

3) ***Satisfactory topography, drainage, and reasonably free from the danger of any flood, tsunami, unstable soil condition, and other adverse environmental effects.***

The topographic contours of the Subject Property are generally level. Except for two pronounced sumps near the east boundary of 'Ewa Makai-East, elevations with the two parcels vary from 20 feet above mean sea level ("msl") to approximately 35 feet msl. The ground slope is approximately one percent. According to Panel 150001-0110 of the Federal Flood Insurance Rate map of 1990, the Subject Property is located in Zone D, an area in which flood hazards are undetermined.

4) ***Contiguity with existing urban areas***

The Subject Property is contiguous with or in proximity to existing urban areas, and is designated on the City's General Plan and Development Plan for urban use.

5) ***Appropriateness of location for new urban concentrations, especially areas of urban growth as shown on the state and county general plans.***

As stated previously, the Subject Property is located in the Kapolei region, designated for future urban growth by the both the State and the City, and therefore is appropriate for new urban concentrations.

6) ***Inclusion of lands which do not conform to the standards in paragraphs (1) to (5) under certain circumstances.***

Not applicable.

7) ***Will not contribute toward scattered spot urban development, necessitating unreasonable investment in public infrastructure or support services.***

The Subject Property will not contribute toward scattered spot urban development as it will be an extension of the existing master planned community of 'Ewa by Gentry, over half of which has already been developed. Gentry will develop additional infrastructure required to service the proposed development. Public infrastructure and support services will not be unreasonably burdened, nor will any unreasonable investment be required as a result of the proposed development.

8) ***General slope of the land.***

The Subject Property does not consist of lands having a slope of twenty percent or more.

6.1.2 Hawai'i State Plan

The purpose of the Hawai'i State Plan as set forth in Chapter 226, Hawai'i Revised Statutes, is to serve as a guide for the future long-range development of the State; identify the goals, objectives, policies, and priorities for the State; provide a basis for determining priorities and allocating limited resources, such as public funds, services, human resources, land, energy, water, and other resources; improve coordination of federal, state, and county plans, policies, programs, projects, and regulatory activities; and to establish a system for plan formulation and program coordination to provide for an integration of all major state, and county activities.

Objectives, policies, and priority guidelines that are relevant to the 'Ewa Makai development are as follows.

Section 226-5: Objectives and policies for population.

It shall be the objective in planning for the State's population to guide population growth to be consistent with the achievement of physical, economic, and social objectives contained in this chapter.

(a) To achieve the population objective, it shall be the policy of this State to:

(1) Manage population growth statewide in a manner that provides increased opportunities for Hawai'i's people to pursue their physical, social, and economic aspirations while recognizing the unique needs of each county.

(3) *Promote increased opportunities for Hawai'i's people to pursue their socio-economic aspirations throughout the islands.*

(7) *Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.*

By providing for a variety of land uses, including residential, commercial-industrial, parks, open space, and a public school facility, 'Ewa Makai will provide increased opportunities for Hawai'i's people to pursue their physical, social and economic aspirations. The proposed industrial-commercial center will provide permanent jobs, as well as short-term construction-related jobs for residents of 'Ewa and the island of O'ahu. With greater economic opportunities and the increased availability of new homes, overall living standards and lifestyles will be enhanced by living and working in the "new city" planned for the greater Kapolei region. The development and availability of land and water resources is being planned in a coordinated manner with public agencies and other developers in the region.

Section 226-06: Objectives and policies for the economy - in general.

(a) *Planning for the State's economy in general shall be directed toward achievement of the following objectives:*

(1) *Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawai'i's people.*

(2) *A steadily growing and diversified economic base that is not overly dependent on a few industries.*

(b) *To achieve the general economic objectives, it shall be the policy of this State to:*

(3) *Seek broader outlets for new or expanded Hawai'i business investments.*

(6) *Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.*

(7) *Foster a business climate in Hawai'i - including attitudes, tax and regulatory policies, and financial and technical assistance programs - that is conducive to the expansion of existing enterprises and the creation and attraction of new business and industry.*

The industrial-commercial center will provide an outlet for new or expanded business investments, thereby helping to foster a positive business climate in Hawai'i. It will provide an opportunity for the expansion of existing enterprises, as well as the creation and attraction of new businesses and industries. The development of 'Ewa Makai will also help the State to achieve a level of construction activity that is consistent with its growth objectives throughout the build-out period.

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

(a) Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:

(1) Prudent use of Hawai'i's land-based, shoreline, and marine resources.

(2) Effective protection of Hawai'i's unique and fragile environmental resources.

(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:

(1) Exercise an overall conservation ethic in the use of Hawai'i's natural resources.

(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

(3) Take into account the physical attributes of areas when planning and designing activities and facilities.

(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai'i.

(7) Pursue compatible relationships among activities, facilities, and natural resources.

Prior to preparation of the proposed 'Ewa Gentry Makai Master Plan, physical, environmental, and cultural aspects of the property were studied. Site features, including slope, existing sump areas, soil stability, and drainage needs were incorporated into the design. There were no rare or endangered plant and animal species and habitats native to Hawai'i found on the Project Site.

With respect to conserving the use of Hawai'i's natural resources, Gentry has been a leader in waste management. From site design and development to waste disposal and recycling, Gentry has successfully incorporated waste saving products, methods, and techniques into all phases of housing development. Gentry has committed to incorporating waste reduction and water saving strategies into its homebuilding business.

Section 226-12: Objective and policies for the physical environment - scenic, natural beauty, and historic resources.

(a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawai'i's scenic assets, natural beauty, and multi-cultural/historical resources.

(b) To achieve the scenic, natural beauty and historical resources objective, it shall be the policy of this State to:

(1) Promote the preservation and restoration of significant natural and historic resources.

(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

(4 Protect those special areas, structures, and elements that are an integral and functional part of Hawai'i's ethnic and cultural heritage.

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

Because the Subject Property was formerly cultivated in sugar, it does not contain any scenic assets, places of natural beauty, or multi-cultural or historical resources. However, plans for the project will promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of the mountains and Honolulu city vistas to the extent possible. There are no ocean views from the Subject Property.

The archaeological survey determined that no archaeological sites are present within the project area. Further, given that the project area was under sugar cane cultivation for approximately 100 years, it was determined to be unlikely that any subsurface cultural materials are still present within the project area. However, should subsurface resources be encountered during the course of development, the Historic Preservation Division of the Department of Land and Natural Resources will be notified in accordance with State requirements.

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

(b) To achieve the land, air, and water quality objectives, it shall be the policy of this State to:

(2) Promote the proper management of Hawai'i's land and water resources.

(3) Promote effective measures to achieve desired quality in Hawai'i's surface, ground, and coastal waters.

(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawai'i's people.

(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

(6) Encourage design and construction practices that enhance the physical qualities of Hawai'i's communities.

(7) Encourage urban developments in close proximity to existing services and facilities.

Gentry will continue to promote the proper management of land and water resources in the development of 'Ewa Makai. From incorporating efficient waste management and waste reduction strategies, to managing stormwater on site and utilizing non-potable water for irrigation purposes, Gentry continues to work toward minimizing any negative impacts to Hawai'i's natural resources. The homes and community are designed and constructed to reduce the threat to life and property from erosion, flooding, hurricanes, and other natural or man-induced hazards and disasters, as well as to enhance the physical qualities of 'Ewa. 'Ewa by Gentry is an urban development in close proximity to existing services and facilities.

Section 226-16: Objectives and policies for facility systems - water.

(b) To achieve the facility systems water objective, it shall be the policy of the State to:

(1) Coordinate the development of land use activities with existing and potential water supply.

(3) Reclaim and encourage the productive use of runoff water and wastewater discharges.

(6) *Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.*

All necessary on-site water facilities will be provided in consultation with the Board of Water Supply (BWS) and will be built in accordance with an approved Water Master Plan. In addition, Gentry is a member of the 'Ewa Plain Water Development Corporation (EPWDC), a non-profit corporation responsible for planning, financing, and implementing the construction of regional source development, reservoir, and distribution systems. Major portions of EPWDC's water program (including dedicated source and well facilities, storage and transmission for a water system of 6.72 million gallons per day) have already been implemented and were dedicated to BWS in 1991. An additional well was approved for drilling in April 1998.

With respect to water conservation practices, Gentry has incorporated the use of non-potable brackish water in its 'Ewa by Gentry development. It is also studying the use of reclaimed water as an alternative to potable water when the non-potable systems are inoperable.

Section 226-17: Objectives and policies for facility systems - transportation.

(b) *To achieve the transportation objectives, it shall be the policy of the State to:*

(2) *Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives.*

(3) *Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties.*

(6) *Encourage transportation systems that serve to accommodate present and future development needs of communities.*

(10) *Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawai'i's natural environment.*

(11) *Encourage safe and convenient use of low-cost, energy-efficient, non-polluting means of transportation.*

Gentry has participated in the coordinated effort among state, county, federal and other private entities which objective is to providing a transportation system that is consistent with and will accommodate planned growth objectives throughout the State. As a designated growth area, transportation improvements must be made to the greater Kapolei region to accommodate the current and future growth patterns. Gentry, along with all regional developers and major landowners are continuing to study the transportation requirements, cost estimates, and timing for transportation improvements throughout the 'Ewa region. Some of those improvements have already been put in place; others are yet to be built. Using as its basis the recently-completed 'Ewa Region Highway Transportation Master Plan, funding sources will be identified and pursued

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

(a) Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:

(1) Greater opportunities for Hawai'i's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to very low-, low- and moderate-income segments of Hawai'i's population.

(2) The orderly development of residential areas sensitive to community needs and other land uses.

As a residential developer in Hawai'i for ~~almost~~ 35 years, Gentry has gained a reputation for providing quality homes at prices affordable to Hawai'i's consumers. Gentry's buyers, many of whom are first time homeowners, represent a socio-economic cross section of Hawai'i's population, including very low-, low- and moderate-income families and individuals. These families and individuals are being afforded the opportunity to secure reasonably priced, safe, sanitary, and livable homes in a suitable master planned community environment. Sensitive to community needs and other land uses, Gentry is the only area developer that has completed its pro rata portion of Kapolei Parkway through the 'Ewa by Gentry community, and is working with other area developers to ensure that regional transportation improvements get funded and built.

(b) To achieve the housing objectives, it shall be the policy of this State to:

(1) Effectively accommodate the housing needs of Hawai'i's people;

(2) Stimulate and promote feasible approaches that increase housing choices for low-income, moderate-income, and gap-group households.

(3) Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.

(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.

'Ewa Makai will be a master planned residential community designed to accommodate the housing needs of Hawai'i's people. As a continuation of the existing 'Ewa by Gentry community, it will increase homeownership opportunities by providing a mix of housing types that are affordable to low-income, moderate-income, and gap-group families. The design of 'Ewa Makai will take into account the physical setting of the 'Ewa plain, accessibility to public facilities and services, and other concerns of existing communities. Transportation improvements, a major employment center, parks and recreational sites, places of worship/day care centers, and an 18-acre middle school will be incorporated into the design of the community.

Section 226-21: Objective and policies for socio-cultural advancement - education.

(b) To achieve the education objective, it shall be the policy of this State to:

(3) Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.

Gentry will be dedicating an 18-acre middle school site in 'Ewa Makai to the State Department of Education to meet the community's needs. There is also a possibility that private schools may be built on the lands that are being set aside for churches.

Section 226-10: Economic priority guidelines.

(e) Priority guidelines for water use and development:

(1) Maintain and improve water conservation programs to reduce the overall water consumption rate.

'Ewa Makai, like the rest of the 'Ewa by Gentry community, will incorporate a dual water system. Brackish water from non-potable wells will be used where feasible to irrigate landscaping in the common areas, thus reducing the overall potable water consumption rate. The 'Ewa by Gentry Community Association is also examining the feasibility of using reclaimed water from the Honouliuli

Wastewater Treatment Plant (instead of potable water) as a back-up system when the non-potable wells are inoperable due to broken pumps or other reasons.

(f) *Priority guidelines for energy use and development.*

(3) *Provide incentives to encourage the use of energy conserving technology in residential, industrial, and other buildings.*

Gentry continues to incorporate energy conserving technology in building its homes.

Section 226-104: Population growth and land resources priority guidelines.

(b) *Priority guidelines for regional growth distribution and land resource utilization:*

(1) *Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.*

(2) *Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.*

(6) *Seek participation from the private sector for the cost of building infrastructure and utilities, and maintaining open spaces.*

Inasmuch as it is surrounded by urban development, the 'Ewa Makai community can be considered an urban "infill" project. It will be located on nonessential agricultural land in an area that is targeted as the "Second City." Preservation of lifestyles is not an issue. 'Ewa Makai will be built by a private sector developer that will pay its fair share of the cost of building necessary roads, as well as utilities needed for the development. Open spaces will be maintained within the project.

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

(10) *Identify critical environmental areas in Hawai'i to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational*

shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.

'Ewa Makai will not affect any critical environmental areas. This is confirmed by the flora and faunal studies conducted for the project.

Section 226-106 Affordable housing.

Priority guidelines for the provision of affordable housing:

(1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of low- and moderate-income and gap-group households.

'Ewa Makai will provide homes for low- and moderate-income and gap-group households on nonessential agricultural land.

(2) Encourage the use of alternative construction and development methods as a means of reducing production costs.

As a developer, Gentry has consistently been on the cutting edge of technology, utilizing alternative construction materials and methods in order to reduce production costs, while improving the quality of homes that are built. For example, long-lasting, durable products such as fiber-cement siding and vinyl fencing are utilized, eliminating waste and providing value to homeowners.

(5) Encourage continued support for government or private housing programs that provide low interest mortgages to Hawai'i's people for the purchase of initial owner-occupied housing.

Gentry has been an ardent supporter and user of the State's Hula Mae Program which provides low-interest loans to first time homebuyers.

(8) Give higher priority to the provision of quality housing that is affordable for Hawai'i's residents and less priority to the development of housing intended primarily for individuals outside of Hawai'i.

As with the rest of the 'Ewa by Gentry development, 'Ewa Makai is intended to provide quality homes that are affordable to Hawai'i's residents.

6.1.3 Coastal Zone Management

The 'Ewa Makai development does not lie within the Coastal Zone Management (CZM) Area established pursuant to Chapter 205A, Hawai'i Revised Statutes, and is therefore not subject to the CZM requirements.

6.1.4 Chapter 343, Hawai'i Revised Statutes

The subject document is ~~a Draft~~ *an* Environmental Impact Statement that has been prepared in accordance with Chapter 343 H.R.S. It is submitted along with an application for rezoning of the 'Ewa Makai lands. The Department of Planning and Permitting of the City and County of Honolulu will be the accepting agency. Figure 23 shows the proposed project in relation to other Gentry Chapter 343, H.R.S. projects.

6.1.5 Five-Year Boundary Review

The five-year boundary review is a comprehensive, statewide, policy-oriented examination of the State land use district classifications that is performed by the Office of State Planning. It provides the State Land Use Commission with an opportunity to review urbanization proposals from a broad, comprehensive and long-range viewpoint.

During the last five-year boundary review conducted in 1992, 1,823 acres of land in the 'Ewa region were recommended for reclassification from the Agricultural District to the Urban District to help met O'ahu's projected demand for urban land. The 'Ewa Makai parcel was included in the acreage recommended for reclassification from agricultural to urban. The project is presently in the process of seeking a boundary amendment from the State Land Use Commission. The existing boundaries are shown in Figure 24.

6.2 City and County of Honolulu Plans and Policies

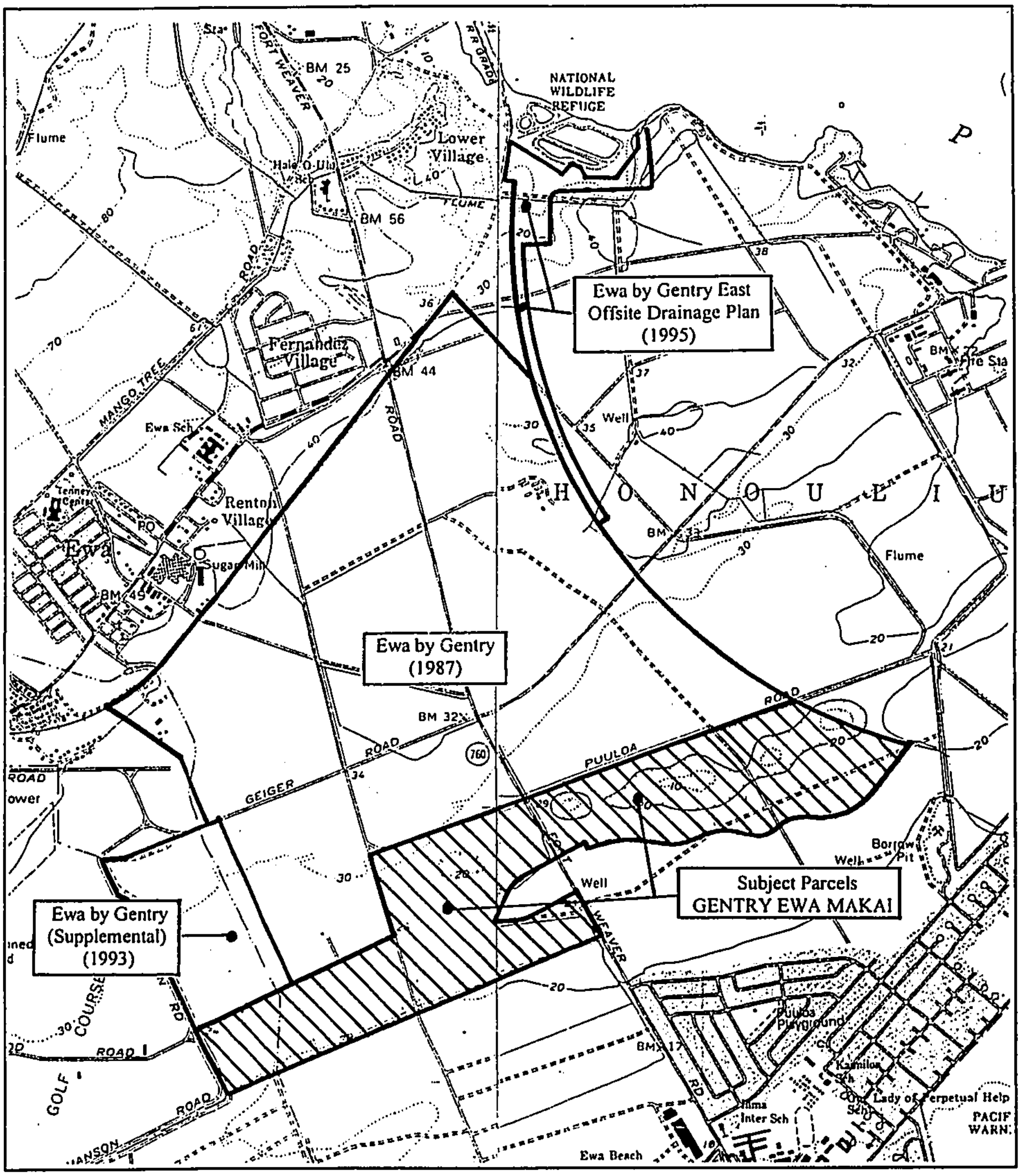
6.2.1 City and County of Honolulu General Plan

The General Plan of the City and County of Honolulu is a comprehensive statement of objectives and policies which set forth the long-range aspirations of O'ahu's residents and the strategies of actions to achieve them. The 'Ewa Makai development will be consistent with the following applicable objectives and policies of the General Plan:

Population

Objective C. *To establish a pattern of population distribution that will allow the people of O'ahu to live and work in harmony.*

Policy 2. *Encourage development within the secondary urban center at Kapolei and the 'Ewa and Central O'ahu urban-fringe areas to relieve developmental pressures in the remaining urban-fringe and*

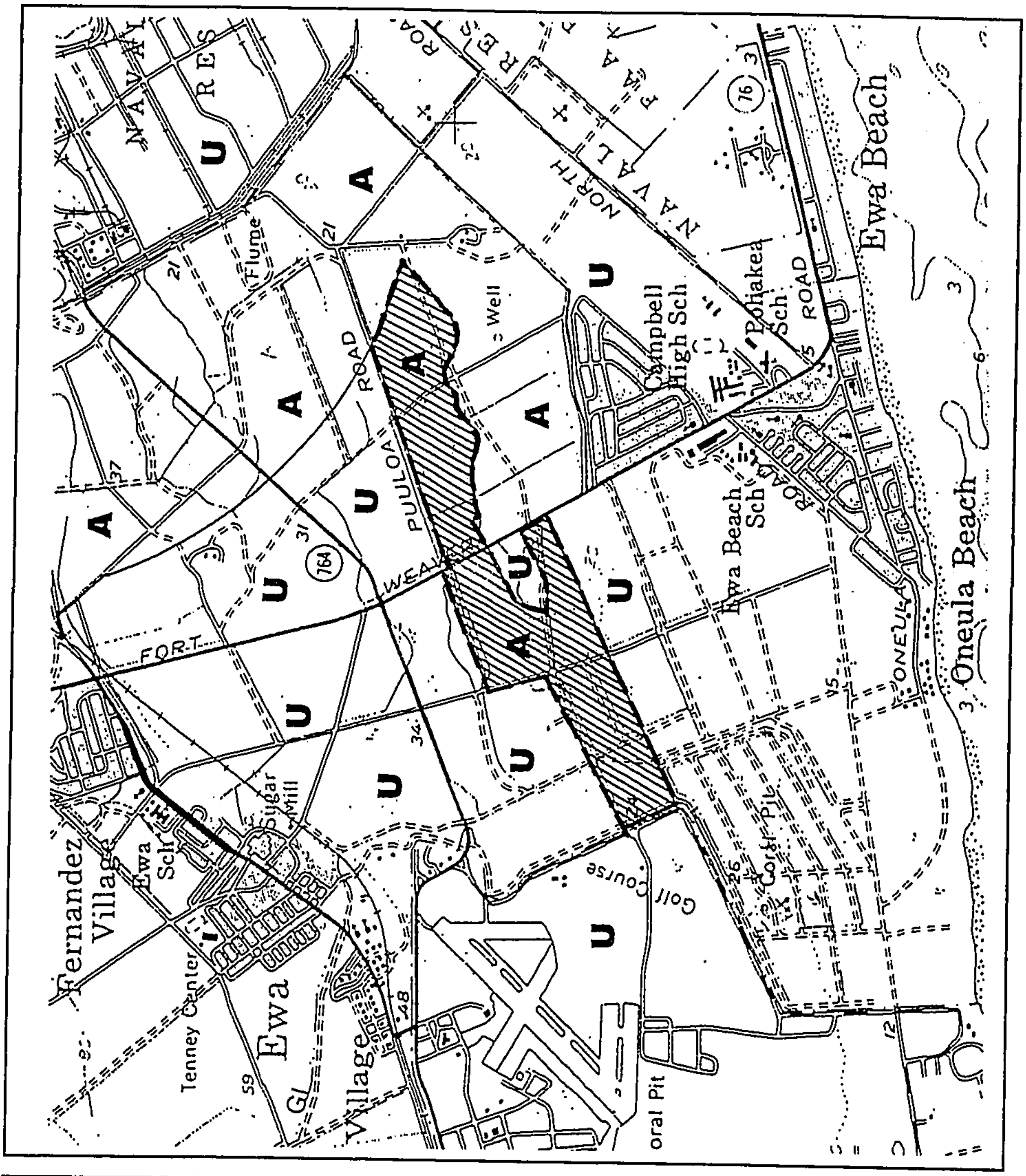


Gentry 'Ewa Makai

Relationship to Past Chapter 343 Projects

Prepared by: Gentry Investment Properties
Source: Gentry Investment Properties

Figure 23



Gentry 'Ewa Makai

State Land Use District Boundary Map

Prepared by: Gentry Investment Properties
Source: Land Use Commission

Figure 24
Page 6-15

rural areas and to meet housing needs not readily provided in the primary urban center.

Policy 3. *Manage physical growth and development in the urban-fringe and rural areas so that:*

a. *An undesirable spreading of development is prevented; and*

b. *Their population densities are consistent with the character of development and environmental qualities desired for such areas.*

The 'Ewa Makai community, which will help to meet the housing needs of O'ahu's residents, will be located in the 'Ewa urban-fringe area where development is encouraged. A residential development in the 'Ewa urban-fringe area will help to prevent an undesirable spreading of development throughout the rest of O'ahu that is not targeted for further development. 'Ewa Makai's population densities will be consistent with the character of development and environmental qualities as set forth in the 'Ewa Development Plan.

Economic Activity

Objective A. *To promote employment opportunities that will enable all the people of O'ahu to attain a decent standard of living.*

Policy 1. *Encourage the growth and diversification of O'ahu's economic base.*

Policy 2. *Encourage the development of small businesses and larger industries which will contribute to the economic and social well-being of O'ahu residents.*

Policy 3. *Encourage the development in appropriate locations on O'ahu of trade, communications, and other industries of a nonpolluting nature.*

The 30-acre industrial-commercial site proposed for 'Ewa Makai-West will provide opportunities for diversified businesses that are safe and nonpolluting in nature and convenient to residents in the 'Ewa area. The property will be primarily used for light and/or service industrial purposes with ancillary retail uses that would support the industrial tenants. Long-term operational employment opportunities will be created, generating an estimated annual income of $24.4 million at build-out. Estimated retail sales and service revenues from the industrial-commercial development will be roughly $60 million annually.

Objective G. *To bring about orderly economic growth on O'ahu.*

Policy 1. *Permit the moderate growth of businesses in the urban-fringe areas.*

The industrial-commercial site in 'Ewa Makai-West will be located in the 'Ewa urban-fringe area.

Natural Environment

Objective A. *To protect and preserve the natural environment.*

Policy 4. *Require development projects to give due consideration to natural features such as slope, flood and erosion hazards, water-recharge areas, distinctive land forms, and existing vegetation.*

Policy 6. *Design surface drainage and flood-control systems in a manner which will help preserve their natural settings.*

Due consideration will be given to the topography and other natural features when designing 'Ewa Makai. Drainage and flood control systems in 'Ewa Makai-East, for example, will incorporate large drainage basins; in 'Ewa Makai-West, a natural drainageway will be incorporated as part of the Kaloi Gulch drainage system.

Housing

Objective A. *To provide decent housing for all the people of O'ahu at prices they can afford.*

Policy 3. *Encourage innovative residential development which will result in lower costs, added convenience and privacy, and the more efficient use of streets and utilities.*

Gentry has been a leader in innovative residential development that results lower costs and efficient site developments without sacrificing quality. It is the City's general policy to recommend that 10% of the total housing units shall be for households earning up to 80% of the area median income: and 20% of the total housing units shall be affordable to households earning up to 120% of the area median income. Gentry will comply with these conditions.

Policy 5. *Make full use of State and Federal programs that provide financial assistance for low- and moderate-income homebuyers.*

Gentry's low- and moderate-income homebuyers have taken advantage of numerous government programs that provide financial assistance, including the State's Hula Mae Single Family Mortgage Purchase Program; the State's Mortgage Credit Certificate Program; the USDA-RD Section 502 Single Family

Home Ownership Program; the Federal Housing Administration Loan Program; and the Veterans Administration Loan Program.

Policy 10. *Promote the construction of affordable dwellings which take advantage of O'ahu's year-round moderate climate.*

'Ewa Makai will offer affordable, energy-efficient homes that take advantage of 'Ewa 's year-round moderate climate.

Objective B. *To reduce speculation in land and housing.*

Policy 2. *Discourage private developers from acquiring and assembling land outside of areas planned for urban use.*

'Ewa Makai is located in an area planned for urban use.

Objective C. *To provide the people of O'ahu with a choice of living environments which are reasonably close to employment, recreation, and commercial centers and which are adequately served by public utilities.*

Policy 1. *Encourage residential developments that offer a variety of homes to people of different income levels and families of various sizes.*

'Ewa Makai will offer a variety of residential types to suit buyers of different income levels and families of various sizes.

Policy 3. *Encourage residential development near employment centers.*

The 'Ewa Makai master plan calls for the development of not only residential units, but also a significant employment center consisting of a 30-acre industrial-commercial area that is adjacent to a 20-acre commercial area. In addition, the secondary urban center of Kapolei, the city of Waipahu, military bases, and other nearby employment centers will offer jobs that are in proximity to the planned 'Ewa Makai development.

Policy 5. *Discourage residential development where roads, utilities, and community facilities cannot be provided at a reasonable cost.*

Roads, utilities and community facilities can be provided at a reasonable cost.

Transportation & Utilities

Objective A. *To create a transportation system which will enable people and goods to move safely, efficiently, and at a reasonable cost; serve* *all people, including the poor, the elderly, and the physically handicapped; and offer a variety of attractive and convenient modes of travel.*

Policy 1. *Develop and maintain an integrated ground-transportation system consisting of the following elements and their primary purposes:*

b. *Roads and highways - for commercial traffic and travel in non-urban areas;*

c. *Bikeways -- for recreational activities and trips to work, schools, shopping centers, and community facilities; and*

d. *Pedestrian walkways - for ... trips to schools, parks, and shopping centers.*

'Ewa Makai will consist of an integrated ground transportation system of roads, parkways, bikeways, and pedestrian walkways, offering residents a variety of attractive and convenient modes of travel.

Objective D. *To maintain transportation and utility systems which will help O'ahu continue to be a desirable place of live and visit.*

Policy 2. *Use the transportation and utility systems as a means of guiding growth and the pattern of land use on O'ahu.*

Millions of dollars in public and private sector resources have been expended in order to encourage the development within O'ahu's secondary urban center, as well as in 'Ewa and Central O'ahu. The development of improved transportation and utility systems will continue to be a priority in the Kapolei and 'Ewa regions in order to continue guiding growth and land use patterns on O'ahu to these areas.

Policy 5. *Require the installation of underground utility lines wherever feasible.*

Underground utility lines will be installed wherever feasible in 'Ewa Makai.

Physical Development and Urban Design

Objective A. *To coordinate changes in the physical environment of O'ahu to ensure that all new developments are timely, well-designed, and appropriate for the areas in which they will be located.*

Policy 2. *Coordinate the location and timing of new development with the availability of adequate water supply, sewage treatment, drainage, transportation, and public safety facilities.*

Policy 3. *Phase the construction of new developments so that they do not require more regional supporting services than are available.*

Implementation of the 'Ewa Development Plan will be accomplished in part through the phasing of development to support the vision for 'Ewa and to maximize the effect of infrastructure investments. It provides the opportunity to focus the impact of scarce public funds for infrastructure development, supports the directed growth strategy of the *General Plan*, and provides a clear signal to private landowners and developers as to where and when development will be supported. ('Ewa DP, pp 5-1, 5-2) Both 'Ewa Makai East and 'Ewa Makai West have been included as "high priority areas" that are supported for zoning changes and infrastructure investments between the years 1997-2005.

Policy 5. *Provide for more compact development and intensive use of urban lands where compatible with the physical and social character of existing communities.*

Policy 6. *Encourage the clustering of developments to reduce the cost of providing utilities and other public services.*

Compact residential developments have been one of the key factors in Gentry's ability to provide quality, affordable homes for Hawai'i's residents. These types of developments, consisting of clustered single family condominiums, multi-family townhomes, and zero lot-line homes, have resulted in reduced infrastructure costs in 'Ewa by Gentry. Similar types of units will be built in 'Ewa Makai, making the physical and social characters of the communities compatible.

Policy 7. *Locate new industries and new commercial areas so that they will be well related to their markets and suppliers, and to residential areas and transportation facilities.*

The industrial-commercial area proposed for 'Ewa Makai will be conveniently located and well-related to its markets and suppliers. It will be in a residential community and will be accessible via various modes of transportation.

Policy 8. *Locate community facilities on sites that will be convenient to the people they are intended to serve.*

There are several community facilities planned for 'Ewa Makai: two church/day care centers; an 18-acre middle school; a community center, and two parks. All are located on sites that will be convenient to the people they are intended to serve. The middle school site has met with the approval of the Department of Education.

Policy 9. *Exclude from residential areas, uses which are major sources of noise and pollution.*

The industrial-commercial site planned for 'Ewa Makai will contain businesses that are compatible with residential living and which will not be major sources of noise and pollution.

Policy 10. *Establish danger zones to exclude incompatible uses from hazardous areas surrounding airfields, electromagnetic-radiation sources, and storage places for fuel and explosives.*

An Explosives Safety Zone has been established in the Naval Magazine Lualualei West Loch Branch and is adjacent to the easternmost boundary of 'Ewa Makai-East. To minimize residents' inadvertent entrance into the Explosives Safety Zone, Gentry has constructed a 6' high PVC-coated chainlink fence along the eastern boundary of existing 'Ewa by Gentry developments. Additional fencing will be installed as development occurs along the eastern boundary of the 'Ewa by Gentry and 'Ewa Makai properties. Gentry will also comply with the Navy requirement banning the construction of any road entering 'Ewa Makai from Iroquois Point Road within 200' of any Navy installation boundary.

Objective C. *To develop a secondary urban center in 'Ewa with its nucleus in the Kapolei area.*

Policy 2. *Encourage the development of a major residential, commercial, and employment center within the secondary urban center at Kapolei.*

The proposed 'Ewa Makai community will provide residences, industrial-commercial businesses, and an employment center within the secondary urban center, consistent with this policy.

Objective D. *To maintain those development characteristics in the urban-fringe and rural areas which make them desirable places to live.*

Policy 1. *Develop and maintain urban-fringe areas as predominantly residential areas characterized by generally low-rise, low-density development which may include significant levels of retail and service commercial uses as well as satellite institutional and public uses geared to serving the needs of households.*

'Ewa Makai will be a predominantly residential community characterized by low-rise, low-density development. It will also include industrial and commercial uses to serve the needs of the community.

Policy 3. *Establish a green belt in the 'Ewa and Central O'ahu areas of O'ahu in the Development Plans.*

The proposed 'Ewa Makai community will be consistent with the 'Ewa Open Space and Greenways Network set forth in the 'Ewa Development Plan. As an extension of the 'Ewa by Gentry master planned community, 'Ewa Makai will incorporate an open space network within the community. Significant acreage of open space will be retained in parks, as well as the Coral Creek Golf Course. The community is also adjacent to agricultural lands in the West Loch Naval Magazine Blast Zone and the Hawai'i Prince Golf Course, both of which are designated as part of the regional open space system. Greenway corridors include the Kapolei Parkway and Fort Weaver Road.

Objective E. *To create and maintain attractive, meaningful, and stimulating environments throughout O'ahu.*

Policy 4. *Require the consideration of urban-design principles in all development projects.*

The 'Ewa Makai development will be consistent with land use principles set forth in the 'Ewa Development Plan. (See below.)

Culture and Recreation

Objective D. *To provide a wide range of recreational facilities and services that are readily available to all residents of O'ahu.*

Policy 1. *Develop and maintain community-based parks to meet the needs of the different communities on O'ahu.*

Policy 9. *Require all new developments to provide their residents with adequate recreation space.*

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

To meet the recreational needs of 'Ewa Makai residents, two community-based parks are planned, as well as a private community recreational facility.

6.2.2 'Ewa Development Plan

The 'Ewa Development Plan, adopted in 1997, provides conceptual, long-range visions and policies to guide land use and infrastructure decisions affecting the 'Ewa region. The

'Ewa Makai community will be consistent with the 'Ewa Development Plan in the following respects:

Vision
'Ewa Makai is consistent with the following key elements of the vision:

Urban Growth Boundary - *"The Urban Growth Boundary for 'Ewa was drawn to give long-range protection from urbanization for over 3,000 acres of prime agricultural land and for preservation of open space while providing adequate land for urban development in 'Ewa for the foreseeable future."*

"...almost 8,400 acres are available for residential development; almost 800 acres for retail and office development; and nearly 1,250 acres for industrial development. Providing this capacity allows for competition and promotes more affordable residential, commercial, and industrial development."

"It should be noted that a portion of the lands indicated for development are in the State Agricultural Land Use District and will have to be approved for transfer to the State Urban District by the State Land Use Commission before they can be developed."

The 'Ewa Makai development lies within the Urban Growth Boundary for 'Ewa. These lands are currently in the State Agricultural Land Use District; approval for transfer to the State Urban District will be sought.

Open Space and Greenways - *"A network of Open Space and Greenways will link the Secondary Urban Center and associated employment centers, new master planned residential developments and revitalized established communities, an 'Ewa shoreline park, and a major regional park and recreation complex at Kalaeloa."*

The proposed development will be an extension of the 'Ewa by Gentry master planned community, which incorporates an open space network within the community. Significant acreage of open space will be retained in parks, as well as the Coral Creek Golf Course which is designated as part of the 'Ewa Open Space and Greenways Network. The community is also adjacent to agricultural lands in the West Loch Naval Magazine Blast Zone and the Hawai'i Prince Golf Course, both of which are designated as part of the regional open space system. Greenway corridors include the Kapolei Parkway and Fort Weaver Road.

Kalaeloa Regional Park and Recreation Complex - *"A major Regional Park and Recreation Complex at Kalaeloa will provide needed open space, recreation opportunities, and access to the beaches and ocean."*

A major bikepath through 'Ewa Makai will serve to link the community with the proposed regional park.

Master Planned Residential Communities - *"A network of master planned residential communities will provide a wide variety of housing and accommodate the need for affordable housing."*

Laulani and Fairways (aka 'Ewa Makai-West and 'Ewa Makai-East, respectively) are among the planned residential communities slated for development in the 'Ewa Development Plan area.

Communities Designed to Support Non-Automotive Travel - *"The master planned residential communities will be designed or redeveloped to support pedestrian and bike use within the community and transit use for trips outside the community."*

As an extension of the 'Ewa by Gentry master planned community, the project will support pedestrian and bicycle use through the development of sidewalks and bikepaths within the community and along Fort Weaver Road. 'Ewa Makai will also be designed to accommodate City bus service along its main streets, and will be located in proximity to a ferry service that is currently in the planning stages.

Conservation of Natural Resources - *"'Ewa Natural Resources, including potable water, coastal water quality, and wetlands and other wildlife habitat, will be conserved by:*
Developing a dual water distribution system with potable water for drinking and other clean water uses, and non-potable water for irrigation and industrial use.
Designing the regional drainage and wastewater treatment system to minimize non-point source pollution of the ocean and Pearl Harbor.
Protecting valuable habitats for endangered waterbirds located in Batis Salt Marsh in 'Ewa Marina and in the West Loch of Pearl Harbor and for endangered plants located within Barbers Point Naval Air Station and elsewhere."

A dual water distribution system is currently being used in 'Ewa by Gentry, and will continue to be used in 'Ewa Makai. Additionally, the drainage and wastewater treatment systems in 'Ewa Makai will be designed as part of a regional system to minimize non-point source pollution of the ocean. 'Ewa Makai does not contain any endangered flora or fauna and is not sited on the 'Ewa DP map of key natural resources.

Preservation and Enhancement of Historic and Cultural Resources - There are no known historic or cultural sites in 'Ewa Makai. However, mauka views of the Waianae Range and views of central Honolulu and Diamond Head will be retained to the extent possible.

Phased Development - 'Ewa Makai will be consistent with the phased development component of the 'Ewa Development Plan in the following respects: It will provide increased land supply to support economic development and job creation and to accommodate major residential growth with an emphasis on providing affordable housing and a diversity of housing types.

It will provide for moderate growth of a commercial-industrial center in an Urban Fringe Area to primarily serve the needs of the surrounding residential communities.

It is consistent with the phasing plan to support residential and commercial development. The Fairways and Laulani Residential projects ('Ewa Makai-East and 'Ewa Makai-West) and the 30-acre Laulani Industrial project are listed in the Phase I development timetable (1997-2005)

There will be adequate facilities requirements to ensure that development does not outpace infrastructure development.

There will be public and private sector coordination on infrastructure needs to support the directed growth strategy of the General Plan.

Land Use Policies, Principles, and Guidelines

The vision for the development of 'Ewa will be implemented through the application of land use general policies, principles, and guidelines. The 'Ewa Makai development will be consistent with these policies, principles, and guidelines, as follows:

Open Space Preservation and Development

Planning Principles - Planning principles that will guide the development of 'Ewa Makai include the following:

Visual and Physical Definition of Urban Areas. "Within the Urban Growth Boundary, the open space system should visually distinguish and physically separate individual communities, neighborhoods, and land use areas in 'Ewa."

The 'Ewa by Gentry community, of which 'Ewa Makai will be an extension, will be visually distinguished by the open space system. It is bordered on the east by the agricultural areas of the U.S. Navy Blast Zone, to the south by the Hawai'i Prince Golf Course, and to the west by the Kalaeloa Golf Course. Portions of the southern boundary will be bordered by the Ocean Pointe golf course and a 20-acre district park.

Passive and Active Open Spaces. *"The open space system shall consist of areas in active use, as well as passive areas. Active areas include parks, golf courses, and agricultural fields. Passive areas include the State Conservation District, fallow land in the State Agriculture District, drainage and utility corridors."*

Creation of Open Space Network. *"The various types of open space should be linked as an open space network, with major open space areas connected by open space corridors along transportation routes, utility corridors, and drainageways."*

Open space areas, in and around the 'Ewa Makai development, will be connected by greenways along major transportation corridors, as well as the open space drainageway that will be part of the Kaloi Gulch drainage system.

Dual Use of Drainageways and Utility Corridors. *"To create the regional open space network, drainageways and utility corridors should be viewed as opportunities to link major open spaces with pedestrian and bike paths along open space corridors. To accommodate such uses, where possible, drainageways should be retained as natural or man-made vegetated channels rather than be replaced by concrete channels."*

An open space area in 'Ewa Makai will extend from the Coral Creek Golf Course to the Ocean Pointe golf course, providing a natural drainage channel. A pedestrian/bike path will traverse through this open space and will connect parks within the community with the proposed Kalaeloa Regional Park and the shoreline.

Relation to Open Space Map

Appendix A of the 'Ewa DP shows components of the regional open space system. The Kaloi Gulch drainage channel in 'Ewa Makai-West, as well as the greenways along Kapolei Parkway and the Fort Weaver Road corridor are included as part of the open space system. Although there will be smaller community and neighborhood parks in 'Ewa Makai, these are not shown on the map because only island-wide, regional, and district parks are shown.

Guidelines

The following guidelines are relevant to 'Ewa Makai:

Natural Gulches and Drainageways. *"Planned improvements to the 'Ewa drainage systems should be integrated into the regional open space network by emphasizing the use of retention basins and recreational access in the design approach."*

The drainage system in 'Ewa Makai-East will consist of a large retention basin around which single-family homes will be developed.

Greenways and Open Space Corridors. *"The rights-of-way for major arterials and collector streets should be designed as landscaped parkways or greenways, complete with a landscaped median strip, landscaped sideway, and bikeways. Major arterials should have separate bike paths, and major collectors should have bike lanes. Suggested width for major arterials, including right-of-way and planting strips, is 120 feet wide and for major collectors is 100 feet wide."*

The rights-of-way for major arterials and collector streets in 'Ewa Makai will conform to the above to the extent possible. Landscaped bike paths, sidewalks, and median strips (as applicable), are an integral part of the existing 'Ewa by Gentry community and will continue to play an important role in providing greenways and open space corridors in 'Ewa Makai.

Regional Parks and Recreation Complexes - There are no regional parks or recreation complexes planned for 'Ewa Makai.

Community-Based Parks

General Policies - General policies that will guide the development of parks in Gentry Makai include the following:

"Adequate parks to meet residents' recreational needs should be provided."

"New residential development should strive to provide land for open space and recreation purposes at a minimum of two acres of park per 1,000 residents."

Based on an estimated population of 5,595 residents (1,865 units x 3 persons per household), an estimated 11.2 acres of land should be provided for open space and recreation purposes in 'Ewa Makai. The 'Ewa Makai Master Plan far exceeds this requirement: 25.5 acres of land are being set aside for public parks and open space, and another 2 acres are being set aside for a private community recreation center. Mini parks may also be developed within neighborhoods. Additionally, a district park that is adjacent to 'Ewa Makai-West is being developed by HASEKO.

Guidelines - The following guidelines are relevant to the development of community-based parks in 'Ewa Makai.

"Where feasible, Community and Neighborhood Parks should be sited at the center of neighborhoods, in order to maximize accessibility."

"Development master plans should provide accessible pathways from surrounding streets to facilitate pedestrian and bicycle access to all features in parks."

Both park areas that are planned for 'Ewa Makai will be centrally located and will be accessible to both pedestrians and bicyclists via pathways from surrounding streets.

Historic and Cultural Resources - Because the 'Ewa Makai area was formerly cultivated in sugar, it does not contain any historic features or native Hawaiian cultural and archaeological sites. However, plans for the project will promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of the makai mountain views, as well as views of central Honolulu and Diamond Head to the extent possible. There are no ocean views from the Subject Property.

Existing and Planned Residential Development - Section 3.6.3 of the 'Ewa DP provides general policies and guidelines for the development of new communities and the expansion or renovation of existing communities.

General Policies - The development of 'Ewa Makai will be consistent with the following general policies.

Overall density - "To achieve the desired compactness and character of development in planned residential communities, the housing density of the aggregate area zoned for residential use (including the streets) should be in the range of 10 to 15 units per acre."

Densities in the 'Ewa Makai community will range from 7.5 units/acre to 20 units/acre. The overall density will average 10 to 11 units per acre. These units will be in conformance with the height guidelines for planned residential developments (i.e., low density units will not exceed two stories, and medium density developments will not exceed three stories).

Compatible Mix of Building Forms - "There should be a variety of housing types and densities to avoid visual monotony and accommodate a variety of housing needs, but without sharp contrasts between the exterior appearance of adjacent housing areas."

The proposed rezoning will provide a mixture of housing types and densities, consistent with the above policy. The homes will be compatible with the exterior appearance of adjacent housing areas.

Transit-Oriented Streets. "Street patterns and rights-of-way should be designed to accommodate mass transit service and make it convenient to access for as many households as possible."

Major streets and rights-of-way will be designed to accommodate mass transit service that is convenient to as many of 'Ewa Macao's households as possible.

Pedestrian and Bicycle Travel. "Pedestrian and bicycle travel should be encouraged, particularly to reach neighborhood designations such as schools, parks, and convenience stores."
'Ewa Makai will provide both sidewalks and bikepaths throughout the community, making it convenient and easy for residents to access neighborhood destinations.

Provision of Community Facilities. "Land should be provided for community facilities, including churches, community centers, and elderly and child care centers."

Land has been set aside in 'Ewa Makai for two church/day care center sites, a community recreation center, and a middle school.

Guidelines: Low Density Residential - The following are guidelines for the development of low density residential areas consisting of one and two-story single family attached and/or detached dwellings with individual entries.

Density - "Density should be 5 to 12 units per acre, typical of residential zoning districts and allowing the application of optional design standards for Clusters and Planned Unit Developments."

The proposed density for the single family and cluster developments will range from 7.5 to 12.5 units per acre. The overall average will be 9.6 units per acre.

Building Height - "In general, buildings should not exceed two stories, although the height may vary according to required flood elevation, slope, and roof form."

Single family and cluster homes in 'Ewa Makai will not exceed two stories.

Site Design - "The site design for small-lot developments should avoid monotonous rows of garages and drainageways along neighborhood street frontages by employing features such as varied building setbacks and shared drainageways."

Where feasible, the site design will strive to employ features such as varied building setbacks and shared drainageways to avoid monotony.

Building Form - "Buildings should provide visual interest and individual identity by using varied roof forms, exterior colors and finishes, building orientation, floor plans and architectural details."

The above elements will be incorporated to the extent possible in order to provide visual interest and individual identity.

Guidelines: Medium Density Residential - The following are guidelines for the development of medium density residential areas consisting of two- and three-story townhouse or low-rise apartment buildings.

Density - "Density should be 10 to 30 units per acre."

The average density for the multi-family developments in 'Ewa Makai will be 20 units per acre.

Building Height - "In general, buildings should not exceed three stories above grade. Maximum building heights should allow for pitched roof forms."

Multi-family buildings will not exceed three stories.

Building Form - "Building form, orientation, location of entries and landscape screening should be employed to maintain a sense of residential scale and provide greater privacy and individual identity for housing units."

The above elements will be incorporated to the extent possible in order to maintain residential scale and provide greater privacy and individual identity for housing units.

Compatibility - "Building scale, roof form and the quality of materials should be compatible with those of adjacent low-density residential areas."

Compatibility with adjacent low-density residential areas will be taken into consideration when designing multi-family buildings.

Guidelines: High Density Residential - Not applicable. There will be no high-density residential buildings in 'Ewa Makai.

Circulation System - The 'Ewa Development Plan states:

"Master-planned projects should each have a circulation plan, or 'circulation element' in their Project Master Plan."

A circulation plan for 'Ewa Makai will be included as part of the Project Master Plan and will include applicable elements of the 'Ewa Development Plan regarding Transit Routes and Facilities, Pedestrian and Bicycle Routes and Facilities, and Landscape Treatment.

Relation to Urban Land Use Map - The planned low- and medium-density areas in the 'Ewa Makai Master Plan will be consistent with the 'Ewa Urban Land Use Map shown as Exhibit A in the 'Ewa Development Plan.

Relation to Zoning - The planned residential areas in 'Ewa Makai will be consistent with the Guidelines for Appropriate Zoning set forth in the 'Ewa Development Plan.

Non-Residential Development: Industrial Centers - The industrial-commercial center in 'Ewa Makai-West is proposed for service-oriented light industrial use and is included for development in Phase I of the Phasing Plan for the 'Ewa DP area. It will be consistent with the planning principles set forth in Section 3.7.3.2 that refer to appropriateness of scale and environmental compatibility.

Public Facilities And Infrastructure Policies And Principles

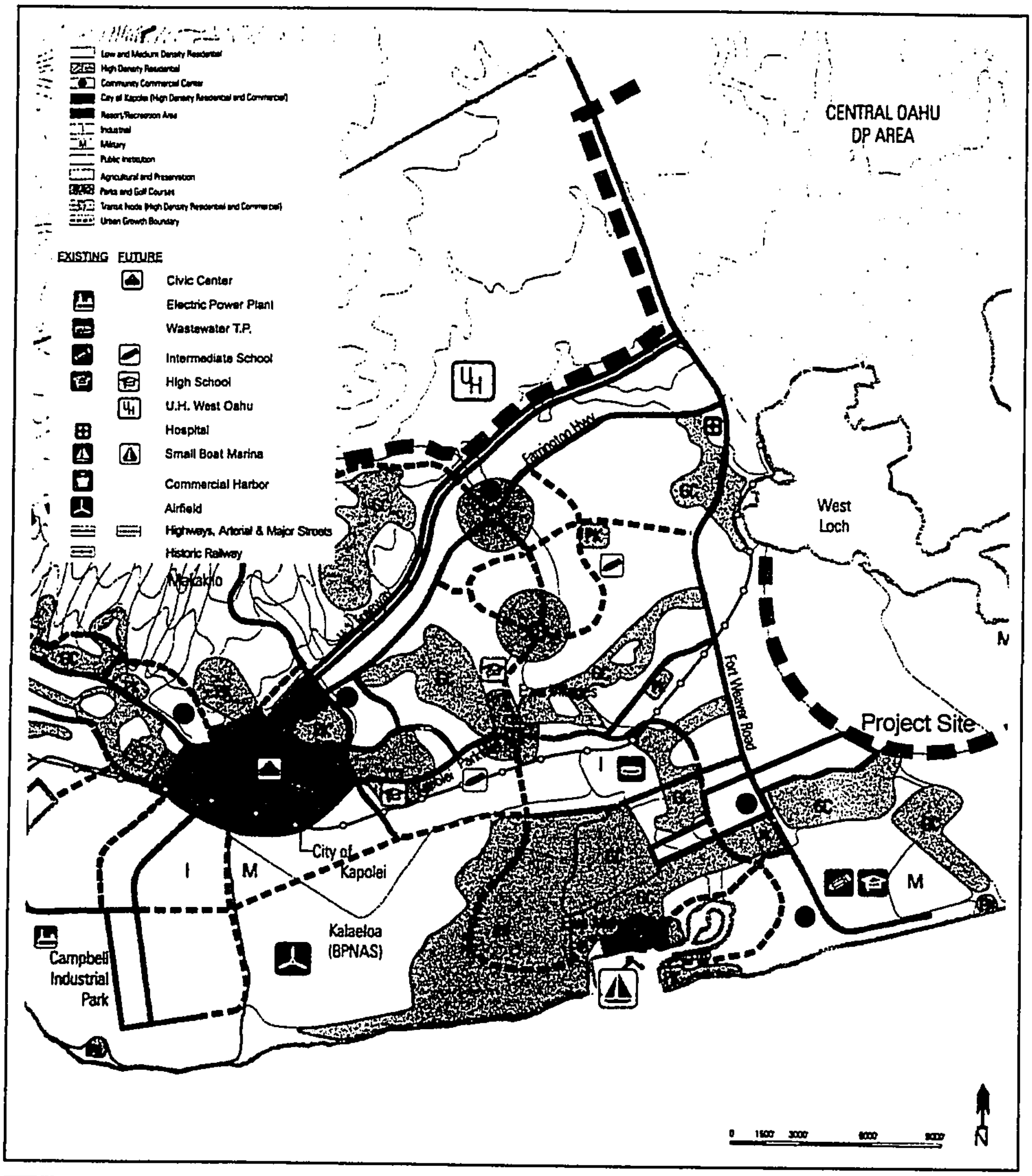
Chapter 4 of the 'Ewa DP sets forth policies and principles to guide the planning and construction of proposed public and private public facility projects and infrastructure systems to carry out the vision for future development of 'Ewa. The Development Plan Map (Figure 25) and the Public Infrastructure Map (Figure 26) show public facilities within the 'Ewa District. The 'Ewa Makai development will be consistent with these policies and principles as follows:

a. Transportation Systems

Roadway Network - One of the major elements of the future 'Ewa roadway network is Kapolei Parkway which is planned as a major corridor. The portion of Kapolei Parkway through 'Ewa by Gentry has already been completed. When remaining portions of the roadway are completed, including those portions through HASEKO's Ocean Pointe community, the 'Ewa Makai community, and State and City property, Kapolei Parkway will serve as a major link from 'Ewa Beach to the city of Kapolei. Eventually, it will serve as a link from 'Ewa Beach to the resort area of West Beach.

Bikeway System - The 'Ewa DP states that major bike paths should run along the OR&L right-of-way and Kapolei Parkway and along the North-South Road and Fort Weaver Road. Bike paths currently existing throughout the 'Ewa by Gentry community and along Fort Weaver Road and Kapolei Parkway, and will be included in the 'Ewa Makai development, as well.

Transit-Oriented Community Street Systems - Circulation systems within the 'Ewa Makai community will be designed to facilitate bicycle and pedestrian travel, allow for increased transit use, and reduce dependence on automobile travel.

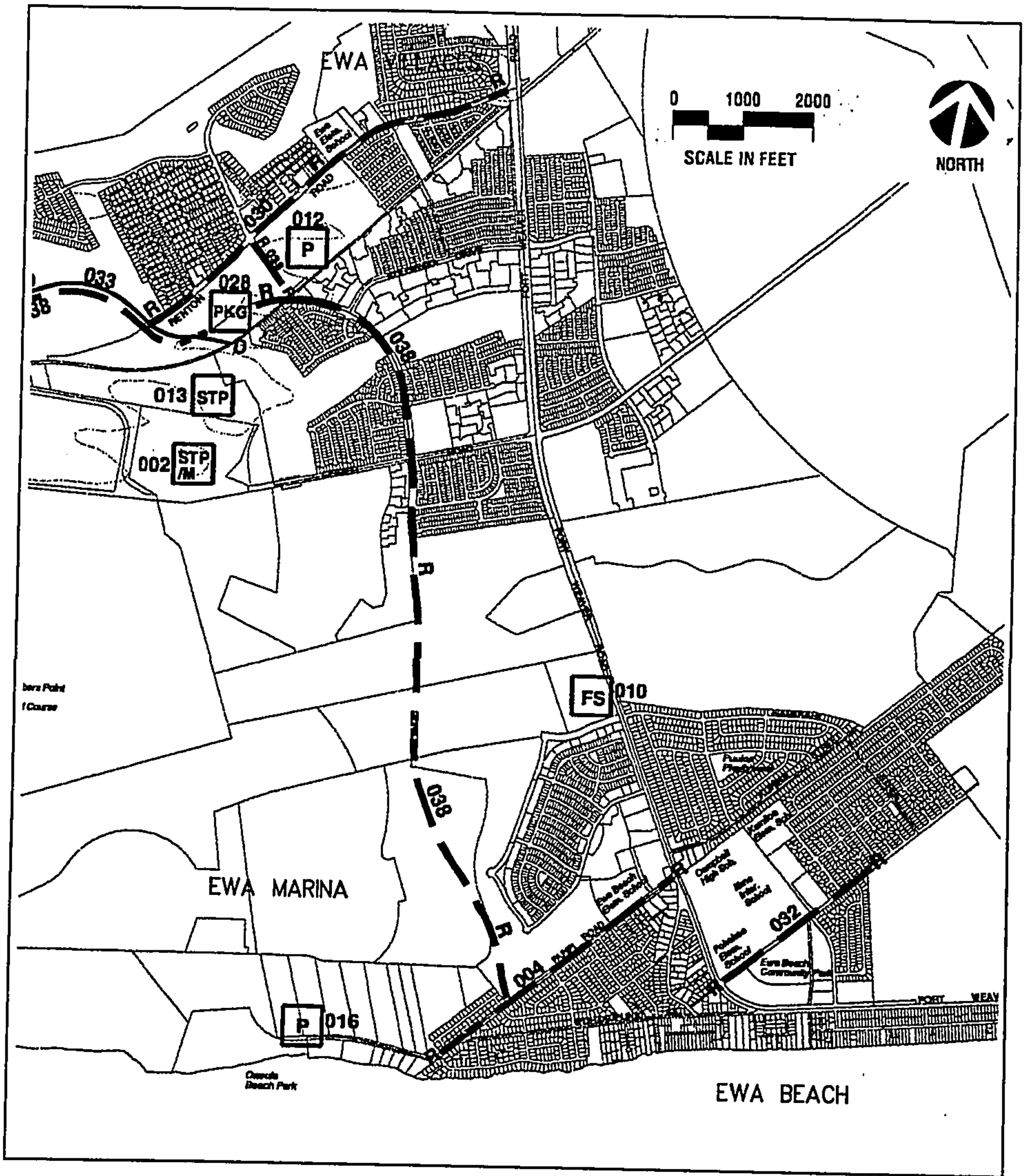


Gentry 'Ewa Makai

'Ewa Development Plan Map

Prepared by: Environmental Communications, Inc.
Source: City and County of Honolulu, Planning Department

Figure 25
Page 6-32



Gentry 'Ewa Makai

Public Infrastructure Map

Prepared by: Environmental Communications, Inc.
Source: City and County of Honolulu

Figure 26
Page 6-33

b. Water Allocation and System Development

Adequacy of Water Supply - The 'Ewa Plain Water Development Corporation (EPWDC), of which Gentry is a member, has dedicated source and well facilities, storage, and transmission for a water system to the City and County of Honolulu. The purpose of these water improvements is to help ensure that there will be an adequate supply of potable water for EPWDC members' current and future projects, including 'Ewa Makai.

Dual Transmission Lines/Use of Nonpotable Water - As with 'Ewa by Gentry, a dual water system will be developed in 'Ewa Makai to conserve the supply of potable water. Nonpotable water will be used where feasible for purposes such as landscape irrigation.

c. Wastewater Treatment

Wastewater produced by the 'Ewa Makai development will be connected to the Honouliuli Wastewater Treatment Plant, a municipal sewer service system. *The project has developed approved sewer master plans for the project. These plans are presently being revised and updated to accommodate the latest project design. These revised plans be submitted to the City and County of Honolulu for review and approval.*

d. Drainage Systems

The 'Ewa DP states that drainage system designs should emphasize control and minimization of non-point source pollution and the retention and/or detention of storm water on-site and in appropriate open space and wetland areas. Natural and man-made vegetated drainageways and retention basins are proposed for 'Ewa Makai. A drainageway that is part of the Kaloi Gulch Drainage Basin is proposed for 'Ewa Makai-West, connecting the Coral Creek Golf Course with Oceanpointe's planned golf course.

In 'Ewa Makai-East, a large retention basin will be built as part of a single-family residential subdivision. This retention basin will be used to detain or infiltrate storm water flows to reduce their volume and runoff rates and the amounts of sediments and pollutants transported. The retention basin may be developed as part of a landscaped passive park, though final plans are undetermined at this time.

Previously accepted drainage system plans are presently being updated to accommodate the latest project design. These plans will be submitted for City and County of Honolulu review and approval.

e. School Facilities

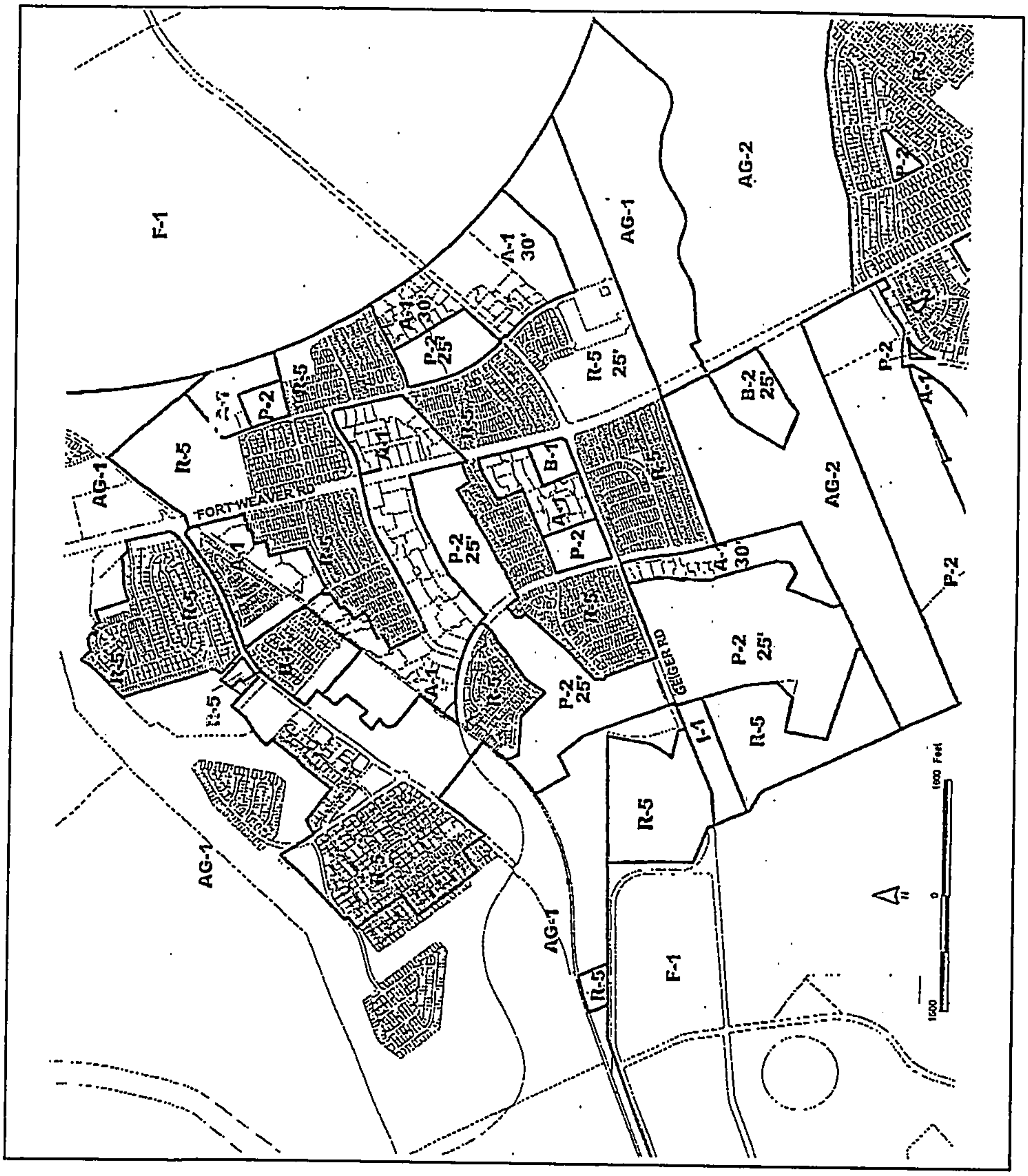
The 'Ewa DP states that the State Department of Education (DOE) has projected a need by 2020 for two new intermediate schools, one of which has already been built in the Villages of Kapolei. Although the 'Ewa DP lists East Kapolei Intermediate as the second intermediate school site, the development of East Kapolei is uncertain at this time. In cooperation with the DOE, Gentry has agreed to dedicate an 18-acre middle school site in 'Ewa Makai-East to service the educational needs of this growing area and to address its fair share contribution for the provision of adequate school facilities.

f. Public Safety Facilities

'Ewa Makai will be serviced by existing public safety facilities, including a regional police station in Kapolei and a fire station in 'Ewa Beach (or Oceanpointe when is built).

6.2.3 Zoning

Zoning for the project site is presently split with the area west of Fort Weaver Road zoned AG-2 General Agriculture, and the eastern portion of the site zoned AG-1 Restricted Agriculture (Figure 27). As previously discussed, it is the intent of the applicant to seek changes in zoning which are consistent with the proposed development (Figure 7).



Gentry 'Ewa Makai

Existing Zoning Designations

Prepared by: Environmental Communications, Inc.
Source: City and County of Honolulu

Figure 27
Page 6-36

7.0 Alternatives to the Proposed Project

7.0 ALTERNATIVES TO THE PROPOSED ACTION

The following discussion consist of alternatives considered to the proposed 'Ewa Makai project. Each alternative, including a no-action alternative have been evaluated and rejected for the proposed master plan. It should be noted that each of the alternatives considered are relatively consistent with existing land use conditions and do not represent extreme departures in land use that are obviously inconsistent with the current regulatory, physical and social environments.

7.1 High Density Alternative

Higher density development was not considered as a development option. While zoning will be sought for the project site, high-density development is not consistent with the 'Ewa Development Plan. Higher density development would create heavier demands on infrastructure which could possibly be accommodated, however, such development is out of character with the surrounding community.

7.2 Low Density Alternative

Low-density development is an alternative to the proposed mix of housing and commercial uses. This alternative would have lower demand on infrastructure but would provide far less benefit to the overall population. It is the applicant's objective to provide housing opportunities at all economic levels as well as diversity of housing types to accommodate different lifestyles. Low-density, single-family housing units are provided within the proposed project, however it is deemed important that other housing types be offered at varying price levels.

7.3 Alternative Without Commercial/Industrial Use

An alternative that did not include the commercial/industrial use was considered for the project. This alternative would have replaced the proposed commercial/industrial area of 30 acres with multi-family or cluster housing. While the commercial/industrial area is well suited for housing, additional housing would also contribute significantly to the overall project demand for infrastructure and services. It is the project intent to include the proposed commercial/industrial use to provide a balance of residential areas and employment and service centers to the 'Ewa region. The proposed commercial/industrial area is not intended to serve as a high traffic commercial center but rather as an area that could provide non-invasive, low impact services such as repair services, storage facilities or other desirable community services. This area is also anticipated to have lower traffic impact that pure commercial uses. The commercial/industrial use is also expected to provide a balance of employment opportunities beyond those associated with retail only services. These benefits were considered to outweigh the provision of additional housing in this area.

~~7.3~~*7.4* Agricultural Use Alternative

~~The~~ *Until recently, the* project site ~~is currently~~ *was* leased as ranch land for horse and cattle grazing ~~but is~~ *that was* operated as a family hobby with no employees. It is possible that agricultural use could be maintained at this location but such use would be inconsistent and undesirable given the urban nature of the surrounding communities. While crops could be cultivated at an economically viable scale, the loss of such lands would be negligible in the overall inventory of lands available for diversified agriculture. The offsetting benefits of new homes, employment opportunities, and economic benefits are considered significant.

~~7.4~~*7.5* No Action Alternative

The "no action" alternative would not make any changes to the existing project site. Under this condition, the site will remain unimproved. Other diversified agricultural uses are discussed in Section 8.4. As stated in Section 5 and Appendix A, sugar production lands that were released in the 1990's and are generally in diversified agricultural or other uses. While the site consist of former sugar cane lands, it is extremely unlikely that the site would revert back to cane land use. The site ~~is currently~~ *was formerly* leased as ranch land but is not sufficiently sized for commercial operations.

It is also likely that no action taken on the project site would result in the property becoming a nuisance to the surrounding community. While it would not increase the built environment, it would likely become an overgrown field that would eventually be a habitat to feral animals, undesirable weedy species and an unsanctioned dumping ground.

The "no action" alternative would also be inconsistent with the master planned 'Ewa by Gentry concept. With no development action, the high demand for housing in the 'Ewa region would not be met. This in turn would create additional demand in other areas less suited for urban growth. As stated in Section 7, the proposed development is consistent with the City and County of Honolulu Development Plan for 'Ewa.

Beyond the provision of housing opportunities, other important components of the project include the Kapolei Parkway, a middle school, an employment center, and church and daycare sites. These important community elements would not be built if the proposed action were not implemented.

Lastly, "no action" would not provide any financial return to the landowner, State, County or general public. The project will provide significant benefits to the community that in addition to the provision of housing opportunities will: generate new tax revenues; create short-term construction related employment and long-term business and service jobs; and provide new capital investment and added spending to the economy.

8.0 Contextual Issues

8.0 CONTEXTUAL ISSUES

8.1 Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance of Long-Term Productivity

The 'Ewa Makai site is presently designated for agricultural use but has lain fallow for several years. Sugar cane cultivation, which was ~~one~~ *once* a primary industry in the 'Ewa Plain has ceased to be economically viable locally, as well as throughout the State of Hawai'i. This decline in production has been subsequently replaced by the demand for housing created by a changing economy. Planning policies further support residential community use for the former agricultural lands. The 'Ewa Makai remains one of the last remaining agricultural zoned lands in the region. The proposed action serves as an infill project that completes the new residential vision for the region.

The site possesses the physical attributes desirable for a master-planned community. The site's relationship to the surrounding master-planned residential areas essentially lends the site an important linking element that will further unify the 'Ewa by Gentry projects and the new Ocean Pointe development.

The 'Ewa Makai development will maintain the same high standards established by the successful 'Ewa by Gentry phases. The project will provide the continuity essential to completing the 'Ewa by Gentry master plan. The principal long-term benefit of the project is the productive use of the site in a coordinated, master-planned development that addresses community services and needs on a large-scale, regional basis. Housing demand in the area remains high, attesting to the desirability of planned development. The long-term appearance of the site will be significantly changed from open, abandoned land to one of planned landscaping. The site in its former cane field use did not provide for any views nor can the present fallow state of the site be considered a view amenity.

The long-term maintenance and operation of the project will provide long-term socioeconomic benefits through the provision of employment centers at the schools, industrial/commercial areas, park and community centers, and the general maintenance of the site. Beneficial secondary uses will also be gained from public revenues obtained from excise, personal, and real property taxes.

Short-term impacts are largely related to construction activities. Impacts associated with construction, such as noise, dust and traffic are typical of any construction activity and will be mitigated by the adherence to State and County construction regulations, good construction housekeeping practices, and careful project planning and management. These impacts do not last beyond the construction phase and do not have any impact on the long-term operation of the project. Positive short-term impacts also include the creation of construction and professional service jobs, tax revenues and secondary economic activity from the purchasing of materials.

Based on the foregoing considerations, the proposed 'Ewa Makai project will create more positive, long-term impacts without posing any long-term risks to the physical and socioeconomic environment. Short-term impacts are generally construction related and are essentially outweighed by the long-term benefits of the development.

8.2 Irreversible and Irretrievable Commitments of Resources

The development of the 'Ewa Makai project will result in the irreversible and irretrievable commitment of natural and fiscal resources. Major resource commitments include the urbanization of the site for a long-term period, the financial resources to develop the site, the use of construction materials, labor, and energy to build the community. The impacts of using these resources should be weighted against the expected positive socioeconomic benefits that will be derived from the development of the proposed project. It should also be considered that the consequences of taking no action or other less beneficial uses of the property would not be consistent with the general policy direction in effect for the project area.

8.3 Probable Adverse Environmental Effects that Cannot be Avoided

Construction of the proposed project will result in impacts which are considered unavoidable. The character of the site will be significantly changed but will be consistent *with the character of the surrounding community. This consistency with the surrounding* environment is not adverse but will permanently remove the site from use as an open space.

As discussed in Section 5.2, the proposed 'Ewa Makai project will result in an increase in vehicular traffic. This impact is unavoidable by the nature of the proposed development however a number of recommendations have been developed to alleviate traffic impacts. In addition, it is expected that a new City and County of Honolulu Ordinance providing for the collection of roadway impact fees in the 'Ewa region will be in effect prior to development of the project site. These fees will contribute to regional traffic improvement in addition the local improvements proposed by the applicant.

Solid waste, electrical power and sewage service demand will increase from the proposed action. These demands are expected of residential development and cannot be avoided. Impacts on these services are discussed throughout Section 5.

Short-term air and noise impacts will result from construction related activities. Typically, air quality in the immediate vicinity of the project will be affected by dust and construction equipment pollutants. These impacts are subject to governmental requirements ~~are~~ *and* will be monitored onsite. *Best Management Practices (BMP) will be employed during construction to control soil erosion in conformance with the Department of Planning and Permitting's Rules Relating to Soil Erosion Standards and Guidelines. Best Management Practices that may be used to control soil erosion and fugitive dust include dust* screens and frequent watering of exposed soil and roadways ~~will~~ *to* control fugitive dust. *Soil erosion measure may include the use of mats and* *hydromulch to control erosion and the use of sand bags or drain screen prevent silt from entering street drains.* Long-term air quality impacts will be experienced from the increased operation of automobiles however as discussed in Section 5.4, even under worst case conditions, air quality will remain within Federal and local standards.

Noise impacts during construction are generally sourced from earthmoving equipment such as bulldozers and heavy trucks. These impacts are regulated by Federal and State noise control regulations. Traffic and aircraft noise will have some impact *on* the proposed residences. Aircraft noise has been determined to be within acceptable levels. Roadway noise will require some mitigation measures that are discussed in Section 5.3. These measures that may be considered include increased right-of-way distances, walls, berm, and air-conditioning.

8.4 Unresolved Issues

The applicant will continue to work with applicable State and County agencies and adjacent community groups and organizations to ensure that the proposed project will meet the applicant's objectives and will satisfactorily address the interest and concerns of these agencies and community groups. At the present stage of planning, final design plans have not been developed therefore some issues will remain unresolved until final plans have been developed. At the present time, the following issues remain outstanding but do not prevent the project from continuation of final planning.

Regional public infrastructure improvements, particularly roadways and schools, remain unresolved issues in the Ewa region. Infrastructure funding and development have not kept pace with the rapid growth of residential communities, resulting in overcrowded elementary schools and peak hour traffic jams along the Fort Weaver Road and H-1 corridors. The developer has agreed to set aside 18 acres for a middle school which, when built, will relieve the pressure of the area elementary schools by absorbing the sixth grade level classes. The developer will also be expediting completion of a portion of Kapolei Parkway through the Ewa Makai development, thus helping to provide an alternative route for Ewa Beach residents who are currently forced to drive on Fort Weaver Road, the only access road in and out of Ewa Beach. In addition, impact fees collected to help pay for various Ewa highway improvements should help to ease traffic congestion. Nonetheless, until those improvements are in place, regional traffic and education remain unresolved issues.

~~Traffic and mass transit/public transit remain unresolved in that the availability of public transit alternatives that could be utilized by the project's residents are uncertain. The addition of a light rail system or the proposed Bus Rapid Transit (BRT) remain as planning studies with an unknown development timetable.~~ The proposed bus rapid transit (BRT) system has established an implementation timetable *which* will begin ~~with~~ regional BRT ~~service to begin~~ *improvements* in 2006 *with service to begin a few years later.* The BRT will use two major transit terminals within the project vicinity. The Kapolei Transit Center and the North-South Road Park-and-Ride will serve the proposed project. Coordination with the Department of Transportation Services will be maintained to ensure that the project is well served by this new system.

Water is expected to be available for the project. The Board of Water Supply has stated that adequate water supply for the entire 'Ewa region however allocations are not confirmed until the applicant submits development plans. This issue will be resolved as the design process proceeds into construction planning and permitting.

Drainage, water, and sewer systems master plans were previously developed for the 'Ewa Makai-East and 'Ewa Makai-West sites and approved by the City and County of Honolulu. These approved master plans will need to be revised or supplemented based on changes made to the 'Ewa Makai Master Plan. For example, the drainage master plan for 'Ewa Makai-East is currently being revised, based on the latest master plan. Approval of revisions to these plans by the City and County of Honolulu is anticipated; however, until these approvals are received, this issue must be considered unresolved. An approved roadway master plan will also be required by the City and County prior to the submittal of subdivision applications.

Public services must be confirmed during the construction period. While services are expected to be available, the appropriate service agencies must be notified prior to demand for the services.

Lastly, the proposed industrial/commercial area is presently under consideration by the City and County of Honolulu for appropriateness within the predominantly residential area. The applicant considers the industrial/commercial area, which would seek IMX zoning, an important employment and services center. The City has expressed concern that the use may not be appropriate within the context of the 'Ewa Area DP.

9.0 Agencies, Organizations, and Individuals Consulted in the Preparation of the Draft EIS

9.0 AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED IN THE PREPARATION OF THE DRAFT EIS

9.1 Federal Agencies

U.S. Department of the Navy
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Department of Agriculture, Resources Conservation Service
U.S. Department of the Interior, U.S. Fish and Wildlife Service

9.2 State of Hawaii Agencies

Department of Accounting and General Services, Comptroller
Department of Agriculture
Department of Business, Economic Development and Tourism, Land Use Commission
Department of Business, Economic Development and Tourism, Office of Planning
Department of Defense
Department of Education
Department of Hawaiian Home Lands
Department of Health
- Clean Air Branch
- Clean Water Branch
- Environmental Planning Office
- Noise and Radiation Branch
- Safe Drinking Water Branch
- Sanitation Branch
- Solid & Hazardous Waste Branch
- Wastewater Branch

Department of Land and Natural Resources, Engineering Division
Department of Land and Natural Resources, Historic Preservation Division
Department of Transportation
Housing and Community Development Corporation of Hawaii
Oahu Metropolitan Planning Organization
Office of Hawaiian Affairs
University of Hawai'i, Environmental Center

9.3 City and County of Honolulu Agencies

Board of Water Supply
Department of Community Services
Department of Design and Construction
Department of Facilities Maintenance
Department of Environmental Services

Department of Parks and Recreation
Department of Planning and Permitting
Department of Transportation Services
Honolulu Emergency Services Department
Honolulu Fire Department
Honolulu Police Department

9.4 Community Organizations and Private Agencies

Coral Creek Golf, Inc.
The Estate of James Campbell
'Ewa Beach Community Association
'Ewa by Gentry Community Association
The Gas Company
HASEKO (Hawaii), Inc.
Hawai'i Prince Hotel
Hawaiian Electric Company
Makakilo/Kapolei/Honokai Hale Neighborhood Board No. 34
Neighborhood Board No. 23, 'Ewa
Oceanic Cable
The Outdoor Circle
Verizon Hawaii, Inc.
West Loch Estates Fairways Homeowners Association
West Loch Estates Fairways Townhouses Association

10.0 LIST OF PREPARERS

10.0 LIST OF PREPARERS

The following parties were involved in the preparation of this Draft Environmental Impact Statement.

Environmental Communications, Inc.
Taeyong Kim, Principal and Preparer

B.D. Neal & Associates – Air Quality Study
Barry D. Neal

Char & Associates – Botanical Survey
Winona P. Char

Decision Analysts Hawaii, Inc. – Agriculture Study
Bruce Plasch

Earthplan – Social Impact Assessment
Berna Cabacungan

Phil Bruner, Environmental Consultant – Faunal Survey
Phil Bruner

Pacific Legacy, Inc. – Archaeological Survey
James McIntosh
Paul L. Cleghorn, Ph.D.

Pacific Legacy, Inc. - Cultural Impact Assessment
C. Celeste LeSuer
Paul L. Cleghorn, Ph.D.

Parsons Brinkerhoff - Traffic Impact Analysis
Wayne Yoshioka

Y. Ebisu & Associates – Acoustic Study
Yoichi Ebisu

11.0 References

11.0 REFERENCES

The following references were used in the preparation of this ~~Draft~~ Environmental Impact Statement.

B.D. Neal & Associates (2003) *Air Quality Study for the Proposed Ewa by Gentry Makai Development.* Kailua-Kona, Hawai'i.

Bruner, Phil (2001) *Avifaunal and Feral Mammal Survey of the Ewa by Gentry Makai Development Project, Oahu.* Laie, Hawai'i.

Char & Associates (2001) *Botanical Survey 'Ewa Gentry Makai 'Ewa District, O'ahu.* Honolulu, Hawai'i.

John Child & Company (2001) *Report to Gentry Homes, Ltd. Covering Market Assessments and Fiscal and Economic Impacts for the Proposed Ewa by Gentry Makai Development.* Honolulu, Hawai'i.

City and County of Honolulu (1997) *Ewa Development Plan.* Honolulu, Hawai'i.

City and County of Honolulu, Board of Water Supply, *Letter to Debra M. A. Luning, Gentry Homes, Ltd., dated January 24, 2003, from Clifford S. Jamile, Manager and Chief Engineer*

Decision Analysts Hawaii, Inc. (2002) *'Ewa Makai: Impact on Agriculture.* Honolulu, Hawai'i.

Earthplan (2002) *Ewa Makai Social Impact Assessment.* Honolulu, Hawai'i.

Engineering Concepts, Inc. (1996) *Drainage Master Plan for Ewa Makai-West,* Honolulu, Hawai'i.

Engineering Concepts, Inc. (2001) *Final Design Report for Gentry Ewa Makai-West Wastewater Pump Station and Force Main.* Honolulu, Hawai'i.

Engineering Concepts, Inc. *Letter to Debra M. A. Luning, Gentry Homes, Ltd., dated February 6, 2003, from Kenneth Ishizaki, P.E., Executive Vice President*

Geolabs, Inc. (2001) *Geotechnical Engineering Exploration East Ewa Makai Project, Ewa, Oahu, Hawaii.* Honolulu, Hawai'i.

Gentry Homes Ltd. (2003) *Ewa Makai Project Master Plan.* Honolulu, Hawai'i.

Juvik, Sonia P. and Juvic, James O. (1998) *Atlas of Hawaii, Third Edition.* Honolulu, Hawai'i.

KN Consulting Services, Inc., Drainage Master Plan (Revised) for Ewa by Gentry East, Phase II and Ewa East Makai (March 2003)

KN Consulting Services, Inc., *Letter to Tosh Hosoda, Gentry Homes, Ltd., dated January 27, 2003 from Kenneth O. Nagai, President and Principal Civil Engineer*

Land Study Bureau, University of Hawai'i (1972) *Detailed Land Classification – Island of Oahu*. Honolulu, Hawai'i.

Tom Nance Water Resource Engineering (2000) *Potable Water Master Plan for Ewa by Gentry*. Honolulu, Hawai'i.

Tom Nance Water Resource Engineering, *Letter to Tosh Hosoda, Gentry Homes, Ltd. dated January 31, 2003, from Tom Nance, President*

Pacific Legacy, Inc. (2002) *Archaeological Survey for the Proposed 'Ewa Gentry Makai Development 'Ewa District, Ahupua'a of Honouliuli, Island of O'ahu (TMK 9-1-10:7 and 9-1-69:5)*. Kailua, Hawai'i.

Pacific Legacy, Inc. (2002) *A Cultural Impact Assessment for the Proposed 'Ewa Gentry Makai Development 'Ewa, O'ahu*. Kailua, Hawai'i.

Park Engineering (1994) *Design Report for the Ewa by Gentry-East Wastewater Pump Station and Force Main*. Honolulu, Hawai'i.

Parsons Brinkerhoff (2002) *Traffic Impact Analysis Ewa by Gentry Makai Development*. Honolulu, Hawai'i.

Parsons Brinkerhoff, *Letter to Debra M. A. Luning, Gentry Homes, Ltd., dated July 3, 2003, from Wayne Y. Yoshioka, Manager of Transportation Planning/Traffic Engineering*

United States Department of Agriculture Soil Conservation Service (1972) *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawai'i*. Washington, D.C.

Y. Ebisu & Associates (2001) *Acoustic Study for the Ewa by Gentry – Makai Development, Ewa, Oahu*. Honolulu, Hawai'i.

12.0 Comments and Responses on the Environmental Impact Statement Preparation Notice

12.0 COMMENTS FROM AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED IN THE PREPARATION OF THE DRAFT EIS PUBLISHED DECEMBER 23, 2002

AGENCY	COMMENT DATE
Federal Agencies	
U.S. Department of the Navy	1/24/03
U.S. Army Corps of Engineers	1/6/03
U.S. Environmental Protection Agency	
U.S. Dept. of Agriculture, Resources Conservation Service	
U.S. Dept. of the Interior, U.S. Fish and Wildlife Service	
State of Hawai'i Agencies	
Dept. of Accounting and General Services, Comptroller	1/9/03
Dept of Agriculture	
Dept of Business, Economic Development and Tourism, Land Use Commission	1/16/03
Dept of Business, Economic Development and Tourism, Office of Planning	1/27/03
Dept of Defense	1/22/03
Dept of Education	1/15/03
Dept of Hawaiian Home Lands	
Dept of Health	
Dept of Health, Clean Air Branch	12/31/02, 2/4/03
Dept of Health, Clean Water Branch	2/4/03
Dept of Health, Environmental Planning Office	2/4/03
Dept of Health, Noise and Radiation Branch	2/4/03
Dept of Health, Safe Drinking Water Branch	
Dept of Health, Sanitation Branch	
Dept of Health, Solid & Hazardous Waste Branch	
Dept. of Health, Vector Control Branch	2/4/03
Dept of Health, Wastewater Branch	1/7/03, 2/4/03
Dept of Land and Natural Resources, Commission of Water Resource Management	1/23/03
Dept of Land and Natural Resources, Engineering Division	1/23/03
Dept of Land and Natural Resources, Forestry and Wildlife	1/23/03
Dept of Land and Natural Resources, Historic Preservation Division	1/6/03
Dept of Land and Natural Resources, O'ahu District Land Office	1/23/03
Dept of Land and Natural Resources, State Parks	1/23/03
Dept of Transportation	1/31/03
Housing and Community Development Corporation of Hawai'i	1/21/03
Oahu Metropolitan Planning Organization	

Office of Environmental Quality Control	1/21/03
Office of Hawaiian Affairs	1/29/03
University of Hawai'i, Environmental Center	
University of Hawaii Water Resource Center*	

City and County of Honolulu Agencies

Board of Water Supply	1/14/03
Dept of Community Services	
Dept of Design and Construction	1/10/03
Dept of Facilities Maintenance	
Dept of Environmental Services	1/22/03
Dept of Parks and Recreation	1/13/03
Dept of Planning and Permitting	2/10/03
Dept of Transportation Services	1/22/03, 2/14/03
Honolulu Emergency Services Department	
Honolulu Fire Department	1/10/03
Honolulu Police Department	1/24/03

Community Organizations and Private Agencies

Patricia L. Collins Jensen	1/15/03
Coral Creek Golf, Inc.	
The Estate of James Campbell	
'Ewa Beach Community Association	
'Ewa by Gentry Community Association	
The Gas Company	
HASEKO (Hawaii), Inc.	
Hawai'i Prince Hotel	
Hawaiian Electric Company	
Makakilo/Kapolei/Honokai Hale Neighborhood Board No. 34	
Neighborhood Board No. 23, 'Ewa	
Glenn J. Oamilda	1/22/03
Oceanic Cable	
The Outdoor Circle	
Representative Tulsi Gabbard Tamayo	1/7/03
Sierra Club*	
Verizon Hawai'i, Inc.	2/23/03
West Loch Estates Fairways Homeowners Association	
West Loch Estates Fairways Townhouses Association	

*In their letter dated January 16, 2003, the LUC recommended that the UH Water Resource Center and Sierra Club be added as consulted parties, however, they were accidentally left off the list. Although these organizations could have commented through the OEQC's notification process, no comments were received from these two organizations. Nevertheless, they will be sent copies of the FEIS and their organizations have been included in this section.

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

REPLY TO ATTENTION OF:

January 6, 2003

Regulatory Branch

Mr. Taeyong M. Kim
Environmental Communications, Inc.
P.O. Box 536
Honolulu, Hawaii 96809

Dear Mr. Kim:

This letter responds to your request for comments on the Environmental Impact Statement (EIS) Preparation Notice for the Gentry Ewa Makai project, dated December 23, 2002. Based on the information you provided I am unable to determine if a Department of the Army (DA) permit will be required for this project. Please include information in the EIS concerning the presence or absence of streams or other water bodies or wetlands on the property, and if present, what effect the project will have on them. Please place us on the mailing list for the draft EIS.

If you have any questions concerning this matter, please contact William Lennan of my staff at 438-6986 or FAX 438-4060, and reference File No. 200300202.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

ENVIRONMENTAL COMMUNICATIONS, INC.

February 7, 2003

Mr. William Lennan
Regulatory Branch
US Army Engineering District, Honolulu
Fort Shafter, Hawaii 96858-5440

Subject: File No. 200300202
Gentry Ewa Makai EISPN

Dear Mr. Lennan:

In response to Mr. George P. Young's request for additional information regarding the above referenced project, we would like to offer the following information.

The project site, which is presently zoned for agricultural use, does not contain any bodies of water or wetlands. The site has long been in agricultural cane land use and has been recently fallowed. A portion of the site is leased as grazing land.

As requested, you office will be placed on the Draft EIS mailing list.

If you have any questions, please call me at 528-4661. Thank you for your assistance.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION HAWAII
517 RUSSELL AVENUE, SUITE 110
PEARL HARBOR, HAWAII 96860-4884

IN REPLY REFER TO:

5090
Ser N465/00017
24 Jan 03

CERTIFIED MAIL NO. 7001 2510 0001 9471 6668

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

Dear Sirs:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION NOTICE FOR GENTRY EWA MAKAI

We have received the EIS preparation notice for the Gentry Ewa Makai Development. We do not have any comments at this time. Please note that the Explosive Safety Quantity Distance (ESQD) arc that is the far eastern boundary of the proposed development is firm and cannot be moved. Please ensure that the exact location of the ESQD arc is verified prior to commencing design and construction.

Should you have any further questions, please contact Mr. John Muraoka at (808) 471-1171, extension 229.

Sincerely,

M. T. WOLFERSBERGER
Lieutenant, CEC, U. S. Navy
Director
Regional Environmental Department
By direction of
Commander, Navy Region Hawaii

Environmental Communications, Inc.

February 7, 2003

Lt. M. T. Wolfersberger, Director
Regional Environmental Department
Department of the Navy
Navy Region Hawaii
Pearl Harbor, Hawaii 96860-4884

Dear Lt. Wolfersberger:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comment regarding the subject project. We understand that your department does not have any comment at this time. We also understand that the eastern boundary of the project is located along the fixed Explosive Safety Quantity Distance (ESQD) and will ensure that the project is located safely outside of this boundary. We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

RUSS K. SAITO
COMPTROLLER

KATHERINE H. THOMASON
DEPUTY COMPTROLLER

(P)1008.3

JAN - 9 2003

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for the opportunity to review the Gentry Ewa Makai Environmental Impact Statement Preparation Notice for the subject project.

This project does not impact any of the Department of Accounting and General Services projects or existing facilities. Therefore, we have no comments to offer.

Should you have any questions, please have your staff call Mr. Allen Yamanoha of the Planning Branch at 586-0488.

Sincerely,

TADASHI YOSHIZAWA
Acting Public Works Administrator

AY:mo
c: Mr. Taeyong Kim✓
Ms. Genevieve Salmonson, OEQC

ENVIRONMENTAL COMMUNICATIONS, INC

February 7, 2003

Mr. Tadashi Yoshizawa
Acting Public Works Director
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Yoshizawa:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comment regarding the subject project. We understand that the project will not have any impact on Department of Accounting and General Services projects or existing facilities. We also understand that your department does not have any additional comments to offer. We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

ANTHONY J.H. CHING
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

January 16, 2003

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: Environmental Impact Statement Preparation Notice (EISPN)
Gentry Ewa Makai

We have reviewed the EISPN for the subject project and have the following comments:

1) We confirm that the project location is designated within the boundary of the State Land Use Agricultural District. We suggest that the Draft Environmental Impact Statement (DEIS) include a map showing the project location in relation to the State land use districts.

2) We recommend that the following be included as consulted parties in the preparation of the DEIS:

State
- Commission on Water Resource Management
- University of Hawaii Water Resources Research Center

Community Organizations and Private Agencies
- Sierra Club

3) We acknowledge that Gentry Investment Properties (GIP) intends to file a boundary amendment petition with the Commission in the near future. It is our understanding that said petition will be filed *prior* to the completion of the EIS process. Representatives of GIP have already met with the Commission staff to discuss the subject project on several occasions. We suggest that they continue to work closely with our office to ensure the orderly processing of the petition.

We have no further comments to offer at this time. Thank you for the opportunity to comment on the subject EISPN.

Please feel free to contact Bert Saruwatari of my office at 587-3822, should you require clarification or any further assistance.

Sincerely,

ANTHONY J. H. CHING
Executive Officer

c: Taeyong Kim, Environmental Communications, Inc.
Office of Environmental Quality Control

February 7, 2003

Mr. Anthony J.H. Ching
Executive Director
Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Ching:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We offer the following in response to your comments:

1. The Draft Environmental Impact Statement will include a map showing the project location in relation to the State land use districts.

2. The Commission on Water Resource Management, the University of Hawaii Water Resources Research Center, and the Sierra Club will be added as consulted parties and will be provided copies of the Draft Environmental Impact Statement.

3. Gentry Investment Properties will continue to work closely with your office in filing the boundary amendment petition.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM

LINDA LINGLE
GOVERNOR

MARY LOU KOBAYASHI
ACTING DIRECTOR
OFFICE OF PLANNING

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-9962

January 27, 2003

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: Environmental Impact Statement Preparation Notice (EISPN)
Gentry Ewa Makai, Ewa District, Oahu, Hawaii

The Office of Planning has reviewed the Environmental Impact Statement Preparation Notice (EISPN) for the Gentry Ewa Makai project proposed by Gentry Investment Properties.

Gentry Homes Ltd. will seek a boundary amendment from the State Land Use Agricultural District to the Urban District for two parcels consisting of approximately 282.614 acres. The proposed boundary amendment is proposed in anticipation of increased housing demand and the eventual absorption of the existing housing inventory within the approved and developed portions of the existing Gentry master-planned community. The parcels, identified by TMK Nos. 9-9-69: 05 and 9-1-10: 07, represent the land area reserved for the second and final phase of development for the 1,000-acre master planned community consisting of approximately 7,200 homes located in the Ewa District of Oahu. The proposed final phase will add another 1,865 residential units.

The Ewa Plain is the location of the City of Kapolei, Kalaeloa community – (formerly the Barbers Point Naval Air Station) and several master planned suburban residential communities including Ewa by Gentry. The Ewa-Kapolei region has become Oahu's prime growth area in terms of population and development. Together with the existing phases of the Ewa by Gentry projects ongoing development projects in the region include:

The Kalaeloa Community Development District (KCDD) consisting of approximately 2,235 acres in the Urban District. Currently zoned F-1 Military and Federal on the Honolulu City and County zoning maps, the area is approximately 1½ miles west of the last development phase for the Gentry Makai project. The KCDD Plan seeks to integrate Barbers Point into the surrounding region through employment, housing for the homeless, and other important themes.

The urban center of Kapolei consisting of approximately 32,000 acres, planned to become Oahu's "second city" of Oahu.

The Villages of Kapolei consisting of eight privately developed residential villages, three schools, a senior housing center, a golf course, neighborhood parks and two recreation centers.

Ocean Pointe a 1,100-acre master-planned residential development is a 15- to 20-year project that will include Ewa Marina, the largest marina in the state.

West Loch Estates, developed by the City's Department of Housing and Community Development. The subdivision is located on the shores of Pearl Harbor, northeast of the subject proposed Ewa by Gentry project.

Traffic congestion, groundwater recharge, wastewater, drainage and flooding are major issues throughout the Ewa region. While the proposed project will be thoroughly assessed for the impacts the development will have on these issues, major emphasis during the review process will focus heavily on the effects the project will have on the existing poor levels of service for roadways in the region.

We recommend the traffic study undertake a thorough long-term evaluation of the roads and traffic circulation patterns in the region. The traffic study should include analysis of the cumulative effects resulting from build-out of existing and proposed projects in the Ewa Plain. The traffic study should demonstrate how the proposed development will further impact traffic circulation patterns for Ewa by Gentry, as well as on the major existing and proposed arterials in the region including Kunia Road, Kapolei Parkway, Fort Weaver Road, Farrington Highway, and access to and from the H-1 Freeway. The Draft Environmental Impact Statement (DEIS) should not entirely depend on the implementation of roadway and transit improvements proposed for this region to mitigate the project's potential impacts, as funding and/or lack of community support may delay or even suspend implementation of these improvements. For example, the proposed Bus Rapid Transit (BRT) has been purported to be a major solution to relieving traffic congestion in the Central, Ewa, Primary, and East districts of Oahu. However, unless there is substantial community and State support to implement the BRT, the system may not evolve as one of the proposed viable solutions to Oahu's traffic problems. These discussions should include at a minimum 10, 20, and 30 year scenarios describing projected impacts on traffic circulation patterns with and without the project and with and without the traffic improvements that are planned for the region.

Developments in the Ewa Plain have also seriously impacted the region's available water resources. The region contains many industrial facilities and residential subdivisions that consume potable water and increase demands on potable water aquifers resulting in the gradual rise in salinity levels. The aquifer is affected by impacts resulting from:

Mr. Tim Hata
Page 3
January 27, 2003

Reduction in the amount of recharge that the caprock aquifer receives because of reduced agricultural activity, and increased development of impervious surfaces;

Pumping of brackish water from the caprock aquifer for irrigation (many golf courses are in the region); and

Increase in potable water demands from industrial uses and residential subdivisions.

The DEIS should examine the effects of the proposed development at build-out on the groundwater and agricultural resources of the region.

While the State generally supports residential development in Ewa, impacts on groundwater resources and traffic circulation patterns should be thoroughly examined. Our Office will comment further on other issues regarding the project's impacts on drainage patterns, wastewater treatment, traffic, roadways, non-source point pollution, and water availability when more information is received.

Thank you for the opportunity to review the subject EISPN. If you have any questions, please contact Judith Henry at 587-2803.

Sincerely,

Mary Lou Kobayashi

Mary Lou Kobayashi
Acting Director
Office of Planning

c: ✓ Taeyong Kim
Anthony Ching, LUC
Sandra Kunimoto, DOA

February 7, 2003

Ms. Mary Lou Kobayashi
Acting Director
Office of Planning
235 South Beretania Street, 6th Floor
Honolulu, Hawaii 96813

Dear Ms. Kobayashi:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand that your primary concerns at this time are related to the project's impacts on traffic and water resources. We offer the following in response to your comments.

Traffic

The traffic study prepared for the project examines both local and regional conditions for the current and periods. The future projections are based on a target year of 2010 which was selected because it is the time frame used to develop the Ewa Impact Fee Ordinance (Chapter 33A, ROH). This scenario is very conservative since it is estimated that the completion date for the project is between 15 to 20 years, therefore a 2010 basis year would concentrate impacts in a relatively short time.

We understand that the proposed Bus Rapid Transit may be implemented in the future, however at this time, the proposal seems uncertain and the actual impact of the system unknown. For this reason, we consider an analysis without the contribution of this system conservative and a better measure of worst case traffic impact.

Water Resources

We understand your concern regarding water resources and wish to ensure you that an adequate water supply is available to accommodate the proposed project. The Board of Water Supply (BWS) has stated that there is sufficient water for the Ewa region. The BWS has water system improvements in the construction and design phases that will provide adequate water source capacity for the Gentry Ewa Makai project.

The BWS has stated that "The Ewa Shaft's estimated yield is 15 million gallons per day (MGD). In addition, the proposed Desalination Facility in Kalaeloa is being designed for 5 mgd with a potential to expand to 35 mgd in the future. The installation of wells at the Waipahu Wells II Station and completion of the Waipahu Wells IV will add 4.21 mgd to our capacity to deliver water. These two well projects should be completed this year (BWS, 1/24/03)".

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

BRIGADIER GENERAL ROBERT G.F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

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

PHONE (808) 733-4300
FAX (808) 733-4287

January 22, 2003

Mr. Taeyong M. Kim
Environmental Communications, Inc.
1188 Bishop Street, Suite 2210
Honolulu, Hawaii 96813

Dear Mr. Kim:

Environmental Impact Statement Preparation Notice (EISPN)-Gentry Ewa Makai
TMK: 1-9-01:005, 1-9-1-010:007; Ewa, Oahu, Hawaii

Thank you for the opportunity to review the EISPN for the Gentry Ewa Makai. Request that the developer install one (1) each solar-powered outdoor warning siren before the first home is occupied. Further request that the siren fronting the Coral Creek Golf Course, which has been installed but never activated, be activated immediately.

- **New Siren:** Location is at the 3.5-acre park along Puuloa Road on the Pearl City side of Fort Weaver Road. Type: Electronic, solar powered, capable of 2,400 watts of power driving four each 121 DBC directional speaker arrays. Refer to enclosure.

- **Old Siren:** The siren fronting Coral Creek Golf Course should be activated and turned over to State Civil Defense before any construction to this development project commences.

When final plans are drawn, we will reevaluate the siren location based on final park location to ensure compatibility and proper sound propagation.

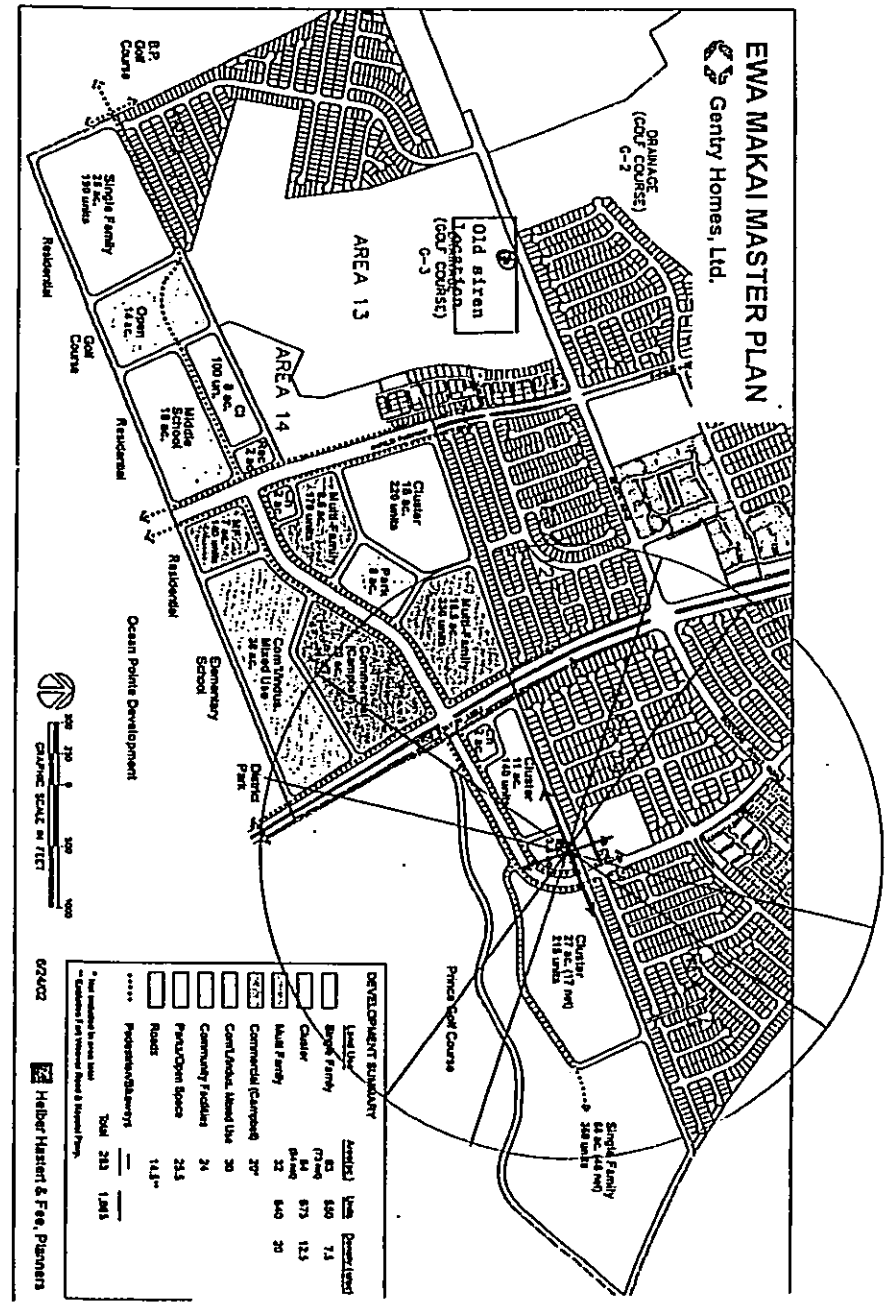
Also, recommend that natural hazards, especially flooding, be evaluated in Section 4, Environmental Impacts and Mitigation Measures.

Should you have any questions, or need assistance, please call Norman Ogasawara of State Civil Defense at 733-4300, extension 531.

Sincerely,

EDWARD T. TEIXEIRA
Vice Director of Civil Defense

Enclosure
c: Oahu Civil Defense Agency
Department of Planning and Permitting



Environmental Communications, Inc.

February 7, 2003

Mr. Edward T. Teixeira
Vice Director of Civil Defense
Department of Defense
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Dear Mr. Teixeira:

Thank you for your comments regarding the subject project. We understand that your department requests the installation of a solar-powered warning siren at the 3.5-acre park site located in the eastern project area prior to construction of the proposed project. In addition, we understand that your department also requests that the siren installed at the Coral Creek Golf Course be activated immediately. It is the developer's intent to comply with these requests, and is working with a contractor to get the Coral Creek siren activated as soon as possible.

Final plans will be provided to your department for final review and to ensure the new siren is appropriately located. Lastly, natural hazards will be assessed in the Draft Environmental Impact Statement (DEIS).

Your comments are appreciated and will be included in the DEIS.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

2002/ED-11

2003 JAN 21 AM 8 57
DEPT OF PLANNING and PERMITTING CITY & COUNTY OF HONOLULU

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

OFFICE OF BUSINESS SERVICES

January 15, 2003

Mr. Tim Hata, Planner
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawai'i 96813

Dear Mr. Hata:

Subject: Environmental Impact Statement Preparation Notice for Gentry Ewa Makai, Ewa, Oahu
TMK: 9-1-010: 007 and 9-1-069: 005

The Department of Education (DOE) appreciates being consulted on the Environmental Impact Statement Preparation Notice (EISPN) for the final third of its Ewa by Gentry planned community. Gentry Ewa Makai consists of two parcels divided by Fort Weaver Road that total approximately 282.7 acres. Gentry Investment Properties proposes to build a total of 1,865 residential units and develop commercial and public spaces.

Gentry has set aside, with the consent of the DOE, an 18-acre site on the west side of the project for a middle school. That property would address a portion of Gentry's fair-share contribution to the schools that will serve the children living in Gentry Ewa Makai.

The DOE proposes that the City and County of Honolulu and the State Land Use Commission include as conditions of approval for boundary amendments and zoning the following standard fair-share language. The proposed wording is:

> The Applicant shall contribute to the development, funding, and/or construction of school facilities, on a fair-share basis, as determined by and to the satisfaction of the Department of Education. Terms of the contribution shall be agreed upon in writing by the Applicant and the Department of Education prior to obtaining zoning approval for any area of development.

Accepted 1/22/03
Doc 197470

Mr. Tim Hata
Page 2
January 15, 2003

The DOE is also concerned that Gentry provide an adequate buffer between its 30-acre proposed commercial and industrial mixed-use site and its shared boundary with the elementary school to be located in the Ocean Pointe community immediately to the south. Security, noise, and other hazards should be taken into consideration from the earliest design stages so there is no conflict between the different uses of adjacent property.

Thank you for the opportunity to review and comment on this EISPN. Should you have any questions, please call Ms. Heidi Meeker of our branch at 733-4862.

Sincerely yours,

Raynor M. Minami

Raynor M. Minami, Director
Facilities and Support Services Branch

RMM:hy

cc: Alfred K. Suga, OBS
Taeyong Kim, Environmental Communications, Inc.

March 4, 2003

Mr. Raynor M. Minami, Director
Department of Education
Facilities and Support Services Branch
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Mr. Minami:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand that the Department of Education (DOE) suggests that standard fair-share language be included as a condition of approval for boundary amendments and zoning. The applicant is aware of this proposed condition and is in general agreement with language suggested as it relates to the DOE's earlier acceptance of the dedication of 18-acres to fulfill DOE's fair-share requirement. This was stated in DOE's letter of January 9, 2002 to Gentry Homes, Ltd. regarding the Ewa Makai Development.

We also understand that the DOE is concerned that an adequate buffer be placed between the proposed commercial and industrial mixed-use site and the Ocean Pointe elementary school. It is the applicant's intent to ensure that adequate physical or landscape barriers will be placed between these uses to ensure that security, noise and other potential hazards are mitigated.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR OF HAWAII

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

LORETTA J. FUDDY, A.C.S.W., M.P.H.
ACTING DIRECTOR OF HEALTH

In reply, please refer to:
File:

03-001/epo

February 4, 2003

Mr. Taeyoung M. Kim
Environmental Communications, Inc.
1188 Bishop Street, Suite 2210
Honolulu, Hawaii 96813

Dear Mr. Kim:

Subject: Environmental Impact Statement Preparation Notice (EISPN)
Gentry Ewa Makai Project
Ewa District, Oahu
Tax Map Keys: 9-1-069:005, 9-1-010:007

Thank you for the opportunity to review and comment on the subject proposal. The EISPN was routed to the various branches of the Environmental Health Administration. We have the following comments:

Environmental Planning Office (EPO)

This project is located in the Pearl Harbor watershed. Pearl Harbor, including nearshore waters to 30' deep from Keehi Lagoon to Oneula Beach, is currently listed under section 303(d) of the Clean Water Act as a water body in which water quality is impaired by excessive nutrients, turbidity, suspended solids, and polychlorinated biphenyls (PCBs). The impaired status of these waters requires that the Department of Health establish Total Maximum Daily Loads (TMDLs) suggesting how much the existing pollutant loads should be reduced in order to attain water quality standards in this water body.

Although these TMDLs are yet to be established and implemented, a first step in achieving TMDL objectives would be to prevent any project-related increases in pollutant loads. We expect that this would be accomplished through the proper application of suitable best management practices for pollutant load reduction and water quality improvement in all phases of the proposed project. When TMDLs are established for Pearl Harbor, the State will establish pollutant load allocations for the lands surrounding the water body and will develop an implementation plan to improve receiving water quality. One of the components of this implementation plan will be to reduce the polluted runoff entering the receiving waters.

In order to assess the potential impact of the proposed project upon Pearl Harbor pollutant loading, we suggest that the Draft Environmental Impact Statement (DEIS) provide detailed information about pre- and post-project drainage patterns, runoff volumes, and pollutant loads.

We suggest that this document include a quantitative analysis of project-related expansion of impermeable surfaces and effects on drainage processes and water quality, such as by calculating pre and post-project impervious surface area within the project area, drainage sub-basins, and the entire watershed and by estimating resultant post-project changes in runoff velocity, volume, and pollutant loads.

One mechanism for managing polluted runoff is provided by the conditions included in NPDES storm water permits held by the City and County of Honolulu (Department of Environmental Services) and the State of Hawaii (Department of Transportation (Highways Division). Thus, if the Gentry Ewa Makai project will utilize City or State storm drain systems, we suggest that Gentry Investment Properties consult with the permittee(s) about storm drain design and management options that would prevent project-related increases in pollutant loads. Regardless of this relationship, we encourage Gentry Investment Properties to participate in the TMDL development process, to consult with the Department of Health Clean Water Branch (Engineering Section) to discuss how water pollution control permitting may be linked with TMDL implementation, and to plan sufficient pollutant load reduction practices for future management of the storm drain system.

If you have any questions about these comments or the Total Maximum Daily Load program, please contact David Penn at (808) 586-4337.

Clean Water Branch (CWB)

1. The Army Corps of Engineers should be contacted to identify whether a Federal permit (including a Department of Army permit) is required for this project. Pursuant to Section 401(a)(1) of the Federal Water Pollution Act (commonly known as the "Clean Water Act"), a Section 401 Water Quality Certification is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters...."

2. A National Pollutant Discharge Elimination System (NPDES) general permit coverage is required for the following activities:

    a. Storm water associated with industrial activities, as defined in Title 40, Code of Federal Regulations, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi);

    (Note: After March 10, 2003, an NPDES permit will be required for construction activities, including clearing, grading, and excavation that result in the disturbance of one (1) acre or more.)

b. Construction activities, including clearing, grading, and excavation that result in the disturbance of equal to or greater than five (5) acres of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. **An NPDES permit is required before the commencement of the construction activities.**

c. Discharge of treated effluent from leaking underground storage tank remedial activities;

d. Discharge of once through cooling water less than one (1) million gallons per day;

e. Discharge of hydrotesting water;

f. Discharge of construction dewatering effluent;

g. Discharge of treated effluent from petroleum bulk stations and terminals;

h. Discharge of treated effluent from well drilling activities;

i. Discharges of treated effluent from recycled water distribution systems;

j. Discharges of storm water from a small municipal separate storm sewer system; and

k. Discharge of circulation water from decorative ponds or tanks.

The CWB requires that a Notice of Intent (NOI) to be covered by a NPDES general permit for any of the above activities be submitted at least 30 days before the commencement of the respective activities. The NOI forms may be picked up at our office or downloaded from our website at http://www.state.hi.us/doh/eh/cwb/forms/genl-index.html.

3. The applicant may be required to apply for an individual NPDES permit if there is any type of activity in which wastewater is discharged from the project into State waters, and/or coverage of the discharge(s) under the NPDES general permit(s) is not permissible. An application for the NPDES permit is to be submitted at least 180 days before the commencement of the activities. The NPDES application forms may also be picked up at our office or downloaded from our website at http://www.state.hi.us/doh/eh/cwb/forms/indiv-index.html.

4. Hawaii Administrative Rules, Section 11-55-38, also requires the owner to either submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD) or demonstrate to the satisfaction of the DOH that the project, activity, or site covered by the NOI or application has been or is being reviewed by SHPD.

If you have any questions, please contact the CWB at (808) 586-4309.

Clean Air Branch (CAB)

Control of Fugitive Dust

There is a significant potential for fugitive dust emissions during all phases of construction. Proposed construction activities will occur in proximity to existing residences, schools, business establishments and major thoroughfares, thereby exacerbating potential dust problems. It is recommended that a dust control management plan be developed which identifies and addresses all activities that have a potential to generate fugitive dust. Implementation of adequate dust control measures during all phases of development and construction activities is warranted.

Construction activities must comply with provisions of Hawaii Administrative Rules, Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33, Fugitive Dust.

The contractor should provide adequate measures to control dust from the road areas and during the various phases of construction. These measures include, but are not limited to:

a. Planning the different phases of construction, focusing on minimizing the amount of dust generating materials and activities, centralizing on-site vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. Providing an adequate water source at the site prior to start up of construction activities;

c. Landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. Controlling of dust from shoulders and access roads;

e. Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and

f. Controlling of dust from debris being hauled away from project site.

If you have any questions regarding these issues on fugitive dust, please contact the CAB at (808) 586-4200.

Wastewater Branch (WWB)

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." We reserve the right to review the detailed wastewater plans for conformance to applicable rules.

If you have any questions, please contact the Wastewater Branch at (808) 586-4294.

Noise, Radiation and Indoor Air Quality (NRIAQ) Branch

All project activities shall comply with the Administrative Rules of the Department of Health, Chapter 11-46, on "Community Noise Control."

If you have any questions, please contact the NRIAQ at (808) 586-4701.

Vector Control Branch (VCB)

The property may be harboring rodents, which will be dispersed to the surrounding areas when any buildings are demolished or the site is cleared. The applicant is required by Hawaii Administrative Rules, Chapter 11-26, "Vector Control", to eradicate any rodents prior to demolition or site clearing activities and to notify the Department of Health by submitting Form VC-12 to the local Vector Control Branch when such action is taken. Rodent traps and/or rodenticides should be set out on the project site for at least a week or until the rodent activity ceases.

If you have any questions, please contact the Vector Control Branch at (808) 831-6767.

Sincerely,

June F. Harrigan-Lum

JUNE F. HARRIGAN-LUM, MANAGER
Environmental Planning Office

c: EPO
CWB
CAB
WWB
NRIAQ
VCB

February 26, 2003

Ms. June F. Harrington-Lum, Manger
Environmental Planning Office
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Ms. Harrington-Lum:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We have reviewed the branch comments provided by your office and offer the following:

Environmental Planning Office (EPO)
We understand that the Department of Health is in the process of establishing Total Maximum Daily Loads (TMDLs) for the Pearl Harbor watershed. We will take your suggestion that the applicant participate in the TMDL development process into advisement. The project engineers have worked with the City to develop acceptable Drainage and Wastewater Master Plans for the Ewa Makai proposal and continue to work on updated plans which reflect the current project plan.

Clean Water Branch (CWB)

1. The Army Corps of Engineers has been consulted in the Environmental Impact Statement Preparation Notice (EISPN) process. No determination has been issued by the Corps of Engineers however it is anticipated that no Corps permits will be required.

2. Thank you for clarifying the National Pollutant Discharge Elimination System (NPDES) requirements. We understand that an NPDES permit will be required due to the scope of clearing required the project site. This requirement will be included in the Draft Environmental Impact Statement.

3. We stand informed regarding the requirement for an individual NPDES permit if there is any wastewater discharge into State waters. The project is not expected to have any wastewater discharge into State waters however in the event that such discharge is necessary, appropriate NPDES permit(s) will be obtained.

4. The State Historic Preservation Division will be copied on any NOI or NPDES permit applications.

Clean Air Branch (CAB)
Thank you for your comments regarding fugitive dust control. The applicant is very aware of this concern and is committed to minimizing fugitive dust. Construction activities will conform with all applicable regulations for air pollution control. An air quality study will be included in the DEIS which discusses this potential impact in greater detail.

Wastewater Branch (WWB)
We understand that the project's wastewater systems must conform with applicable DOH provisions regarding wastewater and that the department reserves the right to review project plans.

Noise, Radiation and Indoor Air Quality (NRIAQ) Branch
We understand that the project's wastewater systems must conform with applicable DOH provisions regarding community noise control. This potential impact is discussed in detail in the DEIS.

Vector Control Branch (VCB)
We understand that rodents must be eradicated prior to site clearing activities. The applicant will take appropriate measures prior to site clearing to ensure that rodents will not be dispersed to surrounding areas.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR OF HAWAII

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

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
File:

December 31, 2002

02-677 CAB

Mr. Tim Hata
Department of Planning and Permitting
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

This letter is to transmit the following comments on the Environmental Impact Statement Preparation Notice for the Gentry Ewa Makai Project:

Control of Fugitive Dust:

There is a significant potential for fugitive dust emissions during all phases of construction. Proposed construction activities will occur in proximity to existing residences, schools, business establishments and major thoroughfares, thereby exacerbating potential dust problems. It is recommended that a dust control management plan be developed which identifies and addresses all activities that have a potential to generate fugitive dust. Implementation of adequate dust control measures during all phases of development and construction activities is warranted.

Construction activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust.

The contractor should provide adequate measures to control dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:

a) Plan the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
b) Provide an adequate water source at the site prior to start-up of construction activities;

c) Landscape and provide rapid covering of bare areas, including slopes, starting from the initial grading phase;
d) Minimize dust from shoulders and access roads;
e) Provide adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
f) Control dust from debris being hauled away from the project site.

If you have any questions, please contact Mr. Barry Ching of my staff at 586-4200.

Sincerely,

Wilfred K. Nagamine

WILFRED K. NAGAMINE
Manager, Clean Air Branch

c: Taeyong Kim, Environmental Communications, Inc.

BC:jhm

Environmental Communications, Inc.

February 7, 2003

Mr. Wilfred K. Nagamine
Manager
Clean Air Branch
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Nagamine:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand your concerns regarding potential fugitive dust and assure you that proper mitigative measures will be used during the site clearing and construction periods. It is in our best interest to control or eliminate fugitive dust impacts within the area and we will plan accordingly to minimize exposed soils. In addition to your recommendations for dust control, Gentry's present development phase incorporates the use of extensive dust barriers and frequent watering to minimize this impact. We also understand that construction activites must conform to the Department of Health's Administrative Rules, Chapter 11-60.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

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

January 7, 2002

Mr. Tim Hata
Department of Planning & Permitting
City & County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: **Environmental Impact Statement Preparation Notice**
Gentry Ewa Makai
1,000 Acre Master Planned Community of 7,200 Homes
Ewa Plain, Ewa, Oahu, Hawaii
TMK: (1) 9-1-69: 05 (167.997 acres)
TMK: (1) 9-1-10: 07 (114.617 acres)

We have reviewed the subject document which proposes a 1,000 acre master planned community of approximately 7,200 homes located in the Ewa Plain, Oahu.

We have no objections to the project as long as connection to the City sewer system is made. Use of recycle water is encouraged for irrigation of common areas, parks and other public facilities within the planned community.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." We do reserve the right to review the detailed wastewater plans for conformance to applicable rules.

Should you have any questions, please contact the Planning & Design Section of the Wastewater Branch at 586-4294.

Sincerely,

HAROLD YEE, P.E., ACTING CHIEF
Wastewater Branch

c: √Mr. Taeyong H. Kim, Environmental Communications, Inc.

Environmental Communications, Inc.

February 7, 2003

Mr. Harold Yee, P.E.
Acting Chief
Wastewater Branch
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Yee:

Subject: Gentry Ewa Maki
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand that your branch does not have any objections to the proposed project provided the City and County sewer system is used for project related wastewater. The use of wastewater for irrigation is encouraged by your branch and will be considered for the project.

We also understand that wastewater plans must conform to the Department of Health's Administrative Rules, Chapter 11-62 and that your branch reserves the right to review the detailed plans. The project engineers will be directed to coordinate the final project plans with your office.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCES MANAGEMENT

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

HAWAI'I HISTORIC PRESERVATION
DIVISION REVIEW

Log #: 31443
Doc #: 0301EJ03

Applicant/Agency: Tim Hata
Department of Planning and Permitting
Address: City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813
SUBJECT: Chapter 6E-42 Historic Preservation Review EISPN for the Gentry Ewa Makai Project

Ahupua'a: Honouliuli
District, Island: 'Ewa, O'ahu
TMK: (1) 9-1-069-005; 9-1-010:007

1. We believe there are no historic properties present, because:

✓ a) intensive cultivation has altered the land
___ b) residential development/urbanization has altered the land
✓ c) previous grubbing/grading has altered the land
✓ d) an acceptable archaeological assessment or inventory survey found no historic properties
___ e) other:

2. This project has already gone through the historic preservation review process, and mitigation has been completed ___.

✓ Thus, we believe that "no historic properties will be affected" by this undertaking

Staff: Elaine Jourdane Date: 1/6/03

Title: Elaine Jourdane, Assistant Archaeologist O'ahu Phone (808) 692-8027

C: Taeyong Kim, Environmental Communications, Inc., 1188 Bishop Street, Suite 2210, Honolulu, HI 96813

Environmental Communications, Inc

February 7, 2003

Ms. Elaine Jordane
Assistant Archaeologist
Historic Preservation Division
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Ms. Jourdane:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand your review of the project has determined that no historic properties will be affected because the site has been intensively cultivated, previous grubbing and grading has altered the land, and an acceptable archaeological assessment has found no historic properties.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

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

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEAN A. NAKANO
ACTING DEPUTY DIRECTOR FOR
THE COMMISSION ON WATER
RESOURCE MANAGEMENT

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

January 23, 2003

LD-NAV
GENTRYEWAMAKAI.RCM

L-166/62/146/3/104

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

Dear Taeyong Kim:

SUBJECT: Environmental Impact Statement Preparation Notice (December 2002) for Gentry Ewa Makai, Oahu, Hawaii

Thank your for the opportunity to review and comment on the subject matter.

A copy of the subject document was distributed to the following Department of Land and Natural Resources' Divisions for their review and comment:

- Division of Aquatic Resources
- Division of Forestry and Wildlife
- Division of State Parks
- Engineering Division
- Commission on Water Resource Management
- Land Division Planning and Technical Services
- Oahu District Land Office

Attached herewith is a copy of the Division of Forestry and Wildlife, Engineering Division and Commission on Water Resource Management comments.

Based on the attached responses, the Department of Land and Natural Resources has no other comment to offer.

Should you have any questions, please feel free to contact Nicholas A. Vaccaro of the Land Division Support Services Branch at 587-0384.

Very truly yours,

Charlene P. Unoki

fr DIERDRE S. MAMIYA
Administrator

C: ODLO

LINDA LINGLE
GOVERNOR

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

ERIC T. HIRANO
ACTING CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEAN A. NAKANO
ACTING DEPUTY DIRECTOR FOR
THE COMMISSION ON WATER
RESOURCE MANAGEMENT

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

January 2, 2003
LD/NAV
Ref.: GENTRYEWAMAKAI.CMT

L-3
Suspense Date: 1/15/03

MEMORANDUM:

TO:
XXX Division of Aquatic Resources
XXX Division of Forestry & Wildlife
Na Ala Hele Trails
XXX Division of State Parks
√XXX Engineering Division (Received Doc)
Division of Boating and Ocean Recreation
XXX Commission on Water Resource Management
Land Division Branches:
XXX Planning and Technical Services
XXX Oahu District Land Office

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice (December 2002) for Gentry Ewa Makai, Oahu, Hawaii
Consultant: Environmental Communications, Inc.

Please review the attached document covering the subject matter and submit your comments (if any) on Division letterhead within the time requested above.

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

( ) We have no comments. (X) Comments attached.

Signed: Eric T. Hirano
Name: Eric T. Hirano
Date: 1/7/03

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LA/NAV
Ref.: GENTRYMAKAI.CMT

COMMENTS

Please correct the information reflected on page 3, Flood Insurance Rate Map, of the EISPN. The project site, according to FEMA Community Panel Numbers 15001 0310 E and 15001 0330 E (November 30, 2000), is located in Zone D. This is an area in which flood hazards are undetermined.

However, if future studies determine that the project site is within the flood zone, the project must comply with rules and regulations of the National Flood Insurance Program (NFIP). If there are questions regarding the NFIP, please contact the State Coordinator, Mr. Sterling Yong, of the Department of Land and Natural Resources at 587-0248. If there are questions regarding flood ordinances, please contact Mr. Robert Sumimoto at 523-4254 or Mr. Mario Siu Li at 523-4247 of the City and County if Honolulu, Department of Planning and Permitting.

Should you have any questions, please call Mr. Andrew M. Monden of the Planning Branch at 587-0229.

Signed: Eric T. Hirano
ERIC T. HIRANO, CHIEF ENGINEER

Date: 1/7/03

E:\WLD\MAKAI\SUZIE\OAHU\EwaMakaiOahu270.doc

LINDA LINGLE
GOVERNOR

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

January 2, 2003
LD/NAV
Ref.: GENTRYEWAMAKAI.CMT

L-3
Suspense Date: 1/15/03

MEMORANDUM:

From: ~~TO:~~
XXX Division of Aquatic Resources
XXX Division of Forestry & Wildlife
Na Ala Hele Trails
XXX Division of State Parks
XXX Engineering Division (Received Doc)
Division of Boating and Ocean Recreation
XXX Commission on Water Resource Management
Land Division Branches:
/ XXX Planning and Technical Services
/ XXX Oahu District Land Office

To: ~~FROM:~~ Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice (December 2002) for Gentry Ewa Makai, Oahu, Hawaii
Consultant: Environmental Communications, Inc.

Please review the attached document covering the subject matter and submit your comments (if any) on Division letterhead within the time requested above.

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

(X) We have no comments. ( ) Comments attached.

Signed: Eric
Name:
Date: 1/6/03

LINDA LINGLE
GOVERNOR

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

L-3

January 2, 2003
LD/NAV
Ref.: GENTRYEWAMAKAI.CMT

Suspense Date: 1/15/03

MEMORANDUM:

TO:
XXX Division of Aquatic Resources
XXX Division of Forestry & Wildlife
Na Ala Hele Trails
XXX Division of State Parks
XXX Engineering Division (Received Doc)
Division of Boating and Ocean Recreation
XXX Commission on Water Resource Management
Land Division Branches:
XXX Planning and Technical Services
XXX Oahu District Land Office

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice (December 2002) for Gentry Ewa Makai, Oahu, Hawaii
Consultant: Environmental Communications, Inc.

Please review the attached document covering the subject matter and submit your comments (if any) on Division letterhead within the time requested above.

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

( ) We have no comments.   ( ) Comments attached.

Signed: ____________________

Name: ____________________

Date: ____________________

Division of Forestry & Wildlife

1151 Punchbowl Street, Rm. 325 • Honolulu, HI 96813 • (808) 587-0166 • Fax: (808) 587-0160

January 9, 2003

MEMORANDUM

TO: Nick Vaccaro, Land Agent
Land Division

THRU: Dierdre S. Mamiya, Administrator
Land Division

FROM: Michael G. Buck, Administrator
Division of Forestry and Wildlife

SUBJECT: **EISPN (December 2002) for Gentry Ewa Makai, Oahu, Hawaii**
Consultant: Environmental Communications, Inc.

The Division of Forestry & Wildlife (DOFAW) has reviewed the subject document regarding impacts the project may have on DOFAW management programs and provide the following recommendations for your consideration. DOFAW is concerned with three endangered plants that are present in the Kapolei-Kalaeloa-Ewa plains area. The endangered plants are: 1) *Chamaesyce skottsbergii var. skottsbergii*, 2) *Achyranthes splendens var. rotundata*, and 3) *Abutilon menziesii*. A Habitat Conservation Plan (HCP) is currently being developed for the North/South Road Construction aimed at mitigating endangered plants along the planned road alignment. Subsequently, DOFAW will defer comments on this project until the draft EIS for Gentry Ewa Makai Development is completed. It will be at this time, when the required botanical survey information of the draft EIS will be completed and a more thorough review by DOFAW can be made to assess the impacts this development will have on the endangered plants found in the project area. Thank you for the opportunity to comment on this project.

C: DOFAW, Oahu Branch
Vickie Caraway, State Botanist

LINDA LINGLE
GOVERNOR

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
P.O. Box 621
HONOLULU, HAWAII 96809

ERIC T. HIRANO
ACTING CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEAN A. NAKANO
ACTING DEPUTY DIRECTOR FOR
THE COMMISSION ON WATER
RESOURCE MANAGEMENT

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

January 2, 2003
LD/NAV
Ref.: GENTRYEWAMAKAI.CMT

L-3
Suspense Date: 1/15/03

MEMORANDUM:

TO:
XXX Division of Aquatic Resources
XXX Division of Forestry & Wildlife
Na Ala Hele Trails
✓XXX Division of State Parks
XXX Engineering Division (Received Doc)
Division of Boating and Ocean Recreation
XXX Commission on Water Resource Management
Land Division Branches:
XXX Planning and Technical Services
XXX Oahu District Land Office

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice (December 2002) for Gentry Ewa Makai, Oahu, Hawaii
Consultant: Environmental Communications, Inc.

Please review the attached document covering the subject matter and submit your comments (if any) on Division letterhead within the time requested above.

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

(✓) We have no comments.

( ) Comments attached.

Signed:

Name: Daniel S. Quinn

Date:

LINDA LINGLE
GOVERNOR

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
P.O. Box 621
HONOLULU, HAWAII 96809

ERIC T. HIRANO
ACTING CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEAN A. NAKANO
ACTING DEPUTY DIRECTOR FOR
THE COMMISSION ON WATER
RESOURCE MANAGEMENT

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

January 2, 2003
LD/NAV
Ref.: GENTRYEWAMAKAI.CMT

L-3
Suspense Date: 1/15/03

RECEIVED
03 JAN 3 P2:59
COMMISSION ON WATER
RESOURCE MANAGEMENT

MEMORANDUM:

TO:
XXX Division of Aquatic Resources
XXX Division of Forestry & Wildlife
Na Ala Hele Trails
XXX Division of State Parks
XXX Engineering Division (Received Doc)
Division of Boating and Ocean Recreation
✓XXX Commission on Water Resource Management
Land Division Branches:
XXX Planning and Technical Services
XXX Oahu District Land Office

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice (December 2002) for Gentry Ewa Makai, Oahu, Hawaii
Consultant: Environmental Communications, Inc.

Please review the attached document covering the subject matter and submit your comments (if any) on Division letterhead within the time requested above.

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

( ) We have no comments.

(✓) Comments attached.

Signed:

Name: LENORE Y. NAKAMA

Date: 1-10-03

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

January 10, 2003

Ref: Ewa by Gentry Makai.dr

TO: Ms. Dede Mamiya, Administrator
Land Division

FROM: Dean A. Nakano, Acting Deputy Director
Commission on Water Resource Management (CWRM)

SUBJECT: Environmental Impact Statement Preparation Notice for Gentry Ewa Makai, Oahu

FILE NO.: GENTRYEWAMAKAI.CMT

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas, which are important for the maintenance of streams and the replenishment of aquifers.

[X] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We are concerned about the potential for degradation of instream uses from development on highly erodible slopes adjacent to streams within or near the project. We recommend that approvals for this project be conditioned upon a review by the corresponding county's Building Department and the developer's acceptance of any resulting requirements related to erosion control.

[ ] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[ ] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[X] OTHER:

We recommend that the Draft Environmental Impact Statement include the projected potable and non-potable demands, an anticipated schedule to buildout, and the proposed water sources to meet the potable demands.

If there are any questions, please contact Lenore Y. Nakama at 587-0218.

February 7, 2003

Ms. Dierdre S. Mamiya
Administrator
Land Division
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Dear Ms. Mamiya:

Thank you for your consolidated comments regarding the subject project. We understand that the subject document was distributed through the Department of Land and Natural Resources Divisions for review with comments from the Division of Forestry and Wildlife, Engineering Division, and the Commission on Water Resource Management. We offer the following in response to these comments.

Division of Forestry & Wildlife
It is our understanding that the Division of Forestry & Wildlife (DOFAW) is concerned about three endangered plants found in the Kapolei-Kalaeloa-Ewa area. A botanical survey for the project has been completed and none of the plants that DOFAW has listed has been found on the project site. We understand that a Habitat Conservation Plan is being prepared for the North/South Road and that the Division reserves the right to defer comment until the DEIS is completed.

Engineering Division
We stand corrected regarding the FEMA map designation for the site, which should be identified as being in Zone D, an area in which flood hazards are undetermined. It is our understanding that if future studies determine the site to be within a flood zone, the project must comply with the rules and regulations of the National Flood Insurance Program.

Commission on Water Resource Management
Coordination with the City and County of Honolulu is expected to continue with the Board of Water Supply (BWS) regarding the demand for potable water. Early coordination with the BWS has confirmed that water supply for the Ewa Region is available and through existing, soon to be completed, and proposed facilities.

The Department of Land and Natural Resource's comments are appreciated and will be included in the DEIS.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

RODNEY K. HARAGA
DIRECTOR

Acting Deputy Director
GLENN M. OKIMOTO

IN REPLY REFER TO:
HWY-PS
2.9242

JAN 3 1 2003

Mr. Eric G. Crispin, AIA Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Attention: Mr. Tim Hata

Dear Mr. Crispin:

Subject: Environmental Impact Statement (EIS) Preparation Notice for Gentry Ewa Makai

Thank you for requesting our review of the EIS Preparation Notice. We have the following comments:

1. The Draft EIS should indicate both the timing of proposed development and the timing of regional highway improvements (including the Kapolei Parkway and Ewa North-South Road) needed to accommodate projected traffic.

2. Impact fees that will be imposed on this development under City and County of Honolulu Ordinance 02-52 will contribute a fair share of the cost to design and construct regional highway improvements proposed by the 2010 Ewa Highway Master Plan. Ordinance 02-52 also provides for a reduction in impact fees as credit for developer extension of the Kapolei Parkway.

3. Proposed extensions to Keaunui Drive and the Kapolei Parkway should be designed to safely accommodate both vehicles and bicycles.

4. The proposed Keaunui Dirve extension intersection with Fort Weaver Road must replace the existing driveway intersection for the Prince Golf Course. EIS traffic impact analysis should clarify appropriate intersection design to accommodate full project build-out. The developer must dedicate required right-of-way and construct all required intersection improvements at no cost to the State.

5. Plans for work within the State highway right-of-way must be submitted to our Highways Division Traffic Branch for review and approval.

If you have any questions, please contact Ronald Tsuzuki, Head Planning Engineer, Highways Division, at 587-1830.

Very truly yours,

for RODNEY K. HARAGA
Director of Transportation

c: Office of Environmental Quality Control
Environmental Communications, Inc.

February 7, 2003

Mr. Rodney K. Haraga, Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Haraga:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We have reviewed your comments and offer the following:

1. Roadway improvements, including the Kapolei Parkway and the North-South Road, are discussed in detail in the Draft Environmental Impact Statement. The year 2010 was used as a basis for future traffic analysis to coincide with the time frame used to develop the Ewa Impact Fee Ordinance. The traffic study assumes that several improvements to the regional roadway system will be completed by 2010, including two lanes of the North-South Road between Kapolei Parkway and the H-1 Freeway, construction of a new North-South Interchange on the H-1 Freeway, the widening of Fort Weaver Road to six lanes between Geiger Road and Farrington Highway, and the completion of Kapolei Parkway from Papipi Road to Fort Barrett Road in Kapolei. Ewa Makai is currently projected to commence in 2004 with buildout in 2017.

2. The applicant is aware of the impact fees required under Ordinance 02-52. The developer understands that a reduction in impact fees is provided as credit for the extension of the Kapolei Parkway.

3. The Keaunui Drive and Kapolei Parkway extensions have not been designed at this time, however they will be designed to safely accommodate both vehicles and bicycles.

4. We understand that the existing Hawaii Prince Golf Course Driveway must be relocated with the Keaunui Drive extension. This will be addressed in the design of the road. The proposed project represents the final build-out of the Ewa by Gentry community therefore the traffic impact study provided in the Draft Environmental Impact Statement represents the total build out of the Ewa by Gentry community. We also understand that required right-of-way and required intersection improvements must be constructed and dedicated at no cost to the State.

5. Plans for work within the State highway right-of-way will be submitted to the Highways Division Traffic Branch for review and approval.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM
HOUSING AND COMMUNITY DEVELOPMENT CORPORATION OF HAWAII
677 QUEEN STREET, SUITE 300
Honolulu, Hawaii 96813
FAX: (808) 587-0600

ROBERT J. HALL
ACTING EXECUTIVE DIRECTOR

03:PEO/24

January 21, 2003

Mr. Tim Hata
Department of Planning and Permitting
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Re: Environmental Impact Statement Preparation Notice for Gentry Ewa Makai

The applicant is proposing to develop 1,865 single family, cluster, and multi-family units. To what extent will the residential units be affordable to households earning less than 80% and 120% of the area median income?

Thank you for the opportunity to comment.

Sincerely,

Robert J. Hall
Acting Executive Director

c: √Taeyong Kim, Environmental Communications, Inc.

Environmental Communications, Inc.

February 7, 2003

Mr. Robert J. Hall
Acting Executive Director
Department Business, Economic Development and Tourism
Housing and Community Development Corporation of Hawaii
677 Queen Street, suite 300
Honolulu, Hawaii 96813

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Dear Mr. Hall:

Thank you for your comments regarding the subject project. We understand your comment regarding affordable housing for households earning less than 80% and 120% of the median income. It is the applicant's intent to fully comply with the requirements and conditions that are likely to be imposed during the zoning process. While this quantity has not yet been determined, it has been the City's general policy to recommend the following conditions:

1) 10% of the total housing units shall be affordable to households earning up to 80% of the area median income: and

2) 20% of the total housing units shall be affordable to households earning up to 120% of the area median income.

Gentry is will to comply with these conditions.

Your comments are appreciated and will be included in the DEIS.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

ENVIRONMENTAL COMMUNICATIONS, INC

February 7, 2003

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, suite 702
Honolulu, Hawaii 96813

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Dear Ms. Salmonson:

Thank you for your comments regarding the subject project. We have reviewed your comments and offer the following responses.

1. A general vicinity map will be included in the DEIS to show the relationship between the Ewa by Gentry Makai project to past environmental documents under Chapter 343, HRS.

2. The project site was fallowed in 1994. The specific date of site clearing is unknown however the condition of the site indicates that it has been cleared for a significant length of time. No known cultural impact surveys or botanical/faunal surveys were conducted prior to site clearing. This information will be reflected in the DEIS.

3. Cumulative impacts are largely addressed as that the Ewa Makai project represents the last major development in the Ewa region. Impacts, such as water use have not been finalized, however the DEIS will address to the fullest extent possible the direct, indirect and cumulative impacts of the Ewa Makai as it relates to the surrounding projects.

4. Water source and cumulative source impacts are still under discussion with the Board of Water Supply. This issue is typically addressed as the project enters the zoning process. Preliminary data regarding water source may be included in the EIS process if these issues are resolved with the BWS.

5. Thank you for the information regarding your website guides. This site will be used as a reference in the development of the EIS.

Your comments are appreciated and will be included in the DEIS.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

January 21, 2003

Ms. Debra Luning
Gentry Investment Properties
P.O. Box 295
Honolulu, Hawai'i 96809-0925

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawai'i 96813

Mr. Taeyong Kim
Environmental Communications, Inc.
1188 Bishop Street, Suite 2210
Honolulu, Hawai'i 96813

Dear. Ms. Luning and Messrs. Hata and Kim:

The Office of Environmental Quality Control has reviewed the final environmental assessment (FEA) and environmental impact statement preparation notice (EISPN) determination for Gentry Investment Properties for the the remaining two parcels of the 'Ewa by Gentry Master Plan for TMK's 1-9-1-069-005 and 1-9-1-010-007 situated in the 'Ewa judicial district. And subject to a State Land Use Commission boundary map amendment from Agriculture to Urban and appropriate zoning by the City and County of Honolulu to complete the urban infill. We offer the following comments for your response and consideration as you prepare the draft environmental impact statement (DEIS).

1. **MAP REVISIONS TO SHOW THE RELATIONSHIP OF THE PROPOSED PROJECT TO PAST ENVIRONMENTAL DOCUMENTS UNDER CHAPTER 343, HAWAI'I REVISED STATUTES.** For clarification purposes, please include in the DEIS a map indicating the present project AND the locations of: (A) 'Ewa by Gentry (1987); (B) 'Ewa by Gentry East, Offsite Drainage Plan (1995). Please indicate any overlap in geographical footprint.
2. **CLEARING OF SITE:** Page 14 of the FEA notes that "[t]he project site was formerly in sugar cane production use for approximately 100 years. This use has since been abandoned and the project site has been fallow and cleared and holds very little by way of ground cover." Please disclose dates for: (A) when the site was abandoned by the sugar plantation; and (B) when it was cleared of vegetation. Also indicate in the DEIS if any cultural impact surveys, and botanical/faunal surveys of the site were done prior to clearing.
3. **BUILDOUT DATA:** Please disclose the total residential buildout for all master planned projects in the region and use this data in determining direct,. indirect and cumulative impacts on the present project's water usage, wastewater generation, traffic generation (especially as related to the North-South Road), non-point source pollution generation, and public facilities use at total buildout. .
4. **WATER:** Please indicate the project's source of water and indirect and cumulative impacts on the water source.
5. **GUIDANCE:** Please visit our Internet site at http://www.state.hi.us/health/oeqc/index.html for recommended guidance in the areas of cultural impact assessment, biological survey, impact analysis, use of native plants, and sustainable building.

Thank you for the opportunity to comment. If you have any questions, please call Leslie Segundo at 586-4185.

Sincerely,

GENEVIEVE SALMONSON
Director

PHONE (808) 594-1888

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

FAX (808) 594-1865

HRD03-878

January 29, 2003

Mr. Tim Hata
Department of Planning and Permitting
650 South King Street
Honolulu, HI 96813

Re: Environmental Impact Statement Preparation Notice (EISPN)
Gentry Ewa Makai

Dear Mr. Hata,

This letter is in response to your request for comments on the above-referenced project.

OHA requests the EIS address the project's impacts on water resources and related cultural practices. The EIS should include a separate technical study on water resources and an integrated water resource plan.

Water Resources
OHA noted the absence of a water resources technical study in the EISPN and asks that this important resource issue be addressed. The EIS must analyze the potable and nonpotable water demands of this project, identify the water resources which will be used to meet these needs and assess impacts. Further, we ask that the EIS examine alternative water resources. Finally, at a minimum, the applicant should complete an integrated water resource plan.

As Ewa-Kunia is a water management area in which the sustainable yield was reduced two years ago and all water has been allocated, OHA is concerned about this project's impact on water resources in this region or possibly tap Windward water resources that support cultural impacts. These concerns must be addressed in this statement to properly inform land use decisions.

Cultural Impacts
OHA noted that the EIS will include a cultural impact assessment. The assessment must identify cultural resources in the ahupua'a in which the project is located, to assess the impact of the project on native rights to resources, and adopt measures to protect these resources. Cultural resources such as burials, cultural sites, native plants, water, view planes and trails must be identified, evaluated, and preserved.

Specifically, the EISPN states that the project will consist of 14.5 acres of roadways. The impact of the increased need for roadways on any subsurface cultural properties should be analyzed and mitigated.
This assessment must be based on meaningful consultation with Native Hawaiian individuals and organizations that are knowledgeable about this area and have ties to the land. Methods used to identify such individuals and organizations, provide notice about the project and obtain their comments should be documented.

Thank you for the opportunity to comment on the above-referenced project. Please call Pua Aiu, Assistant Director at 594-1931.

Sincerely,

Ernest F. Kimoto

Ernie Kimoto, Acting Director
Hawaiian Rights Division

cc: Taeyong Kim
Environmental Communications, Inc.
1188 Bishop Street, Suite 220
Honolulu, HI 96813

ENVIRONMENTAL COMMUNICATIONS, INC

February 7, 2003

Mr. Ernie Kimoto
Acting Director
Hawaiian Rights Division
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Kimoto:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand that your concerns are related to the project's impacts on water resources and cultural practices. We offer the following in response to your comments.

Water Resources
We understand your concern regarding water resources and wish to ensure you that an adequate water supply should be available to accommodate the proposed project. The Board of Water Supply (BWS) has stated that there is sufficient water for the Ewa region. The BWS has water system improvements in the construction and design phases that will provide adequate water source capacity for the Gentry Ewa Makai project.

The BWS has stated that "The Ewa Shaft's estimated yield is 15 million gallons per day (MGD). In addition, the proposed Desalination Facility in Kalaeloa is being designed for 5 mgd with a potential to expand to 35 mgd in the future. The installation of wells at the Waipahu Wells II Station and completion of the Waipahu Wells IV will add 4.21 mgd to our capacity to deliver water. These two well projects should be completed this year (BWS, 1/24/03)".

Cultural Impacts
A cultural impact assessment has been prepared for the project site. The findings of this report, along with the findings of the archaeological assessment and other technical studies prepared for the project indicate that the areas has been heavily disturbed for a significant period of time with no cultural or natural resource impacts. Consultation with knowledgeable individuals and organizations, some whom were referred by the Office of Hawaiian Affairs, confirm these findings and will be provided in the technical studies prepared for the Draft Environmental Impact Statement.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

January 14, 2003

TO: ERIC G. CRISPIN, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

FROM: K. Shida for CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER

ATTN: TIM HATA

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE FOR THE GENTRY EWA MAKAI PROJECT, TMK: 9-1-069: 005, 9-1-010: 007

Thank you for the opportunity to review the Environmental Impact Statement Preparation Notice for the Gentry Ewa Makai Project.

We have the following comments:

1. The developer will be required to install the water system improvements to serve the proposed projects. Construction drawings should be submitted for our approval to ensure conformance with the approved master plan.

2. The availability of water will be confirmed when the building permit or construction plans are approved. When water is made available, the applicant will be required to pay our Water System Facilities Charges for resource development.

If you have any questions, please contact Joseph Kaakua at 527-6123.

cc: ✓Mr. Taeyong Kim

ENVIRONMENTAL COMMUNICATIONS, INC

February 7, 2003

Mr. Clifford S. Jamile
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Jamile:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comment regarding the subject project. We understand your comments and offer the following responses.

1. Gentry will provide the water system improvements required for the project. Construction drawings will be submitted to the Board of Water Supply for review and approval.

2. We understand that the availability of water will be confirmed when the building permit or construction plans are approved. We understand that the applicant will be required to pay Water System Facilities Charges for resource development.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone (808) 523-4564 Fax (808) 523-4567
Website www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

RAE M. LOUI, P. E.
DIRECTOR

GEORGE T. TAMASHIRO, P. E.
ASSISTANT DIRECTOR

January 10, 2003

TO: ERIC G. CRISPIN, AIA, ACTING DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTENTION: TIM HATA

FROM: for RAE M. LOUI, P. E., DIRECTOR

SUBJECT: REVIEW OF GENTRY EWA MAKAI ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN)

Thank you for the opportunity to review the EISPN for the proposed Gentry Ewa Makai development project. The developer is intending to submit and gain acceptance of its environmental impact statement before filing applications for changes in State land use and City zoning designations. We have reviewed the referenced document and have the following comments.

The City and County of Honolulu's Department of Planning and Permitting (DPP) has jurisdiction concerning park dedication requirements. The DPP determines park dedication requirements case-by-case, based upon the governing City Ordinances and recommendations from our department and the Department of Parks and Recreation. The park land area requirement is based upon a formula related to the residential zoning.

Development of single-family homes requires dedication of 350 square feet of park land per unit; apartment/multi-family home development requires dedication of 110 square feet per unit. It is our view that the ultimate City zoning designations should reflect the actual type of housing units to be developed in the respective areas.

We find that the proposed configuration of park recreation spaces is not acceptable as shown because two of them (2 acres and 3.5 acres in area) are impractically small in size to make them usable for active recreation. Assuming the total park acreage indicated in the EISPN was an accurate approximation of the total required land area, we suggest that the developer provide two parks: one neighborhood park, 4 to 6 acres in size, and one community park, 8 to 10 acres in size. The two parks should be located on opposite sides of Fort Weaver Road.

If the State Department of Education requires the developer to provide land for school development, which also meets its stand-alone recreational needs, then location of the larger community park is not significant. However, if the dedicated middle school parcel does not adequately meet the school's recreational needs, then we desire the community park to be located in proximity to the middle school.

We strongly encourage the developer's representative to meet with City officials early in the planning process to determine park dedication requirements in more detail.

Please contact Mr. Terry Hildebrand at extension 4696 if you have any questions.

RML:ei

cc: ✓Taeyong Kim, Environmental Communications, Inc.
William D. Balfour, Jr., Department of Parks and Recreation
Patrick Seguirant, DPP/Urban Design Branch

February 7, 2003

Ms. Rae M. Loui, P.E., Director
Department of Design and Construction
650 South King Street, 11th Floor
Honolulu, Hawaii 96813

Dear Ms. Loui:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand that the Department of Planning and Permitting has jurisdiction concerning park dedication requirements. We concur that the overall park space is in conformance with the dedication requirements for the proposed housing unit count.

The 2 acre "parks" that you have referred to will be private community recreation centers for Ewa by Gentry and Ewa Makai residents. These areas are not intended to serve as active playfields.

We would like to assure you that adequate park space is available on eastern side with the proposed 3.5 acre park site will be combined with a 6.8 acre parcel of land in an area identified as Area 19 to create a park that is 10.3 acres in size. Thus, there will be two sizeable parks: one 8 acres and the other over 10 acres to serve the community. These are in addition to other parks and recreational areas in Ewa by Gentry and surrounding communities that are in existence or are planned.

The school site identified on the western portion of the project site is adequate in size to provide its own recreational area.

Your recommendation for additional coordination with your department is well taken and will be undertaken as soon as practicable.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

01/22/03 WED 16:27 FAX 808 6925113 C&C ENVIRONMENTAL SVCS 001

DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HI 96707

Copy to Mr. Kim via fax

Jeremy Harris, Mayor

Timothy E. Steinberger, P.E., Director
Frank J. Doyle, P.E., Deputy Director

PRO 03-03

January 22, 2003

via fax: 527-6743
MEMORANDUM

TO: ERIC G. CRISPIN, AIA, ACTING DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTN: TIM HATA, PLANNING DIVISION, DPP

FROM: TIMOTHY E. STEINBERGER, DIRECTOR
DEPARTMENT OF ENVIRONMENTAL SERVICES

SUBJECT: GENTRY EWA MAKAI
ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE

We have reviewed the subject Environmental Impact Statement Preparation Notice (EISPN), which was transmitted via a letter from Environmental Communications, Inc., dated December 23, 2002, and have the following comments:

1. The project should address protection of, and access to, existing wastewater collection system pipelines in easements, including gravity lines, force mains, and the land portion of the Honouliuli WWTP outfall pipe.

2. The project should address coordination of new wastewater system infrastructure with other wastewater projects in the area, including those being done by other developers, as well as rehabilitation projects being done by the City. It is important that the correct sizing be chosen for new pipeline projects, and for rehabilitation projects.

3. The project should address solid waste collection and disposal, compliance with City requirements if City services will be needed, and impacts to the City's solid waste disposal services and facilities.

Should you have any questions, please call Jack Pobuk, Program Coordinator, at 692-5727.

Cc: Mr. Taeyong Kim, Environmental Communications, Inc. ✓

Environmental Communications, Inc.

February 7, 2003

Mr. Timothy E. Steinberger, Director
Department of Environmental Services
1000 Uluohia Street, Suite 308
Kapolei, Hawaii 96707

Dear Mr. Steinberger:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We offer the following responses to your comments of January 22, 2003.

1. Wastewater collection will be addressed in greater detail in the Draft Environmental Impact Statement (DEIS) that is being prepared for the subject project. Engineering studies addressing the wastewater system for the project have been prepared and approved and will be updated as necessary. The engineering consultants for the project will be informed of your comments in the event that any additional information is required.

2. We understand that the correct sizing of new pipelines is important and this issue is addressed in the aforementioned engineering reports. Coordination with other development systems can be referenced in the DEIS but will not be described in detail. Specific information for systems provided by other parties should be obtained directly from the developer of the respective system.

3. Solid waste and disposal will be addressed in the DEIS. The project will use municipal facilities and will also use City refuse collection services. Appropriate notification will be provided to ensure that service can be provided on a timely basis.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 309 • KAPOLEI, HAWAII 96707
TELEPHONE: (808) 692-5561 • FAX: (808) 692-5131 • INTERNET: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

WILLIAM D. BALFOUR, JR.
DIRECTOR

EDWARD T. "SKIPPA" DIAZ
DEPUTY DIRECTOR

January 13, 2003

TO: ERIC CRISPEN, ACTING DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

FROM: WILLIAM D. BALFOUR, JR., DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
GENTRY EWA MAKAI

Thank you for the opportunity to review and comment on the Environmental Impact Statement Preparation Notice relating to Gentry Ewa Makai.

The Department of Parks and Recreation recommends that one park of 11.5 acres be constructed rather than one of 3.5 acres and a separate one of 8 acres some 1300 feet away toward the west end of the project.

There are existing park facilities near the west end and we would like to see the proposed 3.5 acre site expanded to a full 11.5 acre park.

Should you have any questions, please contact Mr. John Reid, Planner, at 692-5454.

W. D. Balfour, Jr.

WILLIAM D. BALFOUR, JR.
Director

WDB:mk (J. Reid, MS)
(19720)

cc: Mr. Tim Hata, Department of Planning and Permitting
Mr. Taeyong Kim, Environmental Communications, Inc.
Mr. Don Griffin, Department of Design and Construction

Environmental Communications, Inc.

February 7, 2003

Mr. William D. Balfour, Jr., Director
Department of Parks and Recreation
1000 Uluohia Street, Suite 309
Kapolei, Hawaii 96707

Dear Mr. Balfour:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand that the Department of Parks and Recreation recommends the development of a single 11.5 acre park on the eastern side of the project. We would like to assure you that adequate park space is available on eastern side with the proposed 3.5 acre park site will be combined with a 6.8 acre parcel of land in an area identified as Area 19 to create a park that is 10.3 acres in size. Thus, there will be two sizeable parks: one 8 acres and the other over 10 acres to serve the community. These are in addition to other parks and recreational areas in Ewa by Gentry and surrounding communities that are in existence or are planned.

The 8 acre park located on the western portion of the site is considered an important feature in the relatively higher density development area. We feel that this recreational resource will be heavily used in its current location and would like to proceed with the park as it is currently sited.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF PLANNING AND PERMITTING

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
Telephone: (808) 523-4414 • Fax: (808) 527-6743 • INTERNET: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

ERIC G. CRISPIN, AIA
ACTING DIRECTOR

BARBARA KIM STANTON
DEPUTY DIRECTOR

2002/ED-11 (TH)

February 10, 2003

Mr. Taeyong Kim, Principal
Environmental Communications, Inc.
1188 Bishop Street, Suite 2210
Honolulu, Hawaii 96813

Dear Mr. Kim:

Environmental Impact Statement Preparation Notice (EISPN)
<u>Gentry Ewa Makai, Oahu, Tax Map Key: 9-1-069:005 and 9-1-010:007</u>

We have reviewed the subject EISPN and offer the following comments. We predicate our comments on the assumption that the final EIS will substantially constitute the zone change application.

1. On page 2 of the EISPN, please revise the Approving Agency's address to "650 South King Street."

   On page 3, in the "Permits Required" section, the names of the agencies responsible for issuing the necessary permits are not provided. We recommend that the draft EIS be revised to provide a list of the necessary permits and approvals as well as the name of the agencies responsible for issuing the permits or approvals.

2. The draft EIS should address the following issues:
   a. Drainage and storm water quality, per the Rules Relating to Storm Drainage Standards.
   b. Soil erosion control and Best Management Practices (BMPs), per Rules Relating to Soil Erosion Standards and Guidelines.

3. Page 12 of the EISPN indicates that the proposed project will be developed in phases, and that construction will begin after all regulatory approvals are secured. The draft EIS should be more specific on this issue. We recommend that the draft EIS disclose to the extent possible, when the proposed project is estimated to begin, and how many months the project will take to build out. The draft EIS should also describe how many phases there will be for the project and identify the numerical sequence of construction by project area.

4. Although Page 11 of the EISPN briefly describes the approximate acreage, number of units and location of the four "moderate density cluster development areas," we find this description too vague. We recommend that the discussion of the cluster housing areas be expanded in the draft EIS by clarifying what "cluster development areas" are, and how they differ from the single-family and multi-family areas that are also proposed for the project.

   The EISPN indicates that of the 146 acres that are proposed for rezoning to A-1 Low Density Apartment District, 64 acres will be devoted to 4 cluster housing developments, for a total of 675 residential units. Development of cluster housing for this project may require a cluster housing permit from the Department of Planning and Permitting (DPP). We recommend that the applicant contact the DPP's Urban Design Branch (527-5369) to determine if a cluster housing permit will be required. Should the project require cluster housing permits, the permit needs to be listed in the "Permits Required" section of the draft EIS.

5. Both of the proposed church sites and the community center site would be located within areas to be rezoned to A-1 Low Density Apartment District. As such, the project may require Conditional Use Permit (CUP) approvals from the DPP. We recommend that the applicant contact the DPP's Land Use Approvals Branch (527-5374) to determine if CUP approvals will be needed. Should the project require CUP approvals, the permit need to be listed in the "Permits Required" section of the draft EIS.

6. The draft EIS should include a section entitled "Land Use Plans, Policies and Controls," which describe the proposed project's relationship and conformance to plans including but not limited to the Hawaii State Plan, Chapter 205 Hawaii Revised Statutes, the city's General Plan, Ewa Development Plan (DP), the Ewa Public Infrastructure Map (PIM), and the Land Use Ordinance.

7. In addition to showing the proposed zoning districts, the draft EIS should also provide maps that show relevant land use information including but not limited to state and county land use designations, future facilities and utilities, flood prone areas, and the Special Management Area.

   Page 12 of the EISPN provides a brief discussion of major existing and future roadways that affect the proposed project. As such, we recommend that the draft EIS include a portion of the current Ewa PIM which identifies future utilities and facilities including roadways, such as the Kapolei Parkway, which will run through the western portion of the proposed project.

   Although the EISPN provides a location map, a site plan, and a proposed zoning map, there should be a map to show the surrounding uses, especially to the south, where Haseko is developing their Ocean Pointe community. We recommend that the draft EIS provide a map showing surrounding uses (both existing and planned) including Haseko's Ocean Pointe development. This information is important in determining the appropriateness of adjacent uses, especially between the proposed project's commercial/industrial mixed use area, and development of future housing and an elementary school, which are part of the Ocean Pointe master plan.

8. The Gentry Ewa Makai-West Sewer Master Plan was approved by the DPP on November 29, 1999, however, the project has changed and a revised sewer master plan is required. A revised sewer master plan needs to be listed under "Permits Required" of the draft EIS.

   The Honouliuli Wastewater Treatment Plan is in close proximity to the planned residential development. The draft EIS should disclose that there may be odor and noise problems, specifically during certain weather conditions, and provide remediation, if any. The applicant should contact the Department of Environmental Services for records of odor and noise complaints from the public.

9. An updated Traffic Impact Analysis Report (TIAR) needs to be included in the technical reference section of the draft EIS. The updated TIAR should include traffic count data validating traffic projections at key intersections, as contained in earlier reports. Traffic signal warrants should also be provided at all major intersections throughout the proposed project, and traffic signals should be installed as needed. Underground electrical conduits should be installed at other major intersections in the event that traffic signals need to be installed. Alternate modes of transportation, such as bicycling, pedestrian and bus routing should be

   included and addressed in the TIAR. Use of traffic calming measures should also be considered. The updated TIAR needs to be listed in the "Permits Required" of the draft EIS.

   Multiple roadway connections should be constructed with each planned area of the proposed project to provide alternate means of access into and out of the various developments that may improve vehicular circulation. Two roadway alignments that are of particular concern to the DPP is the future roadway that will serve Ewa by Gentry's Area17; and the roadway connection that currently provides access to the Prince Golf Course. We recommend that the applicant contact our Traffic Review Branch at (523-4119) to discuss appropriate mitigation measures to address these areas of concern.

10. The draft EIS must also include a project master plan which meets the requirements as specified on pages 15 through 18 of the most current DPP zone change application (revised as of January 7, 2003).

Should you have any questions, please contact Tim Hata, of our staff at 527-6070.

Sincerely yours,

Bark K. Ahn
for ERIC G. CRISPIN, AIA
Acting Director of Planning and Permitting

EGC:mo

cc: Office of Environmental Quality Control
Gentry Investment Properties, Attn: Ms. Debra Luning

p:/Division Function/ea-eis/2002/Gentry Ewa Makai/EISPN doc

Environmental Communications, Inc.

February 26, 2003

Mr. Eric G. Crispen, AIA, Director
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Crispen:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We have reviewed your comments and offer the following:

1. The Draft EIS (DEIS) will note that the Approving Agency's address is 650 South King Street. The agencies responsible for required entitlements will be listed in a chapter entitled Required Approvals and Permits.

2. The DEIS will address drainage and stormwater quality as they related to current regulations. Soil erosion control and Best Management Practices will also be addressed in the DEIS.

3. A table will be included in the DEIS that addresses the proposed timing and duration of the construction phases.

4. The Ewa Makai Master Plan will be included in its entirety in the DEIS. This document provides detailed descriptions regarding the nature of each type of housing unit proposed for development.

5. We understand that public uses such as community centers and church sites located within residential districts may require Conditional Use Permit (CUP) - approval. This will be stated in the DEIS in the Required Approvals and Permits section of the DEIS.

6. A chapter of the DEIS entitled "Plans, Policies and Controls" will be included in the DEIS. This section will address in detail the project's relationship to prevailing County and State planning policies.

7. Graphics showing the project's relationship to State and County land use designations, future facilities and utilities, and flood hazard areas will be included in the DEIS. The project's relationship to the Special Management Area (SMA) will be discussed however no graphic depicting this relationship will be included since the project is located very far from closest SMA boundary.

   A portion of the Public Infrastructure Map (PIM) including the project site will be included in the DEIS. A map depicting the project's relationship to Ocean Pointe will also be included in the DEIS.

8. We understand that the previously accepted Gentry Ewa Makai-West Sewer Master Plan will require revision to meet the current plan requirements. We have also confirmed with a project engineer that the Gentry Ewa Makai-East plans, which were previously approved, are presently being revised to conform with the latest development plans. Both plans will be based on the previously accepted plans and should be considered updates, rather than new plans. This information will be included in the Required Approvals and Permits section.

   We are aware of the project's proximity to the Honouliuli Wastewater Treatment facility and that odor and noise impacts are a possibility during certain weather conditions. This information will be disclosed in the DEIS and has been discussed with the Neighborhood Board. This information is also expected to be included in sales documents.

9. An updated Traffic Impact Report (TIR) will be referenced and included in the DEIS. This document will address the concerns listed in your comments and will also be listed in the Required Approvals and Permits section of the DEIS.

   Traffic circulation within the project and to the major traffic corridor have been extensively considered in the planning of the project. The DEIS and TIR will discuss roadway improvements that are expected to ensure that traffic flow through the project site is well accommodated. The project engineers will coordinate their designs with the Traffic Review Branch as road plans are developed for the project.

10. The project Master Plan will be included in its entirety as an appendix to the DEIS.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4529 • FAX: (808) 523-4730 • INTERNET: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

CHERYL D. SOON
DIRECTOR

GEORGE "KEOKI" MIYAMOTO
DEPUTY DIRECTOR

January 22, 2003

TPD03-00015R
(TPD12/02-19677)

MEMORANDUM

TO: TIM HATA
DEPARTMENT OF PLANNING AND PERMITTING

FROM: CHERYL D. SOON, DIRECTOR

SUBJECT: GENTRY EWA MAKAI

In response to the December 23, 2002 letter from Environmental Communications, Inc., we reviewed the environmental impact statement (EIS) preparation notice for the subject project. The following comments should be addressed in the draft EIS:

1. Public transit access to the proposed development should be discussed. This discussion should include the proposed Regional Bus Rapid Transit (BRT) component of the Primary Corridor Transportation Project. The traffic analyses has indicated that the current traffic congestion in the region will worsen because of growth in travel demand. Therefore, the BRT system, with frequent express service to and from Downtown and connections to strategically located transit centers, is a critical transportation element to accommodate any future growth in the Ewa area.

2. The traffic impact study that is being prepared should include a discussion of the capacity levels of Fort Weaver Road and the H-1 Kunia on-ramp. The proposed project should be phased such that Kapolei Parkway adjacent to the proposed project and the east-west arterial are constructed prior to the development. To lessen the impact on Fort Weaver Road, Kapolei Parkway to Kapolei should be completed before any further development proceeds. Additionally, other improvements to Fort Weaver Road, such as a contraflow lane or an additional lane should be completed.

3. On Page 7 of the EIS preparation notice, it is noted that Gentry Ewa Makai is the final increment of the Ewa by Gentry Master Plan. The plan should be included in the draft EIS so that the other increments can be identified.

We look forward to reviewing the draft EIS. In order to facilitate our review of the draft EIS, please provide us with two copies of the document.

Should you have any questions regarding these comments, please contact Faith Miyamoto of the Transportation Planning Division at Local 6976.

CHERYL D. SOON

cc: Mr. Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4529 • FAX: (808) 523-4730 • INTERNET: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

CHERYL D. SOON
DIRECTOR

GEORGE "KEOKI" MIYAMOTO
DEPUTY DIRECTOR

TPD03-00015R
Dir 03-001

February 14, 2003

MEMORANDUM

TO: TIM HATA
DEPARTMENT OF PLANNING AND PERMITTING

FROM: CHERYL D. SOON, DIRECTOR

SUBJECT: GENTRY EWA MAKAI

I have met with Mr. Tosh Hosoda of Gentry and believe that it would be helpful to modify and clarify DTS' comment No. 2 in our correspondence dated January 22, 2003. The revised comments are meant to improve the public disclosure of the timing relationship between the housing implementation and regional-level transportation infrastructure. These comments replace Item 2. Items 1 and 3 remain the same.

2a. The traffic impact study that is being prepared should include a discussion of the capacity levels of Fort Weaver Road and the H-1 ramp. The EIS should include two tables. The first would be a table showing the number of units for each year that are expected to be completed and ready for occupancy; as well as the square footage by year of commercial or industrial lands. The second table should show in what year each of the following roads would be constructed and ready for use: Keanui (ewa of Fort Weaver Road), Keanui (diamond head of Fort Weaver Road), and Kapolei Parkway through Gentry Ewa Makai between the completed section in Gentry and the Haseko OceanPointe Kapolei Boulevard segment.

The goal should be to expect completion of these roads reasonably close to occupancy and this matter should be reviewed at the time of zoning.

2b. To lessen the impact on Fort Weaver Road, the Ewa Road Masterplan calls for this expansion of Kapolei Parkway. The EIS should include a third table projecting when each uncompleted segment will be completed. The information in this third table

should come from interviews with responsible officials for each of the sponsor entities of the uncompleted sections. These include: State of Hawaii Department of Transportation (Villages of Kapolei to Fort Barrette Road), City and County of Honolulu (Ewa Villages section), Gentry and Haseko.

The EIS should also provide the latest available information on the status of planned improvements to Fort Weaver Road, including contra flow, widenings or other improvements.

Cheryl D. Soon
CHERYL D. SOON

cc: Eric Crispin, DPP
√Mr. Taeyong Kim, Environmental Communications, Inc.

Environmental Communications, Inc.

February 26, 2003

Ms. Cheryl D. Soon
Director
Department of Transportation Services
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Dear Ms. Soon:

Thank you for your comments regarding the subject project. We have reviewed your comments of January 22, 2003 and February 14, 2003 and have passed your comments on to the project's traffic consultant. The consultant has prepared a response which is attached.

The Draft Environmental Impact Statement (DEIS) will include a traffic study which addresses your concerns. Supplemental resources and references that also address your concerns are provided in the attached correspondence from the traffic consultant.

The Ewa by Gentry Master Plan will be included in the DEIS. The DEIS will also include a development timetable for residential units, industrial/commercial areas, and internal roadway improvements.

Your comments are appreciated and will be included in the DEIS.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

enclosure

PB

Parsons Brinckerhoff
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813
808-531-7094
Fax 808-528-2368

February 26, 2003

Ms. Debra M.A. Luning
Gentry Homes, Ltd.
P.O. Box 295
Honolulu, Hawaii 96809

Re: Comments to Environmental Impact Statement Preparation Notice (EISPN)
Gentry Ewa Makai, Ewa District, Oahu, Hawaii's
PBQD Reference: 16332C

Dear Ms. Luning:

We have reviewed letters to Mr. Tim Hata of the City and County of Honolulu Department of Planning and Permitting (DPP) regarding the Gentry Ewa Makai project. One was from Ms. Mary Lou Kobayashi, Acting Director of the Office of Planning of the State of Hawaii Department of Business, Economic Development and Tourism (DBEDT) and two were from Ms. Cheryl Soon, Director of the City and County Department of Transportation Services (DTS). The letters were responses generated by review of the Environmental Impact Statement Preparation Notice (EISPN) for Gentry Ewa Makai.

The letter from DBEDT-OP requests evaluation of long-term traffic conditions in the Ewa region. There have been several iterations of long-range transportation studies conducted for this region. The most recent is the Ewa Highway Master Plan/Year 2010 Highway Plan by Kaku Associates dated August 28, 2001 and an amendment to this study dated May 31, 2002. These studies were used as the basis of Chapter 33A of the Revised Ordinances of Honolulu that identified and assigned transportation impact fees to future development within the Ewa plain. A longer-range evaluation is part of the Transportation for Oahu Plan – TOP 2025 approved by the Oahu Metropolitan Planning Organization (OMPO) Policy Committee on April 6, 2001. The proposed Gentry Ewa Makai development was included in both plans.

The Traffic Impact Analysis for Ewa by Gentry Makai Development, dated December 2002 is consistent with the traffic volumes projections developed as part of the Ewa Highway Master Plan/Year 2010 Highway Plan. The traffic impact analysis focuses on the localized needs surrounding the Ewa by Gentry Makai development. The regional issues are handled through the Ewa Highway Master Plan/Year 2010 Highway Plan and the Transportation for Oahu Plan – TOP 2025. This was judged the most appropriate way to maintain consistency with previously conducted long-range studies while providing specific details adjacent to the proposed Ewa by Gentry Makai development.

The two letters from DTS requests that the Traffic Impact Analysis for Ewa by Gentry Makai Development include a discussion of transit access to the development and a discussion regarding the Regional Bus Rapid Transit (BRT) component of the Primary Corridor Transportation Project being pursued by DTS. Page 17 of the traffic impact analysis acknowledges the recent efforts by DTS to implement "Hub and Spoke" bus improvements

Over a Century of
Engineering Excellence

and mentions the Primary Corridor Transportation Project. Although the discussion does not contain a specific reference to BRT, it is included since it is part of the Primary Corridor Transportation Project.

DTS also request that a discussion of capacity of Fort Weaver Road and the H-1 Kunia Interchange On-Ramp should be included. Both the Ewa Highway Master Plan/Year 2010 Highway Plan and the Transportation for Oahu Plan – TOP 2025 studies identify the capacity constraints of Fort Weaver Road and H-1 Kunia Interchange On-Ramp and use them as justification for improvements such as North-South Road, H-1 North-South Road Interchange, and Kapolei Parkway.

Another request in the DTS letter involves the provision of a table that projects schedules for implementation of roadway improvements and for the Ewa by Gentry Makai development. As I understand it, both are being prepared by Gentry Homes, Ltd..

Many of the major roadway improvements such as the widening of Fort Weaver Road, the completion of Kapolei Parkway, and the construction of the North-South Road and H-1 North-South Road Interchange are included as a basis for the the transportation impact fee assessments documented in Chapter 33A of the Revised Ordinances of Honolulu.

During our telephone conversation, you also relayed a concern expressed verbally by the Office of Environmental Quality Control (OEQC). This concern related to the location of the proposed University of Hawaii-West Oahu Campus. Previous plans had it located mauka of H-1 Freeway in the vicinity of the future H-1 North-South Road Interchange. Current concepts now locate it makai of H-1 Freeway, still in the vicinity of the future H-1 North-South Road Interchange. This change in location is judged to have minimal impacts on traffic in the Ewa by Gentry Makai area. The change would also be beneficial in helping to accelerate the schedule for the North-South Road between Kapolei Parkway and Farrington Highway. This would benefit the Ewa and Ewa Beach areas by providing alternative access to H-1 Freeway.

Both DBEDT-OP and DTS raise valid long-range transportation issues. The development community in the Ewa region is very aware of these issues and has cooperated with the State of Hawaii and the City and County of Honolulu to address these long-range issues. The transportation impact fee ordinance is the culmination of these cooperative efforts. Doing additional long-range studies would be re-inventing the wheel on these issues and could interfere with the current impact fee mechanism. The impact fee ordinance for the Ewa region identified transportation improvements and defined a mechanism to pay for those improvements. Because the impact fees are due at the time building permits are obtained, development would necessarily precede the roadway improvements unless the City and County of Honolulu and the State of Hawaii elected to float bonds for their respective roadway improvements and used the impact fee revenue to service the bond debt.

We hope this letter clarifies the issues raised by DTS and DBEDT-OP. We stand ready to assist you in addressing further questions or comments regarding traffic impacts associated with the Ewa by Gentry Makai Development.

Very truly yours,

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Wayne Y. Yoshioka
Manager of Transportation Planning/Traffic Engineering

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
3375 KOAPAKA STREET, SUITE H425 • HONOLULU, HAWAII 96819-1869
TELEPHONE: (808) 831-7761 • FAX: (808) 831-7750 • INTERNET: www.honolulufire.org

JEREMY HARRIS
MAYOR

ATTILIO K. LEONARDI
FIRE CHIEF

JOHN CLARK
DEPUTY FIRE CHIEF

January 10, 2003

TO: ERIC G. CRISPIN, AIA, ACTING DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTENTION: TIM HATA

FROM: ATTILIO K. LEONARDI, FIRE CHIEF

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
GENTRY EWA MAKAI

We received a letter dated December 23, 2002, from Mr. Taeyong M. Kim of Environmental Communications, Inc., requesting our review and comments on the above-mentioned project.

The Honolulu Fire Department (HFD) requires that the following be complied with:

1. Provide a private water system where all appurtenances, hydrant spacing, and fire flow requirements meet Board of Water Supply standards.

2. Provide a fire department access road within 150 feet of the first floor of the most remote structure. Such access shall have a minimum vertical clearance of 13 feet 6 inches, be constructed of an all-weather driving surface complying with Department of Transportation Services (DTS) standards, capable of supporting the minimum 60,000-pound weight of our fire apparatus, and with a gradient not to exceed 20%. The unobstructed width of the fire apparatus access road shall meet the requirements of the appropriate county jurisdiction. All dead-end fire apparatus access roads in excess of 150 feet in length shall be provided with an approved turnaround having a radius complying with DTS standards.

3. Submit civil drawings to the HFD for review and approval.

Should you have any questions, please call Battalion Chief Lloyd Rogers of our Fire Prevention Bureau at 831-7778.

Sincerely,

Attilio K. Leonardi

ATTILIO K. LEONARDI
Fire Chief

AKL/SK:jl

cc: Taeyong M. Kim, Environmental Communications, Inc.

Environmental Communications, Inc

February 7, 2003

Mr. Attilio K. Leonardi
Fire Chief
Fire Department
City and County of Honolulu
3375 Koapaka Street, Suite H425
Honolulu, Hawaii 96819-1869

Dear Chief Leonardi:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. We understand that HFD requires compliance with the following:

1. All private water supply appurtenances, hydrant spacing, and fire flow requirements will meet current Board of Water Supply standards.

2. Fire department access to the most remote structures will conform to the specifications provided by your department and all accesses shall conform to Department of Transportation Services applicable standards.

3. Civil engineering drawings will be submitted to your department for review and approval.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111
http://www.honolulupd.org
www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

LEE D. DONOHUE
CHIEF

GLEN R. KAJIYAMA
PAUL D. PUTZULU
DEPUTY CHIEFS

OUR REFERENCE DK-DK

January 24, 2003

TO: ERIC G. CRISPIN, AIA, ACTING DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTENTION: TIM HATA

FROM: LEE D. DONOHUE, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
GENTRY EWA MAKAI

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

Based on the information provided and the magnitude of this project, we have no comment to offer at this time until more details become available.

If there are any questions, please call Ms. Carol Sodetani or Ms. Deborah Kamanao of the Support Services Bureau at 529-3658 or 529-3255 respectively.

LEE D. DONOHUE
Chief of Police

By [signature]
KARL GODSEY
Assistant Chief of Police
Support Services Bureau

cc: ✓Mr. Taeyong M. Kim
Environmental Communications, Inc.

Serving and Protecting with Aloha

Environmental Communications, Inc.

February 7, 2003

Mr. Lee Donohue
Chief of Police
Honolulu Police Department
801 South Beretania Street
Honolulu, Hawaii 96813

Dear Chief Donohue:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comment regarding the subject project. We understand that the Honolulu Police Department does not have any comments at this time and reserves the right to comment as more information becomes available. We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

HOUSE OF REPRESENTATIVES

STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

January 7, 2003

Debra Luning
Gentry Investment Properties
P.O. Box 295
Hon., HI 96809-0295

RE: EIS FOR GENTRY 'EWA MAKAI

Aloha,

I am interested in being a consulting party on the EIS for Gentry 'Ewa Makai, the second phase of the 'Ewa by Gentry Master Plan.

As the newly elected State Representative of the 42nd district, I would like to be kept informed on the ongoing projects and construction in my area.

Thank you in advance for your help.

Sincerely,

Tulsi

Tulsi Gabbard Tamayo
State Representative, 42nd District

C: Tim Hata, City & County
Taeyong Kim, Environmental Communications, Inc.
Office of Environmental Quality Control

Aloha,
It was nice seeing
you and your
grandsons at the
parade in Ewa Beach.
My best to you in
the New Year!

Environmental Communications, Inc.

February 7, 2003

Representative Tulsi Gabbard Tamayo
House of Representives
State of Hawaii
State Capitol
Honolulu, Hawaii 96813

Dear Representative Gabbard Tamayo:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your interest in the subject project. We understand that you would like to be a consulted party for the subject project. We will keep you informed and will send you a copy of the Draft Environmental Impact Statement for the project when it is published.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

January 15, 2003

To: Governor Linda Lingle

Copies to: Gentry Homes Ltd.
Senator Willie Espero

From: Patricia L. Collins Jensen
91-161 Waimapuna Place, Ewa Beach

Honorable Governor,

I do not anticipate your reading this, but I do hope your staff will direct copies to each agency that might be involved (Department of Transportation, Environmental, Permits, Planning and Development, etc.).

I have been in a Gentry Soda Creek house since April, 1989. The house is not of quality material. Gentry's design committee has allowed paint colors that turned the "community" into an unsightly, mismatched, uncoordinated mess. The area should have been made to remain in dignified subtle colors.

My home has fungus and mold growing on the roof, structure, plants, trees, Futurastone. It was explained to me that Gentry started building in the valley and is moving upward, thus causing extensive dust, dirt, and moisture attaching itself to my home. Please see enclosed letters to Gentry that were ignored.

Soda Creek was built on filled ground. The ground has settled causing 4 to 6 inches of dirt to have disappeared. This has caused cracks in the concrete and Futurastone. On one side of my home the dirt has vanished to the level where the rough portion of the actual foundation is exposed.

I see where Gentry is seeking approval for 1,865 additional homes. Please delay this action until Gentry has been made to take care of the properties under their control for the past 14 to 15 years. Gentry must be made to take full responsibility for the damage and maintenance of existing homes before allowed to keep building more.

Before any developer should be allowed to construct anymore houses in the area, another access to Ewa MUST be in place. Fort Weaver Road has more than it should be expected to handle. Please do not allow additional lanes or improvements to Fort Weaver Road.

During the last redo, I personally watched the exact same sections of road being installed, dug up, installed, dug up, installed, etc. so many times daily that it was nothing less than a circus. Other Ewa residents can verify my statement. No wonder it took so long and cost so much. There was no organization or planning it seemed.

Rather than force us to go thru this again, I beg you to leave Fort Weaver Road as it is except for obvious repairs.

I beg you to utilize the plans and money available NOW for a different access - perhaps the North-South Road should start immediately.

I do not expect any reply and I sincerely thank you for your time and consideration to these matters that are very important to me.

Respectfully,

Patty Jensen

Mold growing as costly burden

By Ray A. Smith
Wall Street Journal

Mold has become a significant legal and financial problem for homeowners and insurers, not to mention a significant health concern. Now it is turning into a big headache at commercial properties — from apartments to hotels to shopping centers.

Archstone-Smith, a major owner of apartments in 22 states, recently said it will have to spend close to $20 million to contend with a mold outbreak at one of its high-rise properties in southwest Florida.

In Hawai'i, Hilton Hotels Corp. in July shut all guest rooms in one of six towers that comprise the Hilton Hawaiian Village in Waikiki after investigators discovered mold. Hilton so far has taken charges totaling $20 million for the cleanup and estimates it will reach $40 million.

A spokesman says the 453 guest rooms in the 25-story tower would remain closed for the next four to seven months.

... real-estate transactions. Last summer, a buyer at the last minute abandoned a $30 million deal to purchase a 250-unit apartment complex in the Southwest because it had mold, according to Jones Lang LaSalle Inc., a Chicago real-estate services firm that represented the apartment's owner.

Real-estate attorneys say mold inspections are increasingly becoming part of the industry's due-diligence process before taking on a transaction.

The fungal growth, found in damp or wet conditions, has been blamed for a number of health problems, including breathing difficulties, headaches, nausea, gastrointestinal ailments, also rashes, severe allergic reactions and neurological damage. Mold-related expenses cost companies that underwrite homeowners' insurance $1.5 billion in 2001, a number that is expected to grow this year, says the Insurance Information Institute, a New York-based trade group. The problem has been most severe in California and Texas.

Insurers and real-estate professionals contend the recent attention about mold has been stoked in part by trial lawyers. Jones Lang LaSalle estimates that more than 9,000 claims of personal injury, property damage or other loss caused by mold

See MOLD, C3

Builder submits 'Ewa pla

Gentry Homes wants to put up 1,865 units

By Catherine E. Toth
Advertiser Staff Writer

Gentry Homes Ltd. is launching plans for the final phase of its 'Ewa Makai development, submitting a rezoning request that will lead to 1,865 more homes in the region.

In a proposal submitted to the Office of Environmental Quality Control, Gentry requested the rezoning of 283 acres of undeveloped land for its Gentry 'Ewa Makai residential and commercial development.

The public has until Jan. 22 to comment on an overview of Gentry's plans, which will be used to draft an environmental impact statement that will look at the development's impact on traffic, noise, environment and infrastructure.

"This is the final piece in our project," said Debra Luning, Gentry's director of government relations and community affairs.

The proposal outlines plans for the construction of 550 single-family units, 675 cluster housing units and 640 multifamily units. About 50 acres will be used for commercial and industrial development.

In the proposal, Gentry has also set aside two acres for a community center, 11.5 acres for a park, four acres for a church, 14 acres for open space and 14.5 acres for roadways.

'Ewa residents have voiced concern over the continued development of their community, saying that developers should be accountable to provide adequate infrastructure to match the area's growth. They have complained about crowded schools and traffic.

Some have supported Gentry's request for rezoning as it may speed up the building of a second access road out of 'Ewa. Right now, there is only one road — Fort Weaver Road — in and out of the area.

Completion of the Gentry 'Ewa Makai development, just south of the 'Ewa by Gentry subdivision and next to the Hawai'i Prince Golf Course, would bring the total number of Gentry homes in the 'Ewa region than 9,000.

'Ewa by Gentry i acre planned co with about 7,200 and only two-thi master plan has b pleted.

The report will able for public vi the state Office of mental Quality Co local libraries. A day period to gath input, the commen included in a draf mental impact sta be published later t

Reach Catherin at 535-8103 or ctc luluadvertiser.com

Dear Ewa by Gentry Homeowner,

New Again roof & decks cleaning

In attempts to assist our homeowners with the cleaning and maintenance of their homes, our office has acquired some business cards of companies specializing in professional cleaning of exterior paint, roofs, windows etc.

This notice is for your information. Obtaining a contract is the homeowners responsibility and will not hold EbGCA, its Board of Directors, Property Management Company, Gentry Homes, Ltd. or City and County of Honolulu liable for any injury, damage or loss resulting from work completed by these companies.

Thank you for your efforts in maintaining your home!

Ewa by Gentry Community Association

spray chemical directly on roof then rinse

MARK KELLEY OK
Owner
Island Property Services
Commercial / Residential
Island Property Services
P.O. BOX 240610
Honolulu, HI 96824-0610
Cellular: (808)375-6178
Fax: (808) 732-2396
Professional Pressure Washing

Specializing in Roof Restoration
New World Roofing
Ph.# 384-7592
625-2140
Lic.# 12398
Daniel Wampler
Owner

RS H
water activated chemical

Good

5 gal. $140

C&C's Window Cleaning
Imagine the Difference
Commercial • Residential
Free Estimate
Pressure Washing
Water Stain Removal
Exclusive Residential
Construction Clean Up
Building Maintenance
CHAS E. GOEBEL
Owner/Operator
P.O. Box 700651
Kapolei, Hawaii 96709-0651
Phone: (808) 224-4894

ISLAND JET WASH
HIGH PRESSURE CLEANING
Exterior House Cleaning • Pool Decks • Driveways
Walkways • Natural Stone • Wooden Decks • Roofs
Mildew and Red Dirt Removal • Weather Proofing
Window Washing • Gutter Cleaning
Call: 627-0506
John F. Kendrick
www.islandjetwash.com
"LET US DO YOUR DIRTY WORK"

attitude is everything CLASS ACTION
DUST DAMAGE
roof - algae growing in soil (dust) on roofs
spores in air from traffic exhaust & soot - medical
sprinklers carry exhaust
GENTRY did FT Weaver side
1 side of townhomes to sell big homes

TO ART PELKAUS F. 685-1737 9-24-02

FROM PATTY JENSEN (LOT 277 SODA CREEK) 685-5226

PLEASE REFER TO THE FAX I SENT 9/16. I NEEDED A RESPONSE BY 9/23 AND DID NOT RECEIVE ONE. IGNORING ME WILL NOT MAKE THIS END.

I WILL BE CONTACTING ACTION LINE AND AN ATTORNEY AND THE NEWSPAPERS, PLUS ANY REGULATORY AGENCY. AS A BUILDER, GENTRY WAS GIVEN CONCESSION AND RESTRICTIONS BY THE GOVERNMENT. PERHAPS PERMITS WOULD NOT COME SO EASILY IF THERE WERE COMPLAINTS FROM YOUR FIRST DELVELOPMENT.

GENTRY IS DEVALUING SODA CREEK BY ALLOWING FOR 14 YEARS THE OWNERS TO NEGLECT THEIR PROPERTY AND NOW MAKING EVERYONE PAY FOR GENTRY'S MISTAKES. THE ALLOWANCE OF SOME OF THE PAINT COLORS HAS MADE SODA CREEK INTO A CHEAP, UGLY NEIGHBORHOOD.

MR. PELKAUS, I EXPECT A TELEPHONE CALL FROM YOU OR YOUR SUPERIOR TODAY. THANK YOU.

2 PGS.

TO: ART PELKAUS F. 685-1737 ✓ 9-~~15~~ 16-02

FROM: PATTY JENSEN (LOT 277 SODA CREEK) P&F 685-5226

ART, I HAVE CALLED SEVERAL TIMES AND HAVE NOT HEARD FROM YOU.

I RECEIVED A LETTER OF VIOLATION FOR DIRTY ROOF. PLEASE REFER TO MY 4-18-98 LETTER TO YOU WITH THIS SAME COMPAINT (SEE ITEM 2).

PLEASE ALSO NOTE ITEM 1 ABOUT THE CONTINUAL DIRT. IT IS IMPOSSIBLE TO KEEP THE PATIO FURNITURE CLEAN EVEN FOR 1 DAY. MY TV, VCR, STEREO, ETC. WILL BE RUINED SOON.

I BELIEVE GENTRY CLEANED THE ROOFS OF THE VARIOUS COMPLEXES SO THE ENTRY ROADS TO THE NEW HOMES WOULD BE PRESENTABLE. IMAGE IS EVERYTHING.

TO ME GENTRY SHOULD CLEAN EVERY ROOF IN SODA CREEK AND KEEP THEM CLEAN UNTIL THE 10-15 YEARS OF NEW HOME DEVELOPMENT IS COMPLETED.

I WAS ADVISED THE ALGAE WOULD RETURN IN A YEAR OR TWO. THAT IS A HEAVY EXPENSE TO EXPECT AND DEMAND THE HOMEOWNER TAKE CARE OF.

I HAVE NO QUALMS RUNNING AN AD TO PROPOSE A CLASS ACTION SUIT AGAINST GENTRY OR LET FUTURE GENTRY HOMEOWNER KNOW WHAT THEY CAN EXPECT.

ANOTHER GRAVE CONCERN OF MINE IS THE SETTLEMENT (IRROSION) OF THE DIRT OVER MY ENTIRE LOT. THE SIDE WHERE YOU NEED TO GO INTO 91-153 WAIMAPUNA PL. HAS SUNK TO WHERE THE CLUMPED PART OF THE FOUNDATION IS SHOWING. I WAS ADVISED THIS IS VERY SERIOUS. I FEEL THIS IS GENTRY CONSTRUCTION PROBLEM AND NEEDS TO BE INSPECTED AND TAKEN CARE OF IMMEDIATELY.

FINALLY, I AM APPAULED AT THE COLORS OF SOME OF THE SODA CREEK HOMES. WHO IN THE WORLD APPROVED SUCH OUT OF LINE COLORS. I REFER TO 2 ON KOKA - ONE IS DOUBLE BLUE AND ONE IS UGLY YELLOW WITH FOREST GREEN TRIM. THERE IS ALSO A TURQUOISE ONE ON KOLOWAKA (YOU CAN SEE THE BACK WHEN YOU DRIVE INTO COMPLEX). THE COLOR SHOULD HAVE REMAINED IN THE PINK, PEACH, AND CREAM THEY WERE ORIGINALLY PAINTED.

I WISH TO HAVE RESPONSE TO THESE SITUATION BY SEPTEMBER 23, 2002. THANK YOU.

Patty Jensen

COMMENTS/VIEWS OF

GLENN J. OAMILDA
91-819 B Pe'eone Place
'Ewa Beach, Hawai'i 96706

MR. TIM HATA
Department of Planning and Permitting
650 South King Street
Honolulu, Hawai'i 96813

REFERENCE: 'EWA by GENTRY MAKAI: PROPOSED LAND USE BOUNDARY AMENDMENT AND ZONE CHANGE

Aloha! Mr. Hata,

My name is Glenn Oamilda, president of the 'Ewa Beach Community Association. I've lived in the leeward O'ahu area all my life. Born and raised in Waipahu on O'ahu Sugar Plantation; now living permanently 'Ewa Beach and actively involved in many community activities and organizations. Mr. Hata, I am writing to you to voice my strong ***opposition*** to 'Ewa by Gentry's ***request for a proposed land use boundary amendment and zoning change.***

Traffic! Traffic Lights! Construction! No Roads Out! No Infrastructures! .... ***is anybody listening? How about the city, or the state, or the landowner, or the developers, or even the politicians. Apparently not!!*** This is exactly what the communities are asking themselves. Public protests of over building, of over developing, of traffic impacts, of the lost of ***life-styles*** and peoples' ***quality of life*** has diminished to a point that it has become so unbearable.... mentally, physically, and financially.

Historically, beginning in the 80's and into the early 90's with the 'Ewa Expandable Housing, the West Loch Fairways and the West Loch Estates, government, city and state, along with the landowners, the developers, as well as our political representatives, insured the ***public*** that housing developments along the Fort Weaver Road Corridor, from H-1 into 'Ewa Beach, wll be built with the utmost care and consideration for the ***quality of life*** foe every individual in the 'Ewa Region. The ***quality of life*** concept meant simply that people would begin to ***live, work***, and ***play*** thus enhancing their ***life-styles*** by spending more time strengthening family relationships and community ties.

Jobs, adequate access alternate roadway, coordination and scheduling of construction activities, all the public amenities that make for well thought out and well planned designed communities,

a ***blanced growth*** concept, were tied to building permits and zoning approvals. None till this day were ever fulfilled. The community was simply duped into thinking that these developers were heaven sent. 'Ewa by Gentry's desire or intent to provide permanent jobs by proposing a mixture of "industrial/commercial" center, I think is more of a deception than a reality. Is the site location properly situated or designated relative to a proposed elementary school, where noise, smells and physical harm could occur? The question should be raised about the sincereity of this whole proposal: Back in the early 90's, when coming before the community for support for permits to build more housing, included in that request was a site plan for a light industrial park adjacent to the Waste Water Treatment Plant, in 'Ewa, it simply never materialized, ***what about it Gentry?*** The reference to the 20 acres commercial site belonging to the Estate of James Campbell has not yet been determined by the owner.

By the early 90's until the present, the number of requests for land re-zoning, and the number of permits issued for housing developments drastically outpaced the government's ability to guide, lead and control and ***keep up*** with the demand for more infrastructure nor did government provide the leadership in mitigating the mounting impacts caused by the ***rampant and uncontrollable*** developments on the'Ewa Plains.

It is nice that 'Ewa by Gentry refers to and cites section 2.2.6 of the 'Ewa Development Plans, but as I read on to section 2.2.10 it clearly states that..." as a condition for zoning approval to insure that development does not outpace infrastructure development...."

Within the 'Ewa area and along the Fort Weaver Road Corridor, extending from H-1 into 'Ewa Beach, a stretch of road about five(5) miles long, there are two major developers, 'Ewa by Gentry snd Haseko. 'Ewa by Gentry is strictly in the housing business, building single and multi-family units. Haseko, on the other hand, has a resort/marina project on line but chooses to build houses instead. I believe that construction of ***only*** houses increases the impacts of more traffic, more cars, more liabilities, thus minimizes the ***quality of life***, more so lessens the chances of obtaining a ***balanced-growth***, and creates ***bedroom communities.***

At the present time, with the lack of an alternate route of the 'Ewa area, 'Ewa communities must deal ***unbearably*** with ten(10) traffic lights, heavy traffic, daily road work, and home construct-ion just to get to H-1. If by all indication, just by viewing 'Ewa by Gentry's proposal development that a road linking the projects will eventually cut accross Fort Weaver Road, the main artery, with a traffic light, I think that thought is ill advised.

Personally speaking, I really don't think at the present time, the 'Ewa area can withstand 1,800 more units, let alone, Haseko's soon request for 1,200 units. With talk of ***profits, buyers' market, deadlines to build out***, and the ***rush*** to build 3,000, the ***balance of*** *growth* will never, never be achieved if developers continue on this same line of thinking!

PAGE 3 — 'EWA by GENTRY MAKAI

'Ewa by Gentry proposal limits its reference(s) to the '*EWA DEVELOPMENT PLANS* for the purpose of concealing the real intent, as indicated in 5.4.2.2, ..."how the project supports the vision, policies, principles, and guidlines of the 'Ewa Development Plans." This is a clear indication on how the developer view the quality of life, lifestyles, balance growth, building bedroom communities, impacts on traffic, construction, permanent job, etc. in the whole region.

Government, city and state, in the region, has surrendered its power to lead, control and guide development in the 'Ewa area. Because of funding, the city and state lack their fair revenue share to build portions of planned infrastructures, thus relying heavily on developers. 5.1.2 of the 'Ewa Development Plan says.... "The city *must* take an active role in planning and coordinating construction of needed infrastructure....and development of the regional transportation system...." Thus, Mr. Hata the developers has taken complete advantage of government causing problems to *snowball* uncontrolled on the 'Ewa Plains.

There are two(2) solutions I see that must happen: 1) government *must* exert its power by reassuming its leadership roles, controls and guidance on development; and, 2) government should take the lead in coordinating construction activities by conferring with all the players-- developers, community boards and organizations, and the citizens.

Lastly, Mr. Hata, I think can I speak for myself and for all those people living in 'Ewa who are angry, frustrated and very apathetic toward government and the governmental process. I ask that you rekindle their hopes and dreams by taking a proactive role, by first and foremost denying 'Ewa by Gentry's request for a land use boundary amendment and a zone change.

Mahalo! Sincerely,

Glenn Oamilda

cc: TAEYONG KIM
Environmental Communications, Inc.
1188 Bishop Street, Suite 2210
Honolulu, Hawai'i 96706

Environmental Communications, Inc.

February 7, 2003

Mr. Glenn J. Oamilda
91-819 B Pecone Place
Ewa Beach, Hawaii 96706

Dear Mr. Oamilda:

Subject: Gentry Ewa Maki
Environmental Impact Statement
Preparation Notice

Thank you for your comments on the proposed land use boundary amendment and zone change for the Ewa Makai project. Your letter points out a number of reasons why you are frustrated with the continuous development of communities in the Ewa Beach area. Your comments will be taken under advisement as we prepare the Draft Environmental Impact Statement (DEIS). Your comments are appreciated and will be included in the DEIS.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

Patty Jensen 91-161 Waimapuna Pl. Ewa Beach, HI 96706 4-18-98

5-4-98 called

5-22 msg. - art

Art Pelkaus Gentry Homes Ltd.
PO Box 295 Honolulu, HI 96809

Dear Art, Re: Soda Creek, Lot 277

I have not heard from you after several messages and inquiries. Perhaps a letter is best.

I have the following concerns:

1. The dirt on the outside and inside of my home is extremely unacceptable. As discussed, a dust screen should have been in place before any grading was started. I painted the outside of my house just a few months ago and just completed the entire interior. I cleaned carefully as I put my things back. At your suggestion, I keep the doors and windows closed during the day. This does nothing but make the house unbearably hot. If my memory is correct, Gentry had to repaint all the houses on Koka after construction. It seems to me $40,000 for a screen would be minimal. PLEASE STOP CONSTRUCTION UNTIL A SCREEN IS ERECTED.

2. These Soda Creek houses are just 9 or 10 years old. The roofs are full of fungus. You advised the manufacturer had been contacted, you had a cleaner, but nothing has happened to repair my roof. This to me is a problem for Gentry to resolve.

3. You inspected for a structural defect under my carpet. Thankfully nothing serious was found. Dean retacked the carpet, but the seams are still split. Please arrange for a carpet person to repair them.

4. I have asked several times for the name and phone number of the vinyl person that is so good. He layed the replacement in my kitchen and bath. The gentleman is welcome to call me to schedule if he does not want his number given.

5. Please drop in my mailbox the garage door information I let you take. If you have secured a better price, that is wonderful.

6. You stated a man named Boogie might mow my lawn on a regular basis. Can you please have him contact me.

As you know I am in school and do not get home until after 4PM most days. My number is 585-5226. A message can be left.

Art, I really honestly appreciate all you have done for me. The kindness you have shown me has helped me learn and cope as a woman alone. Thank you very much.

Patty Jensen

RANDY OUYE
8-29 Postcard to Dad's supervisor
9/24 (or 25) 98 left msg supervisor

9/24/02 died

Environmental Communications, Inc.

February 7, 2003

Ms. Patricia L. Collins Jensen
91-161 Waimapuna Place
Ewa Beach, Hawaii 96706

Dear Ms. Collins Jensen:

Subject: Gentry Ewa Maki
Environmental Impact Statement
Preparation Notice

Thank you for your comments on the proposed Ewa Makai project. We understand your concerns about the maintenance of your neighborhood and traffic along Fort Weaver Road. Your comments will be taken under advisement as we prepare the Draft Environmental Impact Statement (DEIS). A traffic study will also be incorporated in the DEIS. Your comments are appreciated and will be included in the DEIS.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

P.O. Box 536 Honolulu Hawaii 96809 • (808) 528-4661 • Fax (808) 528-4862

GTE Hawaiian Tel
Beyond the call

GTE Hawaiian Telephone Company Incorporated
P.O. Box 2200 • Honolulu, HI 96841 • 808 546-4511

February 23, 2003

Mr. Tim Hata
Department of Planning and Permitting
650 South King Street
Honolulu, HI 96813

Dear Tim,

I have reviewed the Environmental Impact Statement Preparation Notice for the Gentry Ewa Makai project prepared by Environmental Communications, Inc.

A description of the roadway infrastructure is found on page 12. Please contact our buried cable group at 840-1444 to identify underground telephone lines in the vicinity. Your consideration will eliminate accidental damage to our extensive network and avoid inconvenience to our customers.

I appreciate the opportunity to communicate my concern.

Very truly yours,

Harlan Hashimoto
Verizon Hawaii
Environmental Affairs
546-2562

c: T. Kim – Environmental Communications, Inc.

Environmental Communications, Inc.

February 26, 2003

Mr. Harlan Hashimoto
Verizon Hawaii
Environmental Affairs
P.O. Box 220
Honolulu, Hawaii 96841

Dear Mr. Hashimoto:

Subject: Gentry Ewa Makai
Environmental Impact Statement
Preparation Notice

Thank you for your comments regarding the subject project. It is our understanding that underground cables may lie in the project vicinity. The project engineers will be informed and will be requested to coordinate planning with your buried cable group to ensure that your network remains is not affected by the proposed project.

We appreciate your review of this project and will include your letter in the Draft Environmental Impact Statement that is being prepared for the Ewa Makai development.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

13.0 Comments and Responses on the Draft Environmental Impact Statement

13.0 COMMENTS FROM AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED DURING THE DRAFT EIS REVIEW PERIOD

AGENCY	COMMENT DATE
Federal Agencies	
U.S. Department of the Navy	
U.S. Army Corps of Engineers	
U.S. Environmental Protection Agency	
U.S. Dept. of Agriculture, Resources Conservation Service	4/22/03
U.S. Dept. of the Interior, U.S. Fish and Wildlife Service	
State of Hawai'i Agencies	
Dept. of Accounting and General Services, Comptroller	3/20/03
Dept of Agriculture	
Dept of Business, Economic Development and Tourism, Energy, Resources and Technology Division	4/8/03
Dept of Business, Economic Development and Tourism, Land Use Commission	5/2/03
Dept of Business, Economic Development and Tourism, Office of Planning	
Dept of Defense	
Dept of Education	4/15/03
Dept of Hawaiian Home Lands	
Dept of Health	
Dept of Health, Clean Air Branch	
Dept of Health, Clean Water Branch	
Dept of Health, Environmental Planning Office	
Dept of Health, Noise and Radiation Branch	
Dept of Health, Safe Drinking Water Branch	
Dept of Health, Sanitation Branch	
Dept of Health, Solid & Hazardous Waste Branch	
Dept. of Health, Vector Control Branch	
Dept of Health, Wastewater Branch	
Dept of Land and Natural Resources, Commission of Water Resource Management	4/23/03
Dept of Land and Natural Resources, Engineering Division	4/23/03
Dept of Land and Natural Resources, Forestry and Wildlife	
Dept of Land and Natural Resources, Historic Preservation Division	
Dept of Land and Natural Resources, O'ahu District Land Office	4/23/03
Dept of Land and Natural Resources, State Parks	
Dept of Transportation	4/22/03

Housing and Community Development Corporation of Hawai'i	4/27/03
Oahu Metropolitan Planning Organization	
Office of Environmental Quality Control	
Office of Hawaiian Affairs	
University of Hawai'i, Environmental Center	4/23/03

City and County of Honolulu Agencies

Board of Water Supply	4/10/03
Dept of Community Services	3/14/03
Dept of Design and Construction	4/3/03
Dept of Facilities Maintenance	3/19/03
Dept of Environmental Services	
Dept of Parks and Recreation	3/24/03
Dept of Planning and Permitting	5/14/03
Dept of Transportation Services	4/21/03
Honolulu Emergency Services Department	
Honolulu Fire Department	3/21/03
Honolulu Police Department	4/10/03

Community Organizations and Private Agencies

Patricia L. Collins Jensen	
Coral Creek Golf, Inc.	
The Estate of James Campbell	
'Ewa Beach Community Association	
'Ewa by Gentry Community Association	
The Gas Company	3/31/03
HASEKO (Hawaii), Inc.	4/9/03
Hawai'i Prince Hotel	
Hawaiian Electric Company	4/25/03
Makakilo/Kapolei/Honokai Hale Neighborhood Board No. 34	
Neighborhood Board No. 23, 'Ewa	
Glenn J. Oamilda	
Oceanic Cable	
The Outdoor Circle	
Representative Tulsi Gabbard Tamayo	
Verizon Hawai'i, Inc.	
West Loch Estates Fairways Homeowners Association	
West Loch Estates Fairways Townhouses Association	

NRCS
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

United States Department of Agriculture

Our People...Our Islands...In Harmony

April 22, 2003

Taeyong M. Kim
Principal, Environmental Communications, Inc.
City and County of Honolulu
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, HI 96813

Dear Taeyong,

Subject: Draft Environmental Impact Statement, Ewa Makai

We have reviewed the above mentioned document and have no comment to offer at this time.

Thank you for the opportunity to review this document.

Sincerely,

LAWRENCE T. YAMAMOTO
Acting State Conservationist

cc: Gentry Investment Properties
Environmental Communications, Inc.

ENVIRONMENTAL COMMUNICATIONS, INC

July 29, 2003

Mr. Lawrence T. Yamamoto
Acting State Conservationist
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96805

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Yamamoto:

Thank you for your comments of April 22, 2003 regarding the subject project. We understand that your agency does not have any comments at this time.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

STATE OF HAWAII

DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

RUSS K. SAITO
COMPTROLLER

KATHERINE H. THOMASON
DEPUTY COMPTROLLER

(P)1095.3

MAR 20 2003

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: Draft Environmental Impact Statement for the Gentry Ewa Makai, Oahu, project proposed by Gentry Investment Properties, TMK [1] 9-1-069:005; 9-1-010:007

Thank you for the opportunity to review the subject project's Draft Environmental Impact Statement. The project does not directly impact any of the Department of Accounting and General Services' projects or existing facilities. Therefore, we have no comments to offer.

If you have any questions, please have your staff call Mr. Bruce Bennett of the Public Works Division at 586-0491.

Sincerely,

Russ K. Saito

RUSS K. SAITO
State Comptroller

c: Ms. Genevieve Salmonson, OEQC
✓Mr. Taeyong Kim, Environmental Communications, Inc.

Environmental Communications, Inc.

July 29, 2003

Mr. Russ K. Saito
State Comptroller
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Saito:

Thank you for your comments of March 20, 2003 regarding the subject project. We understand that the proposed project will not directly impact any Department of Accounting and General Services projects or existing facilities and that your agency does not have any comments.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT, AND TOURISM

Energy, Resources, and Technology Division
235 South Beretania Street, Leiopapa A Kamehameha Bldg., 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804-2359
Web site: www.hawaii.gov/dbedt/ert

LINDA LINGLE
Governor
THEODORE E. LIU
Director
RAYMOND M. JEFFERSON
Deputy Director

Telephone: (808) 587-3807
Fax: (808) 587-3820

April 8, 2003

Mr. Tim Hata
Department of Planning and Permitting
650 S. King St.
Honolulu, HI 96813

Subject: Gentry Ewa Makai
Ewa, Oahu, Hawaii
Tax Map Key: 1-9-1-069: 005; 1-9-1-010: 007

Dear Mr. Hata:

In response to your March 8, 2003, notice, thank-you for the opportunity to provide comments on the Draft Environmental Impact Statement for the Gentry Ewa Makai Project, the final phase of the 'Ewa by Gentry development. This project includes residential, commercial and school development. We would like to call your attention to: (1) State energy conservation goals, (2) energy saving design practices and technologies, and (3) recycling and recycled-content products.

1. **State energy conservation goals.** Project buildings, activities, and site grounds should be designed with energy saving considerations. The mandate for such consideration is found in Chapter 344, HRS ("State Environmental Policy") and Chapter 226 ("Hawaii State Planning Act"). In particular, we would like to call to your attention HRS 226 18(c)(4) which includes a State objective of promoting all cost-effective energy conservation through adoption of energy-efficient practices and technologies.

We recommend that you consider the City & County of Honolulu Energy Code early on in your project. Hawaiian Electric Co., Inc., (HECO) may also have demand-side management programs that offer rebates and/or incentives for installation of energy efficient technologies.

2. **Energy saving design practices and technologies.** We recommend that energy efficient design practices and technologies be specifically addressed. Energy efficiency is improved with effective building location, orientation and massing, and the

placement of vegetation for shade or wind protection. Some of the methods and technologies that could be considered, as appropriate, include:

- Establish the building on an east-west axis;
- Minimize east- and west-facing glass;
- Use natural ventilation to increase comfort of occupants;
- Maximize use of natural lighting without heat gain;
- Use high efficiency compact fluorescent lighting;
- Use insulation/radiant barrier for an equivalent R-19 value in ceiling; use ceiling fans;
- Use solar water heating; and
- Use landscaping for dust control and to minimize heat gain to area.

3. **Recycling and recycled-content products.**
   - Develop a job-site recycling plan for construction and recycle as much construction and demolition waste as possible;
   - Incorporate provisions for recycling into the project – a collection system and space for bins for recyclables; and
   - Specify and use products with recycled content such as: steel, concrete aggregate fill, drywall, carpet and glass tile.

Please refer to the attached *Guidelines for Sustainable Building Design In Hawaii: A planner's checklist*, the Hawaii BuiltGreen™ Home Builder checklist, the *Buying Recycled Products in Hawaii Fact Sheet*, and *A Contractor's Waste Management Guide*" for additional information.

Sincerely,

Maurice H. Kaya
Chief Technology Officer

Enclosures

c: OEQC
Taeyong M. Kim

Environmental Communications, Inc.

July 29, 2003

Mr. Maurice H. Kaya
Chief Technology Officer
Department of Business, Economic Development, and Tourism
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Kaya:

Thank you for your comments of April 8, 2003 regarding the subject project. We have reviewed your comments and offer the following:

1. Your recommendation regarding the City and County of Honolulu Energy Code and Hawaiian Electric Co., Inc. management programs is well taken and will be incorporated wherever practicable.

2. The project will be designed with energy efficiency in mind. The methods and technologies mentioned as well as other energy conservation means will be used wherever practicable.

3. Recycling programs and the use of recycled content products are already being implemented on the jobsite and are addressed in Section 5.8.4 of the Final EIS.

We appreciate the guideline references your office has provided and will review these documents for applicability and use in the project.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

ANTHONY J.H. CHING
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

May 2, 2003

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: Draft Environmental Impact Statement (DEIS)
Gentry Ewa Makai

We have reviewed the subject DEIS and note that Gentry Investment Properties filed a boundary amendment petition for the subject project with the Commission on March 21, 2003. The petition is currently under review for completeness.

We have no further comments to offer at this time. Thank you for the opportunity to comment on the subject DEIS.

Please feel free to contact Bert Saruwatari of my office at 587-3822, should you require clarification or any further assistance.

Sincerely,

ANTHONY J. H. CHING
Executive Officer

c: Taeyong Kim, Environmental Communications, Inc.
Office of Environmental Quality Control

Environmental Communications, Inc.

July 29, 2003

Mr. Anthony J.H. Ching
Executive Officer
Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Ching:

Thank you for your comments of May 2, 2003 regarding the subject project. We understand that the applicant has subject project has filed a boundary amendment petition and that your office does not have any comments at this time.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

[redacted]
LINDA LINGLE
GOVERNOR

2003 APR 21 PM 3 22
DEPT OF PLANNING
AND PERMITTING
CITY & COUNTY OF HONOLULU

OFFICE OF ADMINISTRATIVE SERVICES
[redacted]

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

PATRICIA HAMAMOTO
SUPERINTENDENT

2002/ED-11

April 15, 2003

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawai'i 96813

Dear Mr. Hata:

Subject: Gentry Ewa Makai
Draft Environmental Impact Statement
Ewa, Oahu, TMK: 9-1-10: 7 and 9-1-69: 5

The Department of Education (DOE) has reviewed the Draft Environmental Impact Statement (DEIS) for Gentry Ewa Makai, a planned community in Ewa, Oahu. The project consists of two parcels, divided by Fort Weaver Road, that total approximately 282.7 acres.

Gentry Investment Properties (Applicant) proposes to build a total of 1,885 residential units and develop commercial and public spaces. The Applicant has set aside an 18-acre site on the west side of the project for a middle school. That property would address a portion of Gentry's fair-share contribution. The balance of the contribution will depend on the fair-share formula in place when there is agreement on the written educational contribution agreement.

The DOE proposes that the City and County of Honolulu include as a condition of zoning approval the following standard fair-share language. The proposed wording is:

> The Applicant shall contribute to the development, funding, and/or construction of school facilities, on a fair-share basis, as determined by and to the satisfaction of the Department of Education. Terms of the contribution shall be agreed upon in writing by the Applicant and the Department of Education prior to obtaining building permits for any area of development.

The DOE is assured by the March 4, 2003 letter from Gentry's consultant, Mr. Taeyong Kim, that the applicant intends to erect barriers between the project's commercial/industrial site and the elementary school in the adjacent development, to provide a security, noise, and exhaust buffer.

Thank you for the opportunity to review and comment on this EISPN.

Should you have any questions, please call Ms. Heidi Meeker of the Facilities and Support Services Branch at 733-4862.

Sincerely yours,

Raynor M. Minami

Raynor M. Minami, Director
Facilities and Support Services Branch

RMM:hy

cc: Rae M. Loui, OAS
Taeyong Kim, Environmental Communications, Inc.

Environmental Communications, Inc.

July 29, 2003

Mr. Raynor M. Minami, Director
Facilities and Support Services Branch
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Minami:

Thank you for your comments of April 15, 2003, regarding the subject property. It is our understanding the Department of Education and Gentry Homes, Ltd. are currently finalizing an Education Contribution Agreement which sets forth Gentry's educational contributions to satisfy DOE's fair-share requirement for the subject development. The agreement includes, among other items, the dedication of 18 acres, more or less, to the State of Hawaii for a public school and ancillary school recreational uses.

We would like to reconfirm that measures will be taken to ensure that buffer the elementary school site from any potential impacts that may come from the commercial/industrial site.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 23, 2003

Ref.: GENTRYEWAMAKAIDDEIS.RCM
Author: LD-PEM

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: Draft Environmental Impact Statement – Gentry Ewa Makai, Oahu

Thank you for the opportunity to review and comment on the subject Draft Environmental Impact Statement. Request for comments were forwarded to our divisions and a copy was made available for their review.

Enclosed for your information are comments from our Engineering Division and Commission on Water Resource Management.

We have no further comments to offer at this time. Should you have any questions, please contact Nick Vaccaro at 587-0384 or Patti Miyashiro at 587-0385.

Very truly yours,

Charlene E. Unoki

for Dierdre S. Mamiya
Administrator

Enclosure

c: Taeyong M. Kim,
Environmental Communications, Inc.
Engineering Division
CWRM

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LA/NAV
Ref.: GENTRYEWAMAKAIDDEIS.CMT2

COMMENTS

Please correct the information reflected on page 4-12, Item 4.7.1 Natural Hazards of the DEIS. As indicated in our previous comments dated January 7, 2003, which is included in Chapter 9.0 of the DEIS, the project site according to FEMA Community Panel Numbers 15001 0310 E and 15001 0330 E (November 30, 2000), is located in Zone D. This is an area in which flood hazards are undetermined.

However, if future studies determine that the project site is within the flood zone, the project must comply with rules and regulations of the National Flood Insurance Program (NFIP). If there are questions regarding the NFIP, please contact the State Coordinator, Mr. Sterling Yong, of the Department of Land and Natural Resources at 587-0248. If there are questions regarding flood ordinances, please contact Mr. Robert Sumitomo at 523-4254 or Mr. Mario Siu Li at 523-4247 of the City and County if Honolulu, Department of Planning and Permitting.

Should you have any questions, please call Mr. Andrew M. Monden of the Planning Branch at 587-0229.

Signed: Andrew M. Monden
for ERIC T. HIRANO, CHIEF ENGINEER
Date: 3/17/03

E:\WLD\MAKAI\SUZIE\OAHU\EwaMakaiOahu288.doc

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

March 20, 2003

Ref: gentry ewa makai dr2

TO: Ms. Dede Mamiya, Administrator
Land Division

FROM: Ernest Y.W. Lau, Deputy Director
Commission on Water Resource Management (CWRM)

SUBJECT: Draft Environmental Impact Statement (February 2003) for Gentry Ewa Makai, Oahu, Hawaii

FILE NO.: GENTRYEWAMAKAIDDEIS.CMT2

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas, which are important for the maintenance of streams and the replenishment of aquifers.

[X] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We are concerned about the potential for degradation of instream uses from development on highly erodible slopes adjacent to streams within or near the project. We recommend that approvals for this project be conditioned upon a review by the corresponding county's Building Department and the developer's acceptance of any resulting requirements related to erosion control.

[ ] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[ ] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[X] OTHER:

We recommend that the report include a discussion of the nonpotable water requirements for the proposed development and identify the projected nonpotable demand schedule and water supply source. The Commission has adopted a sustainable capacity for irrigation wells in the Puuloa Aquifer System, the upper caprock aquifer in the vicinity of the project, at 1,000 mg/l of chloride. With the cessation of sugarcane agriculture in the Ewa Plain, and corresponding decrease in return irrigation recharge from imported better-quality basal water, the chlorides in the Puuloa Aquifer System are expected to increase and may not be suitable for irrigation purposes over the long term. The City and County of Honolulu has adopted an ordinance requiring that all new developments in the Ewa Plain be equipped with dual water systems. The report discusses the potable water requirements and a strategy to meet the potable demand, but does not discuss nonpotable water issues.

If there are any questions, please contact Lenore Y. Nakama at 587-0218.

Environmental Communications, Inc.

July 29, 2003

Ms. Dierdre S. Mamiya
Administrator
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawaii 96809

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Ms. Mamiya:

Thank you for your comments of April 23, 2003 regarding the subject project. We have reviewed the comments from your Engineering Division and Commission on Water Resource Management and offer the following.

Engineering Division
We stand advised that the project site is designated as Zone D on the FEMA Community Panel Numbers 15001 0310 E and 15001 0330 E, dated November 30, 2000. Flood hazards are undetermined in this area. This information will be included in Section 4.7.

Commission on Water Resource Management
A discussion on non-potable water will be include in the Final EIS in Section 4.6. We understand that the City and County of Honolulu has adopted a dual water system ordinance and it the applicant will comply with this requirement. A review of the project by the project's contracted water resource consultant anticipates that the proposed project will not have any significant impact on the shrinking Ewa Caprock Aquifer.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

RODNEY K. HARAGA
DIRECTOR

Acting Deputy Director
GLENN M. OKIMOTO

IN REPLY REFER TO:
STP 8.0741

April 22, 2003

Mr. Tim Hata
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Hata:

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

This is in response to your request for our review of the Gentry Ewa Makai project. We have several concerns with the subject document as noted below and request that the applicant revise the traffic impact report for the project and resubmit it for our review. We provided earlier comments to your department through letters dated July 27, 1998, and January 31, 2003. The following supplements or clarifies our prior comments:

1. Our Fort Weaver Road widening project will provide 6 lanes from Geiger Road to Farrington Highway. Construction is expected to begin in 2004 and we hope to be completed sometime in 2006.

2. Our Ewa North-South Road project initially will provide one (1) northbound lane, one (1) southbound lane, and one (1) reversible lane between the Kapolei Parkway and H-1, with a Honolulu-bound on-ramp, and an Ewa-bound off-ramp on H-1. Provided that endangered species within the project right-of-way can be successfully established at other sites, construction may begin in late 2004 and be completed within roughly two years.

3. Assumptions for traffic forecasting should be included in the project's traffic impact analysis report. For example, assumptions for internal trip capture and more detailed roadway conditions should be provided. Details should include the assumed laneage of the North-South Road and its interchange with H-1.

4. Table 1 in the project's traffic impact analysis report should be revised to reflect the timing of several projects: Fort Weaver Road Widening; the North-South Road; Extension of Kapolei Parkway to Papipi Road; Extension of Kapolei Parkway to Kamaaha Avenue; and the Extension of Keaunui Drive from the Hawaii Prince Golf Course to Kapolei Parkway.

5. To provide flexibility in accommodating future transportation needs, along the route and to buffer roadway noise, we request that a landscaped building setback (approximately 12 feet) along the subject project's Fort Weaver Road frontage be provided.

6. The project's traffic impact analysis report should incorporate queuing analysis to estimate the length of left-turn storage lanes needed at Keaunui Drive intersections with Iroquois Point Road and Fort Weaver Road. The developer must also construct all required improvements to Keaunui Drive's intersection with Iroquois Point Road at no cost to the State.

7. The proposed Keaunui Drive extension intersection with Fort Weaver Road must replace the existing driveway intersection from the Hawaii Prince Golf Course. The developer must dedicate required right-of-way and construct all required intersection improvements at no cost to the State. Appropriate queuing analysis as part of the developer's traffic study needs to be done to ensure that the proposed golf course driveway and any other driveways from Keaunui Drive (including the extension west of Fort Weaver Road) be spaced far enough away from Fort Weaver Road. Locating driveways or access points too close to Keaunui Drive's intersection with Fort Weaver Road, may cause operational problems.

8. We disagree with the cycle lengths used in the developer's traffic analysis. For example, the reduction of cycle lengths from 240 seconds to 100 seconds for study intersections on Fort Weaver Road do not seem appropriate. This analysis should be redone using a more appropriate signal cycle length.

9. Plans for work within State highway/road right-of-ways must be submitted to our Highways Division, Traffic Branch, for review and approval. If the North-South Road is constructed before the proposed Keaunui Drive intersection with Fort Weaver Road, we request that an updated traffic impact analysis report reevaluate the proposed intersection design.

10. Because of the development's close proximity to the aviation activity from the Runways 4L and 4R at Kalaeloa Airport, we request that the Department of Transportation, Airports Division be granted an avigation easement for the Gentry Ewa Makai development. An avigation easement is a grant of property interest in land, over which a right of unobstructed flight in the airspace is established with potential for noise, fumes, smoke, vibrations, other substances, and phenomena from the aircraft. Also, be aware that the property may be impacted by noise from aircraft approaching and departing Kalaeloa Airport.

Mr. Tim Hata
Page 3
April 22, 2003

STP 8.0741

11. A FAA Form 7460-1, a Notice of Proposed Construction or Alteration, should be submitted to the Federal Aviation Administration, Airports District Office, so that they may assess the impacts of the development on Kalaeloa Airport.

With the Ewa Makai project being the final increment of Gentry's Ewa development, we feel that it is important to also reflect on and review the entire development and its impacts along with the subject project. We have no objection to the subject project moving forward, but we would like to maintain the ability to monitor the project's progress and growth within the overall development to ensure that the effects of both local and regional impacts by the project and the overall development can be assessed as updated or new information comes forth. We recognize that the communities in Ewa are part of the changes in the Ewa Plain area and we wish to contribute guidance to the area's development as necessary on a continuing basis.

We appreciate the opportunity to provide comments.

Very truly yours,

RODNEY K. HARAGA
Director of Transportation

c: Genevieve K.Y. Salmonson, Office of Environmental Quality Control
Taeyong Kim, Environmental Communications, Inc.

Environmental Communications, Inc.

July 29, 2003

Mr. Rodney K. Haraga
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Haraga:

Thank you for your comments of April 22, 2003 regarding the subject project. We have reviewed your comments and offer the following:

1. Fort Weaver Road Will be Widened to 6 Lanes by 2006 – The Traffic Impact Analysis Report for Ewa by Gentry Makai Development, December 2002 (TIAR) was the basis of the traffic analyses documented in the DEIS. On page 27 of the TIAR, it is stated that a 4-lane Fort Weaver Road was assumed. It is also acknowledged that HDOT will widen Fort Weaver Road to 6 lanes within the next 5 years. The TIAR evaluated an area directly influenced by Ewa by Gentry Makai. The more regional traffic improvements such as the Fort Weaver Road widening, Kapolei Parkway, and North-South Road are considered part of the impact fee ordinance (Chapter 33A of the Revised Ordinances of Honolulu) that identifies the improvements and a funding scheme to implement the improvements. The impact fee was developed using a sub-regional transportation study conducted by a consultant under the direction of the HDOT. Gentry Homes, Ltd. is one of the parties included in the impact fee program and is actively participating in the funding of the regional improvements.

2. Assuming a four-lane Fort Weaver Road configuration only affects two intersections analyzed: Geiger Road and Keaunui Drive. Under the impact fee ordinance, the makai limit of the Fort Weaver Road widening is Geiger Road. It is expected that the transition from 6 lanes to 4 lanes would be accomplished by designating the makai-bound outside lane as right turn only, and picking up a new lane in the mauka-bound direction. This would leave Fort Weaver Road a 4-lane facility makai of Geiger Road. This configuration is what is depicted in Figure 9 on page 31 of the report.

3. Ewa North-South Road is Projected to be Implemented by late 2006 – On page 17, the TIAR acknowledges the completion of Ewa North-South Road within the time frame of the analysis (2010). The TIAR describes the interim North-South Road as a 2-lane roadway. The HDOT letter describes it as having three lanes with one of them reversible. We defer to the HDOT description and have changed the description on Section 5.2.12 of the FEIS. This should not affect the conclusions of the TIAR, since a lesser configuration was assumed in the TIAR than what HDOT plans to implement.

4. Traffic Forecasting Assumptions Should be Included – Table 4 on Page 20 of the TIAR identifies the percentage of traffic assumed to be contained within the Gentry development area. This area includes the existing Ewa by Gentry and the proposed Ewa by Gentry Makai developments. The internal travel relates to trips to schools and to neighborhood shopping that exist or are proposed as part of the development. Assumed laneage of North-South Road is documented on page 17 of the TIAR.

5. Table 1 in the TIAR Should be Revised to Reflect Future Roadway Projects – Table 1 summarizes existing intersection operating conditions. As such, future roadway projects do not affect the results documented.

6. Landscaped Setback of 12-feet Along Fort Weaver Road - Gentry Homes, Ltd. has implemented appropriate sound attenuation measures to reduce noise levels from vehicular traffic affecting property along Ft. Weaver Road within the existing Ewa by Gentry development, more specifically in the Sun Terra, Summer Hill, Lofts, Alii Cove, Carriages, WoodBridge, Sonoma, and Prescott communities along Ft. Weaver Road. These measures include setback of residences from the road travel lanes, a 6' plaster fence, wall insulation with central air conditioning as standard, and substantial landscaping. Similar sound attenuation measures will also be incorporated for homes built in the remainder of Gentry's projects along Ft. Weaver Road as those projects are constructed.

   Gentry Homes, Ltd. currently provides a 10-foot wide landscaped lot along Fort Weaver next to the HDOT right-of-way. These lots are dedicated to the Ewa by Gentry Community Association. Additionally, homes are set back either 5' or 10' from the property line. Therefore, residential structures along Fort Weaver Road are set back approximately 15 to 20-feet from the HDOT right-of-way. This indicates that the requested set back has already been provided. The current HDOT right-of-way already allows for widening of Fort Weaver Road, so flexibility for future roadway improvements is also provided. This information will be added to a new section under heading 5.2.22, Future Transportation Buffer and Noise Attenuation.

7. Keaunui Drive Intersections at Iroquois Point Road and Fort Weaver Road – The Keaunui Drive/Iroquois Point intersection is currently being redesigned to accommodate improvements on Iroquois Point Road to the east and to prepare the intersection for signalization. Queuing analysis will be included in the design input. Gentry Homes, Ltd will fund the Keaunui Drive/Iroquois Point Road intersection improvements. Likewise, future design of the Keaunui Drive/Fort Weaver Road intersection will have queuing analysis as input.

8. Keaunui Drive Extension/Fort Weaver Road Intersection – The existing intersection near the Hawaii Prince Golf Course is constructed with the future extension of Keaunui Drive in mind. The Hawaii Prince Golf Course Driveway does not directly connect to Fort Weaver Road, but connects to a segment of roadway that, in turn, connects to Fort Weaver Road. This segment will become part of the Keaunui Drive extension. During final design of this roadway, queuing analysis will be conducted and appropriate access configuration will be implemented.

9. Traffic Signal Cycle Lengths – HDOT disagrees with the traffic signal cycle lengths used in the TIAR analyses. The TIAR uses 100-second cycles. The reason for the 100 second cycle was to decrease the delays to the street approaches crossing Fort Weaver Road. Currently, the cycle lengths are in the 240-second cycle range. While this allows large throughput on Fort Weaver Road, it results in very long vehicle queues on the cross streets. The future 2010 analysis time frame contains assumptions of future roadway improvements such as the completion of Kapolei Parkway, North-South Road, and the widening of Fort Weaver Road. As such, it was judged that cycle length could be reduced to a more typical 100-second cycle as part of a corridor optimization program. We are open to working with alternative cycle lengths as the Fort Weaver Road corridor evolves over the next few years.

10. Plans for Work within State Highway/Road Right-of-Ways – Plans for work within State right-of-way must be submitted to Highways Division. Current policy is for plans to be circulated to appropriate branches for comment before approval of the plans. If additional analysis is requested by HDOT, it will be provided.

11. Avigation Easement – It is our understanding that avigation easements are required for residential properties located within the 60 DNL (day-night average) sound level. All residential components of the proposed project are located outside of this contour. The only area within the entire Ewa Makai project is located on a small corner portion of the proposed commercial/industrial component located adjacent to Fort Weaver Road. We do not believe that an avigation easement will be necessary for the project but will coordinate our planning efforts with the Airport Division to ensure that the project will comply with any applicable rules and regulations.

12. FAA Form 7560-1 – Discussion with the Federal Aviation Administration, Airports District Office have indicated that FAA Form 7560-1 is not required for this project as the project will not have any structures over 200 feet in height or interfere with radar or antenna signals.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM
HOUSING AND COMMUNITY DEVELOPMENT CORPORATION OF HAWAII
677 QUEEN STREET, SUITE 300
Honolulu, Hawaii 96813
FAX (808) 587-0600

ROBERT J. HALL
ACTING EXECUTIVE DIRECTOR

2002/ED-11

03:PEO/61

March 27, 2003

RECEIVED
DEPT. C... ...ING
HONOLULU, HI 96813

Mr. Tim Hata, Planner
City and County of Honolulu
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, HI 96813

Dear Mr. Hata:

Subject: Draft Environmental Impact Statement
Gentry 'Ewa Makai
'Ewa, O'ahu, Hawai'i

Thank you for the opportunity to review the Draft Environmental Impact Statement for Gentry 'Ewa Makai. We have no comments.

Sincerely,

Robert J. Hall
Acting Executive Director

Environmental Communications Inc

July 29, 2003

Mr. Robert J. Hall
Acting Director
Housing and Community Development Corporation of Hawaii
677 Queen Street, Suite 300
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Hall:

Thank you for your comment of March 27, 2003 regarding the subject project. We understand that the Housing and Community Development Corporation of Hawaii does not have any comments regarding the Draft Environmental Impact Statement for the Gentry Ewa Makai project.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

UNIVERSITY OF HAWAI'I AT MĀNOA
Environmental Center

April 23, 2003
RE: 0733

Ms. Debra Luning
Gentry Investment Properties
P.O. Box 295
Honolulu, HI 96809

Dear Ms. Luning:

Draft Environmental Impact Statement
Gentry Ewa Makai
Ewa, Oahu, Hawaii

Ewa by Gentry is a 1,000-acre master planned community consisting of approximately 7,200 homes located on the Ewa plain on the island of Oahu. Approximately two-thirds of the master plan has been completed to date. Gentry Homes, Ltd. is proposing the final increment, the Gentry Ewa Makai, of its master plan.

The proposed Gentry Ewa Makai project will include approximately 93 acres for 550 single-family units; 64 acres for 675 cluster housing units; 32 acres for 640 multi-family units; 20 acres for commercial use; 30 acres for industrial commercial mixed use; 2 acres for a community center; 4 acres for a church; 11.5 acres for a park; 14 acres for open space; and 14.5 acres for roads.

The permits required for this project include an LUC boundary amendment, general plan amendments, zoning, grading and building permits.

The Environmental Center reviewed this document with the assistance of Peter Flacksbart of Urban and Regional Planning Department and Kevin Polloi of the Environmental Center.

<u>General Comments</u>

The Environmental Center questions the need for more residential development despite the fact that Oahu's infrastructures such as the highway and solid waste capacities are currently over-capacity. These are good examples of planning failures due to the lack of properly implementing development management strategies.

2500 Dole Street, Krauss Annex 19, Honolulu, Hawai'i 96822-2313
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

The assessment of impact fees, while they help the City and County in mitigating the increased use of public facilities, fails in this instance due to the already existing overloaded conditions. Any new development must be carefully scrutinized considering the current state, while more effort should be directed at advancing and improving Oahu's infrastructure capacities.

While the document addresses most of the concerns raised in the Preparatory Notice stage, we did not see any discussion in the document of the direct impacts of this project, in addition to the cumulative impact of the overall Ewa project, to major infrastructure such as the H-1 Freeway and the Waimanalo Gulch solid waste facility.

The Environmental Center commends the developer in setting aside 18 acres for a middle school to serve the children living in the development. However, is the construction of the school going to coincide with the development in the area? In other words, will the school be built and ready to accommodate the children when the residential development has been occupied?

Thank you for the opportunity to review this draft environmental impact statement.

Sincerely,

Jacquelin N. Miller

Jacquelin Miller, Ph.D.
Associate Environmental Coordinator

Cc: OEQC
Tim Hata
Taeyong Kim
James Moncur
Peter Flacksbart
Kevin Polloi

ENVIRONMENTAL COMMUNICATIONS INC

July 29, 2003

Ms. Jacquelin Miller, Ph.D
Associate Environmental Coordinator
Environmental Center
University of Hawaii
2500 Dole Street, Krauss Annex 19
Honolulu, Hawaii 96822-3980

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Ms. Miller:

Thank you for your comments of April 23, 2003 regarding the subject project. We have reviewed your comments and offer the following.

1. It is our understanding that the Environmental Center questions the need for more residential development due to concerns about the capacity of Oahu's infrastructure. This question is significantly larger than the scope of the proposed project and is a policy issue that is best addressed by policy makers and elected officials. With respect to the proposed project, the applicant is fulfilling a master planned project that has is consistent with the City and County of Honolulu's Ewa Development Plan. Residential development is a function of demand and it is the applicant's intent to provide a variety of housing types that serve the varying needs of Oahu's growing population.

2. We understand your concern that impact fees will fail to solve all infrastructure problems, however, it is an important first step in acquiring the funding necessary to build the needed Ewa highway improvements. It is the applicant's intent to provide a pro-rata share of improvement cost for the regional infrastructure. The applicant has been, and continues to be, involved with surrounding developments in addressing regional concerns regarding traffic, water, drainage and other community issues. The demands on infrastructure are an island wide issue and it would be unfair to penalize a specific project for larger issues that are clearly beyond the applicant's control.

3. We do not agree that the Draft Environmental Impact Statement does not address direct impacts of the project. Chapters 4 and 5 of the document concludes each section with a statement or narrative on the impacts of specific environmental issues. The assessment of impact on major infrastructure such as the H-1 Freeway and the Waimanalo Gulch solid waste facility are again, significantly larger than the scope of the project and are policy related issues that are beyond the responsibility of the applicant. The agencies responsible for these issues are consulted parties throughout the EIS process and we have not received any comment that the proposed action cannot be accommodated by the existing infrastructure. The City has indicated in a letter dated June 25, 2003, that it will be able to satisfy the solid waste collection and disposal requirements of the Ewa Makai project.

4. The construction of the school proposed for the project will be developed on a scheduled to be determined by the Department of Education. In general, it is not feasible for major capital facilities to be completed prior to the project's occupancy. It is the applicant's intent that the needs of the community will be met without delay. Funding for the schools is, however, an issue that is beyond the applicant's control.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

[illegible]

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

April 10, 2003

TO: ERIC G. CRISPIN, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTN: TIM HATA

K. Shito

FROM: for CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE GENTRY EWA MAKAI PROJECT, TMK: 9-1-69: 5, 9-1-10: 7

The developer will be required to install the water system improvements to serve the proposed projects. The construction drawings should be submitted for our approval to ensure conformance with the approved master plan.

The availability of additional water will be confirmed when the building permit or construction plans are approved. When water is made available, the applicant will be required to pay our Water System Facilities Charges for resource development, transmission, and daily storage.

If you have any questions, please contact Joseph Kaakua at 748-5440.

cc: Taeyong Kim, Environmental Communications, Inc.

ENVIRONMENTAL COMMUNICATIONS, INC

July 29, 2003

Mr. Clifford J. Jamile
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Jamile:

Thank you for your comments of April 10, 2003 regarding the subject project. We have reviewed your comments and offer the following:

1. We understand that the developer will be required to install the water system improvements that will serve the proposed project. Construction drawings will be submitted to your agency for approval and conformance review with the approved water master plan.

2. We understand that additional water for the project will be confirmed when the building permit or construction plans are approved. We also acknowledge that when water is made available, the applicant will be required to pay Water System Facilities Charges for resource development, transmission, and daily storage.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF COMMUNITY SERVICES
CITY AND COUNTY OF HONOLULU

715 SOUTH KING STREET, SUITE 311 • HONOLULU, HAWAII 96813
TELEPHONE: (808) 527-5311 • FAX: (808) 527-5498 • INTERNET: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

MICHAEL T. AMII
DIRECTOR

JOHN R. SABAS
DEPUTY DIRECTOR

March 14, 2003

MEMORANDUM

TO: ERIC G. CRISPIN, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTENTION: TIM HATA

FROM: MICHAEL T. AMII, DIRECTOR

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
GENTRY EWA MAKAI

We note that the developer of the proposed 1,865 unit residential development is aware of the City's general policy to recommend that affordable housing be provided for low- and moderate-income and gap group households. Within this set aside, we recommend that provision be made for special needs housing and rental housing.

Thank you for the opportunity to provide comment. If there are any questions, please call Randy Wong at 523-4435.

MICHAEL T. AMII
Director

MTA:dk

cc: Environmental Communications

Environmental Communications, Inc.

July 29, 2003

Mr. Michael T. Amii
Director
Department of Community Services
715 South King Street, Suite 311
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Amii:

Thank you for your comments of March 14, 2003 regarding the subject project. The project developer is aware of the City's general policy to recommend that affordable housing be provided for low- and moderate-income and gap group households. We also understand that the Department of Community Services is recommending that a provision should be made for special needs housing and rental housing within the set aside units.

The developer has already provided special needs and rental housing units in Ewa by Gentry, but is willing to examine the feasibility of providing additional such units.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 523-4564 • Fax: (808) 523-4567
Website: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

TIMOTHY E. STEINBERGER, P.E.
ACTING DIRECTOR

GEORGE T. TAMASHIRO, P.E.
ASSISTANT DIRECTOR

April 3, 2003

TO: ERIC G. CRISPIN, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTENTION: TIM HATA

FROM: TIMOTHY E. STEINBERGER, P. E., ACTING DIRECTOR

SUBJECT: GENTRY EWA MAKAI
DRAFT ENVIRONMENTAL IMPACT STATEMENT

We are recommending that the area designated for cluster housing in the applicant's master plan be zoned Residential rather than Apartment, A-1. We believe that the number of occupants, their anticipated ages, and the recreational needs associated with cluster homes more nearly resemble those of residential-zoned areas than apartment-zoned areas. Residential-zoned land requires the provision of 350 square feet per dwelling unit, as opposed to only 110 square feet per unit in an apartment-zoned district.

With the stated number of cluster home units (675) shown in the master plan, the applicant's required park land dedication amounts to 236,250 square feet or 5.42 acres, assuming 350 square feet of dedicated park land per unit. Adding the other land areas to meet park dedication requirements in proposed residential and apartment-zoned areas yields a total park dedication requirement of 11.46 acres.

With the inclusion of an 8-acre park and a 3.5-acre park addition, the proposed plan already meets or exceeds these stricter requirements. The configuration and siting of the proposed park lands also appear to be satisfactory. However, the applicant should be aware that the City's Park Dedication Ordinance also specifies grade requirements to be followed. The City ultimately reserves the right to review and approve park plans before the construction of improvements and acceptance of these lands.

Please call Mr. Terry Hildebrand at extension 4696 if you have any questions.

TES:ei

cc: √Taeyong M. Kim, Environmental Communications, Inc.
William D. Balfour, Jr., Department of Parks and Recreation

Environmental Communications, Inc

July 29, 2003

Mr. Timothy E. Steinberger, P.E.
Acting Director
Department of Design and Construction
650 South King Street, 11th Floor
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Crispin:

Thank you for your comments of April 3, 2003 regarding the subject project. We have reviewed your comments and offer the following:

1. We have taken your recommendation that the cluster housing areas of the project be zoned Residential instead of Apartment, A-1 into advisement. At this time, the applicant would like to continue with their intent of seeking A-1 zoning for the cluster home areas to maintain a degree of flexibility in meeting market conditions.

2. We concur that the project meets the stricter park requirements and that the proposed park locations are appropriate to the project. We understand that the City's Park Dedication Ordinance specifies grade requirements and intend to meet these conditions. We also acknowledge that the City reserves the right to review park plans before the construction of improvements and acceptance of these park lands.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF FACILITY MAINTENANCE
CITY AND COUNTY OF HONOLULU
1000 Uluohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 692-5054 • Fax: (808) 692-5857
Website: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

LARRY LEOPARDI, P.E.
DIRECTOR AND CHIEF ENGINEER

ALVIN K.C. AU
DEPUTY DIRECTOR

IN REPLY REFER TO:

March 19, 2003

MEMORANDUM

TO: ERIC G. CRISPIN, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTN: TIM HATA

FROM: Larry Leopardi
LARRY J. LEOPARDI, P.E., DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF FACILITY MAINTENANCE

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
GENTRY EWA MAKAI

The Department of Facility Maintenance does not have any comments at this time, but will reserve further comments when the construction documents are submitted.

If you have any questions, please call Laverne Higa at 692-5111.

LJL:lh

cc: Gentry Investment Properties
✓Environmental Communications, Inc.

ENVIRONMENTAL COMMUNICATIONS, INC

July 29, 2003

Mr. Larry J. Leopardi
Director and Chief Engineer
Department of Facilities Maintenance
1000 Uluohia Street, Suite 215
Kapolei, Hawaii 96707

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Leopardi:

Thank you for your comments of March 19, 2003 regarding the subject project. We understand that your agency does not have any comments at this time but will reserve comments when the construction documents are submitted for your agency's review.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 309 • KAPOLEI, HAWAII 96707
TELEPHONE: (808) 692-5561 • FAX: (808) 692-5131 • INTERNET: www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

WILLIAM D. BALFOUR, JR.
DIRECTOR

EDWARD T. "SKIPPA" DIAZ
DEPUTY DIRECTOR

March 24, 2003

TO: ERIC G. CRISPIN, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

FROM: WILLIAM D. BALFOUR, JR., DIRECTOR

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
GENTRY EWA MAKAI

Thank you for the opportunity to review and comment on the Environmental Impact Statement relating to the Gentry Ewa Makai project.

The EIS states in Section 5.9.5, page 5-63, that the 3.5-acre park in the eastern portion of the site will be part of a larger 10.3-acre park, but the accompanying maps and exhibits do not identify the adjacent park that the 3.5-acre park will be combined with.

Please send us a map and description of the adjacent 7 plus acre property and provide the timetable for the turnover of both of these parcels to the City and County of Honolulu for park purposes.

Should you have any questions, please contact Mr. John Reid, Planner, at 692-5454.

W. D. Balfour, Jr.
WILLIAM D. BALFOUR, JR.
Director

WDB:mk (J. Reid, EOS)
(23042)

cc: Mr. Don Griffin, Department of Design and Construction
Mr. Tim Hata, Department of Planning and Permitting
Mr. Taeyong Kim, Environmental Communications, Inc.

Environmental Communications, Inc.

July 29, 2003

Mr. William D. Balfour, Jr.
Director
Department of Parks and Recreation
1000 Uluohia Street, Suite 309
Kapolei, Hawaii 96707

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Balfour:

Thank you for your comments of March 24, 2003 regarding the subject project. As requested, Figure 7 has been revised in the Final Environmental Impact Statement to identify the adjacent park lands along the eastern portion of the project site.

A copy of the park plan and a project description will be transmitted to the Department of Parks and Recreation. A timetable for the turnover of the park parcels has not yet been determined however this information will be provided to your department as soon as a dedication timetable is established.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET • HONOLULU, HAWAII 96813
TELEPHONE (808) 523-4414 • FAX (808) 527-6743 • INTERNET www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

ERIC G. CRISPIN, AIA
DIRECTOR

BARBARA KIM STANTON
DEPUTY DIRECTOR

2002/ED-11 (TH)

May 14, 2003

Mr. Taeyong Kim, Principal
Environmental Communications, Inc.
1188 Bishop Street, Suite 2210
Honolulu, Hawaii 96813

Dear Mr. Kim:

Draft Environmental Impact Statement (DEIS)
Gentry Ewa Makai, Oahu, Tax Map Key: 9-1-069:005 and 9-1-010:007

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

1. Sections 4.3 and 5.8.3 of the DEIS does not adequately address our drainage comments contained in our letter of February 10, 2003.

   - Sections 4.3 and 5.8.3 of the Final EIS (FEIS) should provide an expanded discussion explaining the type of drainage facilities that will be constructed to handle storm water runoff for both the eastern and western portions of the project prior to discharging the storm water runoff into the Kaloi Gulch extension.

   - Second, the FEIS should identify where these facilities will be located (i.e., on-site or off-site) relative to both the eastern and western portions of the project site.

   - Third, the FEIS should disclose how soil erosion will be mitigated during construction; and what types of Best Management Practices will be employed during construction to control soil erosion, per the Department of Planning and Permitting's (DPP) Rules Relating to Soil Erosion Standards and Guidelines.

2. In our comments on the EISPN, we requested that the DEIS "...provide maps that show relevant land use information including but not limited to state and county land use designations..." However, the DEIS does not provide a graphic showing a portion of the Ewa Development Plan (DP) Urban Land Use Map. Providing the correct graphic is important because the land use information shown on the Ewa DP Urban Land Use Map differs from the land use information shown on Figure 19, which is a portion of the Ewa DP Public Facilities Map. For instance, Figure 19 does not show two "Community Commercial Centers" that are shown on the Ewa DP Urban Land Use Map and located in Ewa Beach; and on TMK: 9-1-069:009, which abuts the western portion of the Gentry Ewa Makai project and is currently zoned B-2 Commercial Business District.

   The FEIS should include a portion of the Ewa DP Urban Land Use Map to supplement the discussion regarding the Ewa DP in Section 6.2.2.

3. In our comments on the EISPN, we specified that the Gentry Ewa Makai-West Sewer Master Plan needs to be revised because the project has changed since the original sewer master plan was approved by the DPP in November 1999. Further, we stated that the revised sewer master plan needs to be listed in the "Permits Required section of the DEIS. However, Sections 2.10.3 and 5.8.2 of the DEIS fail to mention that the applicant needs to revise the previously approved sewer master plan, nor does it mention revising or submitting a new sewer master plan for the Gentry Ewa Makai East project site. Though your response to our comments dated February 26, 2003 states that these plans will be revised and listed in the DEIS, Section 3.0 does not mention these revised sewer master plans.

   Therefore, the FEIS should disclose that the DPP requires revised sewer master plans for both the Gentry Ewa Makai West and East portions of the project. Further, these revised master plans need to be listed in Section 3.0 of the FEIS.

4. We have the following comments regarding traffic:

   - The Traffic Impact Analysis Report (TIAR) in Appendix J of the DEIS should be revised by using a more conservative time frame consistent with the anticipated build-out or growth rate of the various stages of the Gentry Ewa Makai. The time frame the DPP recommends using is based on the 2005 to 2017 time frame contained in Table 1 on page 2-5 of the DEIS. This time frame should also account for the associated traffic being generated by Haseko's development at Ocean Pointe. During the zone change process the DPP and the applicant will discuss the timing for submitting the revised TIAR.

- Please be aware that after the revised TIAR is submitted to the DPP, we will be asking the applicant to provide the DPP with periodic updates of the TIAR at predetermined intervals to be agreed on by the applicant and the DPP. Periodic updates of the TIAR should validate the estimated traffic from the initial TIAR and establish when anticipated traffic signal warrants will be met.

- The applicant will need to submit a roadway master plan to the DPP prior to submittal of subdivision applications. The roadway master plan should establish roadway alignments and cross-sections and anticipated lengths of auxiliary turning lanes. Alternate transportation modes, such as bicycling, pedestrian and bus routing and traffic calming measures should also be included and addressed.

5. Finally, for any long-range issues (i.e., regional traffic and drainage) where the potential impacts or concerns cannot be anticipated or mitigated, this should be acknowledged and addressed in an "Unresolved Issues" section of the FEIS. These unresolved issues should also be summarized in the applicable sections in the body of the FEIS text.

6. We are still reviewing possible additional comments for this EIS. A meeting is being scheduled to discuss these remaining issues before the comments are finalized.

Should you have any questions, please contact Tim Hata of our staff at 527-6070.

Sincerely yours,

ERIC G. CRISPIN, AIA
Director of Planning and Permitting

EGC:mo

cc: Office of Environmental Quality Control
Gentry Investment Properties, Attn: Ms. Debra Luning

p:/Division Function/ea-eis/2002/Gentry Ewa Makai/deis doc

Environmental Communications, Inc.

July 29, 2003

Mr. Eric G. Crispin, AIA
Director of Planning and Permitting
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Crispin:

Thank you for your comments of May 14, 2003 regarding the subject project. We have reviewed your comments and offer the following:

1. Drainage

Sections 4.3 and 5.8.3 have been revised and expanded to include a more detailed discussion on the existing drainage conditions and the proposed drainage improvements planned for the project. The drainage discussion identifies the separate drainage systems that have been planned for the western and eastern sides of the project.

Drainage improvements for both the eastern and western portions of the site are shown in a new Figures 20 through 23. These figures show the existing drainage flow patterns as well as the proposed drainage master plans for the Ewa Makai-East and Ewa Makai-West sites.

Sections 4.3 and 8.3 have been revised to include a statement that discusses Best Management Practices that may be employed to control soil erosion. Measures that may be used include the use of field grass, hydromulch, mats, and site clearing at the last practicable moment to prevent or minimize soil exposure. Measures to prevent soil runoff into street drains include the use of sand bags or screens at drain entrances.

2. Ewa Development Plan Urban Land Use Map

Figure 26 has been replaced with the Ewa Development Plan Urban Land Use Map. The replacement map includes the Ewa Beach area to show the location of the nearest "Community Commercial Centers".

3. Sewer Master Plan

We understand that the revised sewer master plans for the 'Ewa Makai-East and 'Ewa Makai-West sites may need to be submitted to the Department of Planning and Permitting for approval. This information has been added to Sections 2.10.3, 3.3.4, and 5.8.2 of the Final Environmental Impact Statement. We apologize for this omission in the Draft EIS and assure you that this information is now included in the Final EIS document.

4. Traffic

We understand that you have concerns regarding the time frames used by the Traffic Impact Analysis Report (TIAR). According to the project traffic consultant, the timeframes used in the TIAR are considered to be conservative. In the event that the development period is extended beyond the proposed development timeframe, traffic impacts will actually be less since the proposed regional traffic improvements will be built regardless of the status of the 'Ewa Makai project. We understand that your department will request additional TIAR information during the zone change process and will coordinate the scheduling of this revised report with your office.

We also stand advised that your department will be requesting periodic updates of the TIAR at predetermined intervals to be agreed upon. A roadway master plan will also be submitted to your department for review and approval prior to the submittal of subdivision applications. It is our understanding that these plans should include: roadway alignment, cross-sections, turning lane lengths, and should also alternative transportation modes.

5. Long-Range Issues

Long-range issues that cannot be anticipated or mitigated are addressed in Section 8.4 of the Final EIS. This section has been revised to add that drainage and sewer system issues remain however this are issues that are anticipated to be resolved through appropriate review with the applicable County and State agencies.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR • HONOLULU, HAWAII 96813
TELEPHONE (808) 523-4529 • FAX (808) 523-4730 • INTERNET www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

CHERYL D. SOON
DIRECTOR

GEORGE "KEOKI" MIYAMOTO
DEPUTY DIRECTOR

Ta-yong Kim

April 21, 2003

TP3/03-22902R

MEMORANDUM

TO: ERIC G. CRISPIN, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTN: TIM HATA

FROM: CHERYL D. SOON, DIRECTOR

SUBJECT: GENTRY EWA MAKAI

In response to the March 8, 2003 letter from Environmental Communications, Inc., we reviewed the draft environmental impact statement (DEIS) for the subject project. The following comments are the result of this review:

1. All existing and proposed roads should be identified as City, State or private jurisdiction.

2. Section 2.1 on Page 2.1 references the Ewa by Gentry Master Plan. This plan should have been included in the DEIS as we requested in our previous comments.

3. The reference to "Roads" that appears in the Development Summary table on Pages 2-2 and 2-9 should be clarified to specify whether these "Roads" are internal roads.

4. Table 1, **Estimated Development Timetable for Ewa Makai**, on Page 2-5 should indicate when the roadways would be completed and ready for use, as requested in our previous comments.

5. The figure on Page 2-9 should be revised as follows:

   - This figure should be numbered or labeled as a figure.
   - The internal roads should be identified and the development areas labeled as "areas" consistent with the information in Table 1 on Page 2-5.
   - The 20-acre commercial site should be clearly labeled as not part of this development.

6. The first sentence in the paragraph regarding Kapolei Parkway that appears on Page 5-15 should be revised. Kapolei Parkway is constructed between the south end of the Ewa by Gentry property line and the OR&L right-of-way. However, it is open to traffic from Launahele Street and Kolowaka Street. The second sentence should be revised to reflect that parking is prohibited on both sides of Kapolei Parkway.

7. Section 5.2.9 on Page 5-20 should include a discussion of the capacity levels of Fort Weaver Road and the H-1 Kunia on-ramp as requested in our previous comments. The existing traffic conditions on Fort Weaver Road are limited by its capacity. These conditions cannot be mitigated by further traffic signal adjustments.

8. Section 5.2.12 on Page 5-21 should include current information on plans for a contra-flow lane on Fort Weaver Road as previously requested.

9. The Kapolei Parkway discussion in Section 5.2.12 on Page 5-21 should include a timetable projecting when each uncompleted segment will be completed, as requested previously. In addition, the right-of-way width and number of lanes to be provided should also be included. Since Kapolei Parkway will connect to North-South Road, the right-of-way widths and number of lanes should be coordinated.

10. On Page 5-25, the Section 5.2.18 descriptions of two of the three unsignalized intersections analyzed should be clarified. Entrance B is described as Access Road to Parcel 34D, but in the figures provided in the DEIS, there is no Parcel 34D. Also, Entrance C is described as Access to Parcels 16, 17 and 34A. In the figures provided, it appears that Entrance C is the access for Area 17 only.

11. Section 8.4 **Unresolved Issues** states in part that the proposed bus rapid transit (BRT) project remains as a planning study with an unknown development timetable. The BRT project has developed an implementation timetable that shows the phasing of the Regional BRT to begin in 2006 with the a.m. zipper lane extension. The p.m. zipper lane would then be constructed, followed by the extension of the zipper lane to H-2. The construction of the Kapolei Transit Center and the North-South Road Park-and-Ride are also included in the schedule. Coordination with this department regarding the BRT project and other public transit services is imperative.

12. The following comments are regarding Appendix J, Traffic Impact Analysis, Ewa by Gentry Makai Development:

   a. The discussion regarding Kapolei Parkway that appears in Section II.A. on Page 6 should be revised as stated in Comment No. 6.
   b. Figure 7 should be consistent with Figure 9. Also, Figure 7 shows a Street A, that appears to cut through Hawaii Prince Golf Course and is similar to the proposed Keaunui Drive extension. It should be verified that this street would be developed without the proposed project.
   c. Figure 8 should be consistent with Figure 9.
   d. The descriptions of Entrances B and C that are in Section III.F.1. on Page 25 should be clarified as stated in Comment No. 10.
   e. The reference to Parcel 34A that appears in Section IV.A.3 on Page 33 should be clarified, along with Figure 2.

Should you have any questions regarding these comments, please contact Faith Miyamoto of the Transportation Planning Division at Local 6976.

Cheryl D. Soon
CHERYL D. SOON

cc: Mr. Taeyong Kim
Environmental Communications, Inc.

[illegible]

July 29, 2003

Ms. Cheryl D. Soon, Director
Department of Transportation Services
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Ms. Soon:

Thank you for your comments of April 21, 2003 regarding the subject project. We have reviewed your comments and offer the following:

1. Road Jurisdiction

Jurisdictions for major roadways are now stated in the headings of Section 5.2.2. All other internal roads within the project scope will be either dedicated to the City and County of Honolulu or held under private ownership. Final design of the internal roadway system has not been completed at this time therefore it is unknown which roads will be designed to City standards for dedication purposes.

It should be noted that Fort Weaver Road and Kapolei Parkway are excluded from the road area calculations as noted in the footnote in the graphic key.

2. Ewa by Gentry Master Plan

A new graphic is included as Figure 5 which shows the entire master planned Ewa by Gentry community.

3. Development Summary Table

The Development Summary Table has been revised to clearly state that the road areas included in the area total are internal roads.

4. Estimated Development Timetable

Timeframes for roadway construction are included in the Estimated Development Timetable shown as Table 1 of the FEIS. This table is year specific, and it should be assumed that roadways serving any area will be complete prior or upon the completion of housing units in the respective development. It should be noted that an internal roadway master plan has not yet been developed. A roadway master plan will be completed and submitted for review to the City and County of Honolulu prior to the submittal of any subdivision applications.

5. Master Plan Figure

The master plan figure has been labeled as Figure 7 and is now found on page 2-6. In addition, a new figure showing the relationship with the overall Ewa by Gentry project has been added as Figure 5 on page 2-4. Internal roadways have not yet been designed and are therefore not labeled. Internal roadway plans are subject to DTS review and approval and will be submitted later in the planning and approval process. The 20-acre commercial site is labeled in the graphic key as belonging to Campbell Estate and is not figured in the area calculations.

6. Kapolei Parkway Description

Your corrections to Section 5.2.2 have been made under the heading of Kapolei Parkway. The section now states that Kapolei Parkway is open to traffic between Launahele Street and Kolowaka Street, and that Gentry Homes, Ltd. has completed the Parkway to its ultimate width between the makai end of Ewa by Gentry and the OR&L right-of-way. This section has also been revised in the FEIS to state that parking is restricted along Kapolei Parkway but is allowed for a short segment near Geiger Park between Geiger Road and Kahiuki Street.

7. Fort Weaver Road and the Kunia On-Ramp

A new statement has been added to Section 5.2.9 which states that: With respect to the capacity of the Fort Weaver Road and the H-1 Kunia Interchange On-Ramp, both the Ewa Highway Master Plan Year 2010 Highway Plan and the Transportation for Oahu Plan – TOP 2025 studies identify the capacity constraints of Fort Weaver Road and H-1 Kunia Interchange On-Ramp and use them as justification for improvements such as the North-South Road, the H-1 North-South Road Interchange, and the Kapolei Parkway.

8. Contraflow Lane on Fort Weaver Road

The widening of Fort Weaver Road is currently under final design and is on track to be constructed by 2006. Initial studies have indicated that contra-flow operation would not be desirable to implement with the existing four-lane configuration. The widening project will incorporate the ability to contra-flow traffic once Fort Weaver Road has been widened to six lanes. This information will be stated in Section 5.2.12.

9. Kapolei Parkway Timetable

Gentry Homes has already constructed Kapolei Parkway to its ultimate cross-section between a point south of Geiger Road to the OR&L right of way. The City & County of Honolulu has awarded construction contract for the segment of Kapolei Parkway between the OR&L right of way and Renton Road. Construction should be complete by summer of 2004. The segment of Kapolei Parkway between Renton Road and the future North-South Road will be needed as part of the access to the Hawaiian Home Lands residential parcels. The segment of Kapolei Parkway between Renton Road and North-South Road is currently under design, and this segment is expected to be constructed within the 2006 to 2007 time frame. Current plans of the State of Hawaii Department of Transportation calls for an initial three-lane North-South Road and half-diamond intersection on H-1 Freeway by the same 2006 to 2007 time frame. The time schedule for implementation of Fort Weaver Road and North-South Road were stated in a letter from Mr. Rodney Haraga, Director of the State of Hawaii Department of Transportation to Mr. Tim Hata of the City and County of Honolulu Department of Planning and Permitting, dated April 22, 2003. The time schedule for implementation of segments of Kapolei Parkway are based on telephone conversations between Ms. Debra Luning of Gentry Homes, Ltd. and Mr. Tim Steinberger, Acting Director, City and County of Honolulu Department of Design and Construction on February 20, 2003. These schedules are consistent with the assumption in the Traffic Impact Analysis Study (TIAR) for the Ewa by Gentry Makai Development, December 2002, that these improvements would be completed by the year 2010. When warranted, North-South Road will be expanded to its ultimate 6-lane cross-section and full diamond interchange will be constructed on H-1 Freeway. This ultimate configuration is assumed to occur by Year 2025 in the current Regional Transportation Plan. This information will be added to Section 5.2.12, Kapolei Parkway.

10. Entrance B and C

These entrances will provide access into Ewa by Gentry Makai parcels. Both will be updated in a revised TIAR to provide more specific descriptions of the parcels to be serviced. Entrance B is located on Kapolei Parkway and it will provide access to the makai portion of Area 14 on the Waianae side of Kapolei Parkway and Areas 38 and 39 on the Koko Head side of Kapolei Parkway. Entrance C is located on Geiger Road, and it will provide access to Area 17 within the existing Ewa by Gentry development and the proposed Area 44 within the Ewa by Gentry Makai development. The Final EIS will also state that Entrance B serves areas 14, 38 and 39, and that Entrance C serves parcels 16, 17 and Area 44. Figure 2 and appropriate sections of the revised TIAR text will be updated to reflect the current parcel designations.

11. Unresolved Issues

We stand corrected regarding the bus rapid transit system. Section 8.4 has been revised with the removal of the statement about the status of the BRT system and has been replaced by narrative stating that coordination with the DTS will me maintained to ensure that public transportation concerns are addressed.

12. Traffic Impact Analysis

All of your department's comments regarding the Traffic Impact Analysis for the Ewa by Gentry Makai Development are noted and addressed in responses 1 through 11 above. The FEIS has also been revised to reflect these clarifications and changes. The TIAR document included in the FEIS does not reflect all of your requested clarifications and changes but will be incorporated in a revised TIAR that will be prepared in accordance with the Department of Planning and Permitting's (DPP) comments of May 14, 2003.

This revised TIAR will be prepared on a schedule to be negotiated between the DPP and the applicant during the zoning process.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
3375 KOAPAKA STREET, SUITE H425 • HONOLULU, HAWAII 96819-1869
TELEPHONE: (808) 831-7761 • FAX: (808) 831-7750 • INTERNET: www.honolulufire.org

JEREMY HARRIS
MAYOR

ATTILIO K. LEONARDI
FIRE CHIEF

JOHN CLARK
DEPUTY FIRE CHIEF

March 21, 2003

TO: ERIC G. CRISPIN, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

ATTENTION: TIMOTHY HATA, PLANNER
POLICY PLANNING BRANCH

FROM: ATTILIO K. LEONARDI, FIRE CHIEF

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
GENTRY EWA MAKAI PROJECT

We received a letter dated March 8, 2003, from Taeyong M. Kim of Environmental Communications, Inc., requesting our review and comments on the above-mentioned project.

The Honolulu Fire Department (HFD) requires that the following be complied with:

1. Provide a private water system where all appurtenances, hydrant spacing, and fire flow requirements meet Board of Water Supply standards.

2. Provide a fire department access road within 150 feet of the first floor of the most remote structure. Such access shall have a minimum vertical clearance of 13 feet 6 inches, be constructed of an all-weather driving surface complying with Department of Transportation Services (DTS) standards, capable of supporting the minimum 60,000-pound weight of our fire apparatus, and with a gradient not to exceed 20%. The unobstructed width of the fire apparatus access road shall meet the requirements of the appropriate county jurisdiction. All dead-end fire apparatus access roads in excess of 150 feet in length shall be provided with an approved turnaround having a radius complying with DTS standards.

3. Submit civil drawings to the HFD for review and approval.

Should you have any questions, please call Battalion Chief Lloyd Rogers of our Fire Prevention Bureau at 831-7778.

Sincerely,

Attilio K Leonardi

ATTILIO K. LEONARDI
Fire Chief

AKL/SK:bh

cc: Taeyong M. Kim, Environmental Communications, Inc.

July 29, 2003

Mr. Attilio K. Leonardi
Fire Chief
Fire Department
City and County of Honolulu
3375 Koapaka Street, Suite H425
Honolulu, Hawaii 96819-1869

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Chief Leonardi:

Thank you for your comments of March 21, 2003 regarding the subject project. We have reviewed your comments and offer the following:

1. We understand that the project water system must provide appurtenances, hydrant spacing, and fire flow volumes that meet Board of Water Supply standards.

2. The project has been planned to provide fire department access roads that are in compliance with Fire Department and Department of Transportation Services standards applicable to the support of fire apparatus vehicles.

3. Civil engineering drawings will be provided to the Honolulu Fire Department for its review during the building permit approval process.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111
http://www.honolulupd.org
www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

LEE D. DONOHUE
CHIEF

GLEN R. KAJIYAMA
PAUL D. PUTZULU
DEPUTY CHIEFS

OUR REFERENCE GL-DK

April 10, 2003

Mr. Taeyong M. Kim
Environmental Communications, Inc.
P.O. Box 536
Honolulu, Hawaii 96809

Dear Mr. Kim:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement for the Gentry Ewa Makai project.

During its construction, this project may have a negative impact on calls for police services in the area because of dust, noise, and traffic complaints. However, when it is completed, there should be negligible impact. It would be advisable for the contractor to work directly with Acting Major Gregory Lefcourt of District 8 (Kapolei) as a means of minimizing any anticipated problems.

If there are any questions, please call Acting Major Lefcourt at 692-4253.

Sincerely,

LEE D. DONOHUE
Chief of Police

By
KARL GODSEY
Assistant Chief of Police
Support Services Bureau

Serving and Protecting with Aloha

Environmental Communications, Inc.

July 29, 2003

Mr. Lee D. Donohue
Chief of Police
Police Department
City and County of Honolulu
801 South Beretania Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Chief Donohue:

Thank you for your comments of April 10, 2003 regarding the subject project. We understand that the number of police service calls in the project area may increase during the construction period due to the increase in dust, noise and construction related traffic. The developer will be advised to coordinate construction activities with the appropriate authority at District 8 to minimize any potential construction impacts. We concur that the completed project should not significantly impact police services.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

[illegible]

515 Kamakee Street Honolulu, Hawaii 96814
P.O. Box 3000 Honolulu, Hawaii 96802-3000
Telephone 808.535.5900 Facsimile 808.594.5630 Sales

THE GAS COMPANY

March 31, 2003

Department of Planning and Permitting
650 South King Street
Honolulu, Hawaii 96813

Attention: Mr. Tim Hata

Gentlemen:

Subject: Draft Environmental Impact Statement for the
Gentry Ewa Makai Project

Please be advised that The Gas Company maintains underground utility gas mains in the project vicinity, which serves commercial and residential customers in the area and is interconnected with the utility network in Ewa. We would appreciate your consideration during the project planning and design process to minimize any potential conflicts with the existing gas facilities in the project area.

Thank you for the opportunity to comment on the Draft Environmental Impact Statement. Should there be any questions, or if additional information is desired, please call Chris Anderson at 594-5564.

Sincerely,

Charles E. Calvet, P.E.
Manager, Engineering

CEC:...
03-122

cc: ✓Mr. Taeyong Kim, Environmental Communications, Inc.

July 29, 2003

Mr. Charles D. Calvet, P.E.
Manager, Engineering
The Gas Company
P.O. Box 3000
Honolulu, Hawaii 96814

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Calvet:

Thank you for your comments of March 31, 2003 regarding the subject project. We stand advised that The Gas Company has underground utility gas mains in the project vicinity. The project engineers will be notified and directed to plan accordingly to minimize any potential conflicts with the existing gas lines and facilities.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

HASEKO

HASEKO (Ewa), Inc.

April 9, 2003

Mr. Eric G. Crispin, AIA, Director
City and County of Honolulu
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, Hawaii, 96813

Attention: Tim Hata

Dear Mr. Crispin:

Draft Environmental Impact Statement
Gentry 'Ewa Makai

We offer the following comments, related to the continuation of conditions addressing regional drainage requirements and concerns over the potential for incompatible adjacent uses.

Both the Ocean Pointe and Gentry 'Ewa Makai properties are within the 10-square mile Kaloi Gulch Watershed, which extends back to the Waianae Range. Ocean Pointe is the makai-most ongoing development within the Kaloi Gulch Watershed. Gentry 'Ewa Makai is immediately mauka of Ocean Pointe. While little runoff, even during extreme storms, presently reaches the Ocean Pointe property, the ongoing urbanization of the watershed will significantly increase - surface runoff. It has been estimated that at full urbanization a 100-year storm event could result in 10,000 cubic feet per second of storm water flowing to Ocean Pointe.

HASEKO is committed to the orderly development of the region and, along with other development interests (including Gentry Development Company, who committed to various drainage related and flood control improvements in their 1994 rezoning of the lands above and adjacent to the properties covered in this impact statement), recognizes that the cooperation of all developers on a number of issues is essential. Previous State Land Use and Zoning boundary amendments have included conditions of approval requiring the necessary drainage improvements, including on-site siltation basins and provisions to share, on a pro rata basis, in costs incurred by the City, or others, to dredge the future marina, or the Pacific Ocean in the event the marina has not yet been constructed, for silt contributed by the project.

820 Mililani Street, Suite 820 • Honolulu, Hawaii 96813-2938 • Phone (808) 536-3771 • Fax (808) 538-7654

We are also concerned about the potential incompatibility between the proposed 30-acre Commercial-Industrial Mixed Use area adjacent to the Ocean Pointe sites approved, and presently being developed, for a City park, State school, and low density apartment residential uses. The Land Use Ordinance permits a number of uses which may not be the most appropriate uses adjacent to schools, parks or residential areas. Such uses may include base yards, manufacturing, and warehousing.

We encourage the proposed school, park, and residential uses in Gentry's 'Ewa Makai be located in the vicinity of the previously approved park, school, and residential uses in Ocean Pointe. Depending on the precise uses in the Industrial-Commercial development proposed, the area may be more appropriately cited along Fort Weaver Road in the mauka area of the proposed development.

Thank you for this opportunity to comment.

Very truly yours,

Tsutomu Sagawa
Executive Vice President

TS/BM:dsl

cc: Debra Luning, Gentry Investment Properties
Taeyong Kim, Environmental Communications

July 29, 2003

Mr. Tsutomu Sagawa
Executive Vice President
Haseko (Ewa), Inc.
820 Mililani Street, Suite 820
Honolulu, Hawaii 96813-2938

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Sagawa:

Thank you for your comments of April 9, 2003 regarding the subject project. We have reviewed your comments and understand that Haseko is concerned about regional drainage issues and the potential for incompatible uses adjacent to Ocean Pointe.

We share your concern regarding regional drainage impacts and remain committed to providing the necessary drainage improvements that the project will require.

You also express concern about the potential incompatibility between the proposed 30-acre commercial-industrial mixed use area in Ewa Makai and the park, elementary school, and low-density apartments currently planned for Ocean Pointe. As you know, the commercial-industrial area in Ewa Makai was on Gentry's master plan prior to Haseko deciding to amend its land use plan for Ocean Pointe. The original Ocean Pointe plan called for the development of a park and golf course adjacent to the C/I area thereby averting any potential "conflicts." Gentry, in fact, pointed this out when commenting on Haseko's proposed rezoning request by stating that we would defer to the DOE regarding the appropriateness of siting an elementary school next to the C/I area. Because a decision has been made by DOE and the City regarding the revised zoning for Ocean Pointe, we would like to assure you that any conflict should be negligible. The IMX-1 district is intended to promote and maintain a viable mix of light industrial and commercial uses to provide employment and to serve the surrounding community without exposing non-industrial uses to unsafe and unhealthy environments. Thus, the types of businesses anticipated will be clean, non-polluting, and compatible with the surrounding neighborhood. There will also be a heavily landscaped buffer between the Ocean Pointe park, school, and residences and the Gentry C/I area, thus minimizing any visual, noise, or other impacts that may affect adjacent or nearby properties.

We appreciate your review of the Draft Environmental Impact Statement and will include your comments in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

April 25, 2003

Ms. Debra M.A. Luning
Gentry Homes, Ltd.
560 N. Nimitz Hwy, Suite 300
Honolulu, Hawaii 96817

Dear Ms. Luning:

Subject: Comments to Draft Environmental Impact Statement - Gentry Ewa Makai, Ewa District, Oahu, Hawaii

We have reviewed the subject document and have the following comments:

1. HECO will need to coordinate the installation of the electrical infrastructure within the development as well as along Kapolei Parkway for 12kV distribution lines and one or two 46kV subtransmission lines to a new substation in the Ocean Pointe subdivision that will serve both the Gentry Ewa Makai and the Ocean Pointe subdivisions. This new substation will be situated off Kapolei Parkway adjacent to the property designated for use as a middle school. It is HECO's understanding that there will also be a sewage pumping station on the southeastern corner of the middle school site. HECO strongly recommends that the developer coordinate with the Department of Education to ensure that the planned utilities are a compatible use with that of the middle school.

2. As mentioned above, the routing of one or two 46kV subtransmission lines along Kapolei Parkway to serve the new HECO substation is normally planned to be installed overhead on wood or steel poles. If the developer desires that these lines be placed underground, adequate ducts and manholes sized to accommodate these 46kV subtransmission lines should be installed along with those required for the electric 12kV distribution lines, telephone, cable TV and street lighting cables.

3. In order to properly plan for reliable electrical service to the Gentry Ewa Makai development, HECO will need to have electrical load projections and the timing of when these loads will materialize. HECO is also available to provide energy efficiency consulting services to the developer.

I would appreciate your keeping HECO informed of your electrical design plans and construction schedule. You can contact me at 543-7516 or fax 543-7099.

Sincerely,

Francis Hirakami
Principal Engineer

Environmental Communications, Inc.

July 29, 2003

Mr. Francis Hirakami
Principal Engineer
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Subject: Draft Environmental Impact Statement
Gentry Ewa Makai

Dear Mr. Hirakami:

Thank you for your comments of April 25, 2003 regarding the subject project. We offer the following in response to your comments.

1. We understand that close coordination will be required for the planning and installation of electrical infrastructure for both the Ocean Pointe and Gentry Ewa Makai projects. We also note that a new substation will be located adjacent to the middle school site. Discussions with the Department of Education (DOE) will be initiated to ensure that the selected site is deemed appropriate for DOE use.

2. It is the developer's intent to locate the 46kV transmission line(s) underground. Your office will be kept informed as the infrastructure design progresses to ensure that adequate facilities are planned and developed to accommodate the underground lines.

3. Electrical load projections for the project have not yet been determined. HECO will be consulted as these figures are developed and appropriate coordination will be maintained throughout the planning and design process.

We appreciate your review of the Draft Environmental Impact Statement and will include your comment in the Final Environmental Impact Statement.

Sincerely,

Taeyong Kim
Environmental Communications, Inc.

APPENDIX A

EWA MAKAI

PROJECT MASTER PLAN

January 2003

TABLE OF CONTENTS

TABLE OF CONTENTS, cont'd

EXHIBITS

Introduction

The Project Master Plan for Ewa Makai is a guide that describes how the project will promote the vision, policies, and guidelines for Ewa as set forth in the Ewa Development Plan (Ewa DP). The Ewa DP, adopted in 1997, provides conceptual, long-range visions and policies to guide land use and infrastructure decisions affecting the Ewa region.

This Project Master Plan for Ewa Makai follows the format and key elements described in Section 5.4.2 of the Ewa DP.

Project Description

The 283-acre Ewa Makai development will be a continuation of the existing Ewa by Gentry community. Ewa by Gentry, which is situated to the north of the Ewa Makai parcels, is a 1,000-acre planned development that will consist of approximately 7,200 homes at build out. About 5,100 homes have been completed thus far. The complementary phases of the Ewa Makai and the Ewa by Gentry communities will facilitate more effective overall planning and provision of required infrastructure for the entire master planned community.

Major Planned Land Uses

The Conceptual Master Plan for the Subject Property, which consists of approximately 283 acres, includes the following land uses: approximately 550 single family detached units (93 acres), 675 cluster units (64 acres), 640 multi-family units (32 acres), community facilities (24 acres) (including a middle school, a community recreation center complex, and two church sites), an industrial/commercial complex (30 acres), parks (11.5 acres), open space for infrastructure/drainage (14 acres), and roadways (14.5 acres). A copy of the Conceptual Master Plan is included as Exhibit A on the following page.

The following is a brief description of the major land use elements of the Ewa Makai Conceptual Master Plan:

<u>Residential</u>

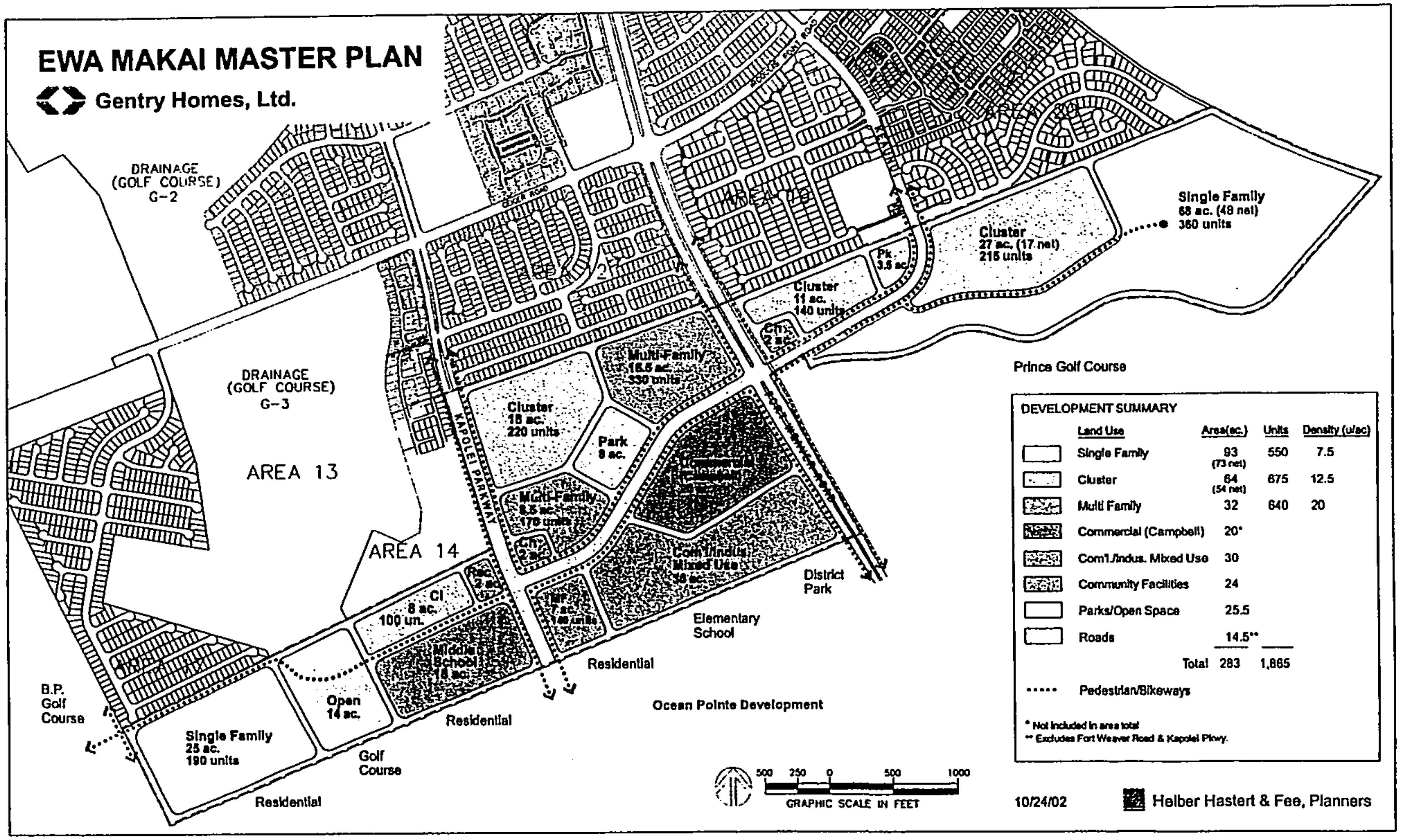
Approximately 550 single family homes, 675 single family cluster homes and 640 multi-family units are planned for development on the Subject Property. These units are intended to meet the housing needs of a spectrum of income and age groups.

<u>Parks/Open Space Corridor</u>

The conceptual plan incorporates two neighborhood parks: an 8-acre park in Ewa Makai-West and a 3.5 acre park in Ewa Makai-East. The 8-acre park in Ewa Makai-West will be centrally located and within walking or biking distance for many area residents. The 3.5 acre park in Ewa Makai-East will be an extension of a planned 6.8 acre park in the existing Ewa by Gentry community, thereby increasing the overall park size to 10.3 acres. In addition, a 2-acre private community recreation center complex is planned in Ewa Makai-West for use by Ewa by Gentry residents, and additional private recreational areas may be developed in conjunction with individual residential developments.

The open space/drainage corridor will function as a collector for surface runoff and an aesthetic amenity extending from the makai end of the Coral Creek Golf Course in Ewa by Gentry to the mauka boundary of Haseko's planned golf course in Ocean Pointe. The channel through the project is planned to be a wide, grass-lined drainage way that will have a bottom width ranging from about 450 feet near the Gentry golf course boundary to about 330 feet at the Ocean Pointe boundary with 4:1 side slopes. The major drainage channel will be designed in accordance with City and County Storm

Exhibit A



DEVELOPMENT SUMMARY

Land Use	Area(ac.)	Units	Density (u/ac)
Single Family	93 (73 net)	550	7.5
Cluster	64 (54 net)	675	12.5
Multi Family	32	640	20
Commercial (Campbell)	20*		
Com'l./Indus. Mixed Use	30		
Community Facilities	24		
Parks/Open Space	25.5		
Roads	14.5**		
Total	283	1,865	

..... Pedestrian/Bikeways

* Not included in area total
** Excludes Fort Weaver Road & Kapolei Pkwy.

Drainage Standards in anticipation of dedicating the channel to the City. It is envisioned that the 14-acre drainage way will be an attractive, landscaped open space that could also provide for recreational activities.

Tentative site plans also call for the development of open space areas in Ewa East that will incorporate needed drainageways and retention/detention basins into attractive vegetated greenways and open space areas within the community.

Industrial-Commercial Area

A 30-acre industrial-commercial complex is intended as an adjunct to the future 20-acre Laulani Commercial Center. *(Note: The Laulani Commercial Center, which is not a part of the current land use petition and zone change, was processed separately by the landowner, Campbell Estate, and has already received its land entitlements.)* The 30-acre industrial-commercial complex is envisioned to provide services supplemental to the needs of the area and would also provide a source of employment for an estimated 1,500 full-time, part-time, and self-employment jobs at build-out.

Church/Day Care Sites

To address the spiritual and educational needs of the community, two 2-acre church sites are planned for both Ewa Makai-West and Ewa Makai-East. It is envisioned that the church sites will serve as centers for day care and/or other community services during the weekdays.

Community Recreation Center

Plans call for a 2-acre site to be dedicated to the Ewa by Gentry Community Association on which it will build a recreational facility for use by its residents. It is anticipated that such a community center will provide a meeting facility in which various functions and activities could take place, including parties, group meetings, and classes. The actual planned uses would be largely contingent on the community's needs and desires, and could include also such recreational amenities as a swimming pool, play courts, playground areas, etc.

Middle School

An 18-acre site will be dedicated to the State Department of Education for the development of a public intermediate or middle school. Plans for the school have not been drafted as yet.

Statement of Consistency with Ewa Development Plan Vision, Policies, Principles, and Guidelines

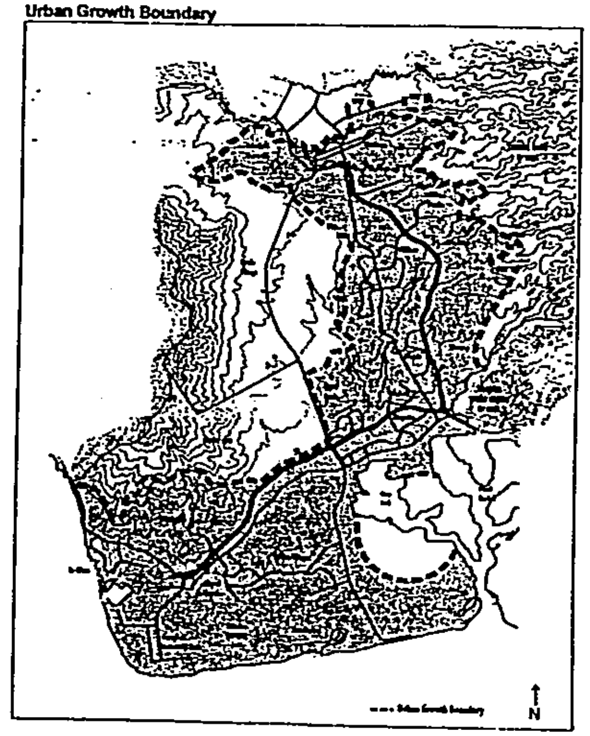
The Ewa Makai community will be consistent with the following key elements of the vision, policies, principles, and guidelines of the Ewa Development Plan. The Ewa Development Plan, adopted in 1997, provides conceptual, long-range visions and policies to guide land use and infrastructure decisions affecting the Ewa region. The Ewa Makai community will be consistent with the Ewa Development Plan in the following respects:

1. CONSISTENCY WITH EWA DP VISION
   Ewa Makai is consistent with the following key elements of the vision:

   Urban Growth Boundary – *"The Urban Growth Boundary for Ewa was drawn to give long-range protection from urbanization for over 3,000 acres of prime agricultural land and for preservation of open space while providing adequate land for urban development in Ewa for the foreseeable future."*

   The Ewa Makai development lies within the Urban Growth Boundary for Ewa as shown on the map below.

Urban Growth Boundary



Open Space and Greenways – *"A network of Open Space and Greenways will link the Secondary Urban Center and associated employment centers, new master planned residential developments and revitalized established communities, an Ewa shoreline park, and a major regional park and recreation complex at Kalaeloa."*

The proposed development will be an extension of the Ewa by Gentry master planned community, which incorporates an open space network within the community. Significant acreages of open space will be retained in parks, as well as in the landscaped drainageways and retention areas that will provide visual greenbelts in the Ewa Makai development. The community is also adjacent to agricultural lands in the West Loch Naval Magazine Blast Zone and the Coral Creek, Barbers Point and Hawaii Prince golf courses, all of which are designated as part of the regional open space system. Greenway corridors include the Kapolei Parkway and Fort Weaver Road.

Kalaeloa Regional Park and Recreation Complex – *"A major Regional Park and Recreation Complex at Kalaeloa will provide needed open space, recreation opportunities, and access to the beaches and ocean."*

A bikepath through Ewa Makai will serve to link the community with the proposed regional park.

Master Planned Residential Communities – *"A network of master planned residential communities will provide a wide variety of housing and accommodate the need for affordable housing."*

Laulani and Fairways (aka Ewa Makai-West and Ewa Makai-East, respectively) are among the planned residential communities slated for development in the Ewa Development Plan area. These units are intended to meet the needs of a spectrum of income and age groups, and will include entry-level, move-up, and other types of housing units.

Communities Designed to Support Non-Automotive Travel – *"The master planned residential communities will be designed or redeveloped to support pedestrian and bike use within the community and transit use for trips outside the community."*

As an extension of the Ewa by Gentry master planned community, the project will support pedestrian and bicycle use through the development of sidewalks and bikepaths within the community and along Fort Weaver Road. Ewa Makai will also be designed to accommodate City bus service along its main streets, and will be located in proximity to a ferry service that is currently in the planning stages.

Conservation of Natural Resources – *"Ewa Natural Resources, including potable water, coastal water quality, and wetlands and other wildlife habitat, will be conserved by:*

- *Developing a dual water distribution system with potable water for drinking and other clean water uses, and non-potable water for irrigation and industrial use.*

- *Designing the regional drainage and wastewater treatment system to minimize non-point source pollution of the ocean and Pearl Harbor.*
- *Protecting valuable habitats for endangered waterbirds located in Batis Salt Marsh in Ewa Marina and in the West Loch of Pearl Harbor and for endangered plants located within Barbers Point Naval Air Station and elsewhere."*

A dual water distribution system is currently being used in Ewa by Gentry, and will continue to be used in Ewa Makai where feasible. Additionally, the drainage and wastewater treatment systems in Ewa Makai will be designed as part of a regional system to minimize non-point source pollution of the ocean. Ewa Makai does not contain any endangered flora or fauna and is not sited on the Ewa DP map of key natural resources.

Preservation and Enhancement of Historic and Cultural Resources – There are no known historic or cultural sites in Ewa Makai. However, mauka views of the Waianae Range and views of central Honolulu and Diamond Head will be retained to the extent feasible.

Phased Development – Ewa Makai will be consistent with the phased development component of the Ewa Development Plan in the following respects:

- It will provide **increased land supply** to support economic development and job creation and to accommodate residential growth with an emphasis on providing affordable housing and a diversity of housing types.

- It will provide for **moderate growth of an industrial-commercial center in an Urban Fringe Area** to primarily serve the needs of the surrounding residential communities.

- It is **consistent with the phasing plan** to support residential and commercial development. The Fairways and Laulani Residential projects (Ewa Makai-East and Ewa Makai-West) and the 30-acre Laulani Industrial project are listed in the Phase I development timetable (1997-2005)

- There will be **adequate facilities** to ensure that development does not outpace infrastructure development.

- There will be **public and private sector coordination on infrastructure** needs to support the directed growth strategy of the General Plan.

2. CONSISTENCY WITH EWA DP LAND USE POLICIES, PRINCIPLES, AND GUIDELINES

The vision for the development of Ewa will be implemented through the application of general land use policies, principles, and guidelines. The Ewa Makai development will be consistent with these policies, principles, and guidelines, as follows:

a. <u>Open Space Preservation and Development</u>

Planning Principles -- Planning principles that will guide the development of Ewa Makai include the following:

Visual and Physical Definition of Urban Areas. "Within the Urban Growth Boundary, the open space system should visually distinguish and physically separate individual communities, neighborhoods, and land use areas in Ewa."

The Ewa by Gentry community, of which Ewa Makai will be an extension, will be visually distinguished by the open space system. It is bordered on the east by the agricultural areas of the U.S. Navy Blast Zone, to the south by the Hawaii Prince Golf Course, and to the west by the Kalaeloa Golf Course. Portions of the southern boundary will be bordered by the future Ocean Pointe golf course and a 20-acre district park.

Passive and Active Open Spaces. "The open space system shall consist of areas in active use, as well as passive areas. Active areas include parks, golf courses, and agricultural fields. Passive areas include the State Conservation District, fallow land in the State Agriculture District, drainage and utility corridors."

Creation of Open Space Network. "The various types of open space should be linked as an open space network, with major open space areas connected by open space corridors along transportation routes, utility corridors, and drainageways."

Open space areas, in and around the Ewa Makai development, will be connected by greenways along major transportation corridors, as well as the open space drainageway that will be part of the Kaloi Gulch drainage system.

Dual Use of Drainageways and Utility Corridors. "To create the regional open space network, drainageways and utility corridors should be viewed as opportunities to link major open spaces with pedestrian and bike paths along open space corridors. To accommodate such uses, where possible, drainageways should be retained as natural or man-made vegetated channels rather than be replaced by concrete channels."

An open space area in Ewa Makai-West will extend from the Coral Creek Golf Course to the Ocean Pointe golf course, providing a natural drainage channel. A pedestrian/bike path will traverse through this open space and will connect parks within the community with the proposed Kalaeloa Regional Park and the shoreline.

Ewa Makai-East will have a vegetated drainageway leading to a retention/detention basin. This open space greenway will contain a pedestrian/bike path and other recreational features where appropriate.

Relation to Open Space Map

Appendix A of the Ewa DP shows components of the regional open space system. The Kaloi Gulch drainage channel in Ewa Makai-West, as well as the greenways along Kapolei Parkway and the Fort Weaver Road corridor are included as part of the open space system. Although there will be smaller community and neighborhood parks in Ewa Makai, these are not shown on the map because only island-wide, regional, and district parks are shown.

Guidelines
The following guidelines are relevant to Ewa Makai:

Natural Gulches and Drainageways. "Planned improvements to the Ewa drainage systems should be integrated into the regional open space network by emphasizing the use of retention basins and recreational access in the design approach."

As noted above, the drainage channel in Ewa Makai-West will form an open space link between the Coral Creek and Ocean Pointe golf courses.

The drainage system in Ewa Makai-East will consist of a dual use recreational/vegetated drainageway leading to a retention/detention basin at the eastern corner.

Greenways and Open Space Corridors. "The rights-of-way for major arterials and collector streets should be designed as landscaped parkways or greenways, complete with a landscaped median strip, landscaped sidewalk, and bikeways. Major arterials should have separate bike paths, and major collectors should have bike lanes. Suggested width for major arterials, including right-of-way and planting strips, is 120 feet wide and for major collectors is 100 feet wide."

The rights-of-way for major arterials and collector streets in Ewa Makai will conform to the above to the extent possible. Landscaped bike paths, sidewalks, and median strips (as applicable), are an integral part of the existing Ewa by Gentry community and will continue to play an important role in providing greenways and open space corridors in Ewa Makai.

b. **<u>Regional Parks and Recreation Complexes</u>** -- There are no regional parks or recreation complexes planned for Ewa Makai.

c. **<u>Community-Based Parks</u>**

General Policies -- General policies that will guide the development of parks in Gentry Makai include the following:

"Adequate parks to meet residents' recreational needs should be provided."

"New residential development should strive to provide land for open space and recreation purposes at a minimum of two acres of park per 1,000 residents."

Based on an estimated population of 5,595 residents (1,865 units x 3 persons per household), an estimated 11.2 acres of land should be provided for open space and recreation purposes in Ewa Makai. The Ewa Makai Master Plan far exceeds this requirement: 25.5 acres of land are being set aside for public parks and open space, and another 2 acres are being set aside for a private community recreation center. Mini parks may also be developed within neighborhoods.

Guidelines – The following guidelines are relevant to the development of community-based parks in Ewa Makai.

"Where feasible, Community and Neighborhood Parks should be sited at the center of neighborhoods, in order to maximize accessibility."

"Development master plans should provide accessible pathways from surrounding streets to facilitate pedestrian and bicycle access to all features in parks."

Both park areas that are planned for Ewa Makai will be centrally located and will be accessible to both pedestrians and bicyclists via pathways from surrounding streets.

d. **Historic and Cultural Resources** – Because the Ewa Makai area was formerly cultivated in sugar, it does not contain any historic features or native Hawaiian cultural and archaeological sites. However, plans for the project will promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of the makai mountain views, as well as views of central Honolulu and Diamond Head to the extent possible. There are no ocean views from the Subject Property.

e. **Existing and Planned Residential Development** – Section 3.6.3 of the Ewa DP provides general policies and guidelines for the development of new communities and the expansion or renovation of existing communities. Ewa Makai will be consistent with these policies and guidelines, as follows:

General Policies – The development of Ewa Makai will be consistent with the following general policies.

Overall density – *"To achieve the desired compactness and character of development in planned residential communities, the housing density of the aggregate area zoned for residential use (including the streets) should be in the range of 10 to 15 units per acre."*

Densities in the Ewa Makai community will range from 7.5 units/acre to 20 units/acre. The overall density will average 10 to 11 units per acre. These units will be in conformance with the height guidelines for planned residential developments (i.e., low density units will not exceed two stories, and medium density developments will not exceed three stories).

Physical Definition of Neighborhoods – *"The boundaries of neighborhoods should be made evident through the use of street patterns, landscape or natural features, and building form and siting. The focus of neighborhood activity should be on the local street or a common pedestrian right-of-way or recreation area."*

Ewa Makai is divided into three distinct neighborhoods: (1) the area west of Kapolei Parkway; (2) the area between Kapolei Parkway and Fort Weaver Road; and (3) the area east of Fort Weaver Road. Each neighborhood has a central park or open space feature which is linked to the surrounding residential areas by a network of pedestrian and bike paths. The two major highways, along with the Barbers Point and Hawaii Prince golf courses, and the Navy open space provide distinct boundaries for the three neighborhoods.

Compatible Mix of Building Forms – *"There should be a variety of housing types and densities to avoid visual monotony and accommodate a variety of housing needs, but without sharp contrasts between the exterior appearance of adjacent housing areas."*

The proposed rezoning will provide a mixture of housing types and densities, consistent with the above policy. The homes will be compatible with the exterior appearance of adjacent housing areas.

Transit-Oriented Streets. *"Street patterns and rights-of-way should be designed to accommodate mass transit service and make it convenient to access for as many households as possible."*

Major streets and rights-of-way will be designed to accommodate mass transit service that is convenient to as many of Ewa Makai's households as possible.

Pedestrian and Bicycle Travel. *"Pedestrian and bicycle travel should be encouraged, particularly to reach neighborhood designations such as schools, parks, and convenience stores."*

Ewa Makai will provide both sidewalks and bikepaths throughout the community, making it convenient and easy for residents to access neighborhood destinations.

Integration of Linear Corridors. *"Physical and visual connections between communities should be encouraged through the creative design of transportation and utility corridors and drainage systems."*

The Ewa Makai community will be connected to the communities on the north (Ewa by Gentry) and the south (Ocean Pointe) by Kapolei

Parkway and Fort Weaver Road. In addition, the Kaloi Gulch drainage system passes through the west side of the community as a proposed 14-acre landscaped open area linking the Coral Creek and Ocean Pointe golf courses.

Provision of Community Facilities. *"Land should be provided for community facilities, including churches, community centers, and elderly and child care centers."*

Land has been set aside in Ewa Makai for two church/day care center sites, a community recreation center, and a middle school.

Guidelines: Low Density Residential – The following are guidelines for the development of low density residential areas consisting of one and two-story single family attached and/or detached dwellings with individual entries.

Density – *"Density should be 5 to 12 units per acre, typical of residential zoning districts and allowing the application of optional design standards for Clusters and Planned Unit Developments."*

The proposed density for the single family and cluster developments will range from 7.5 to 12.5 units per acre. The overall average will be 9.6 units per acre.

Building Height – *"In general, buildings should not exceed two stories, although the height may vary according to required flood elevation, slope, and roof form."*

Single family and cluster homes in Ewa Makai will not exceed two stories.

Site Design – *"The site design for small-lot developments should avoid monotonous rows of garages and driveways along neighborhood street frontages by employing features such as varied building setbacks and shared driveways."*

Where feasible, the site design will strive to employ features such as varied building setbacks and shared driveways to avoid monotony.

Building Form – *"Buildings should provide visual interest and individual identity by using varied roof forms, exterior colors and finishes, building orientation, floor plans and architectural details."*

The above elements will be incorporated to the extent possible in order to provide visual interest and individual identity.

Guidelines: Medium Density Residential – The following are the Ewa DP's guidelines for the development of medium density residential areas consisting of two- and three-story townhouse or low-rise apartment buildings.

Density – *"Density should be 10 to 30 units per acre."*

The average density for the multi-family developments in Ewa Makai will be approximately 20 units per acre.

Building Height – *"In general, buildings should not exceed three stories above grade. Maximum building heights should allow for pitched roof forms."*

Multi-family buildings will not exceed three stories.

Building Form – *"Building form, orientation, location of entries and landscape screening should be employed to maintain a sense of residential scale and provide greater privacy and individual identity for housing units."*

The above elements will be incorporated to the extent possible in order to maintain residential scale and provide greater privacy and individual identity for housing units.

Compatibility – *"Building scale, roof form and the quality of materials should be compatible with those of adjacent low-density residential areas."*

Compatibility with adjacent low-density residential areas will be taken into consideration when designing multi-family buildings.

Guidelines: High Density Residential – Not applicable. There will be no high density residential buildings in Ewa Makai.

Circulation System – The Ewa Development Plan states: *"Master-planned projects should each have a circulation plan, or 'circulation element' in their Project Master Plan."*

Transit Routes and Facilities – *"The circulation plan should define the hierarchy of streets within the project and its relationship to the surrounding transportation network. The circulation plan should also indicate existing and proposed bus routes and specific measures to accommodate efficient transit service for as many households as possible. Most residences should be within a five-minute (or one-quarter mile) walking distance of a proposed bus route. The rights-of-way along transit routes should make provisions for bus shelters, bus pull-outs, and, if applicable, park-and-ride facilities and/or future transit stations."*

A hierarchy of streets is planned throughout the Ewa Makai development area. Two major arterials, Fort Weaver Road and the extension of the Kapolei Parkway, run through the area providing the primary access to the Ewa Beach, Ocean Pointe and Iroquois Point communities. The only major collector road within the project is a proposed continuation of Keaunui Drive extending from the east side of the Ewa by Gentry development across Fort Weaver Road to the Kapolei Parkway.

Currently two regional City bus lines (#41 & #42) pass through the Ewa Makai project area, both on Fort Weaver Road. In addition, a local circulator bus (#431) provides hourly service from the Waipahu Transit Center through the Ewa Villages and existing Ewa by Gentry development mauka of Geiger/Iroquois Point Road.

In order to serve the Ewa Makai area, it would be relatively easy to move the current circulator route (#431) from Geiger/Iroquois Point Road down to the proposed extension of Keaunui Drive where it crosses Fort Weaver Road and connects to the Kapolei Parkway as shown on the Ewa Makai Circulation Plan. A circulator bus along this route would place approximately 80% of the residential units and all of the non-residential uses in Ewa Makai within a quarter mile of a public transportation route.

If a secondary loop were added to the expanded circulator route along a proposed collector road within the residential area at the east end of the project (as shown on the Circulation Plan), 90% of the units would then be within a quarter mile of the route.

Bus pull-outs, shelters and other improvements will be constructed in accordance with any proposed bus routes within the Ewa Makai area.

Pedestrian and Bicycle Routes and Facilities – *"The circulation plan should indicate any pedestrian and bicycle paths that are physically separated from roadways. Street intersections along these separated paths should have a narrow curb radius and include special signage and paving to encourage safe and convenient pedestrian and bicycle crossings. Interior pedestrian/bicycle routes may be provided as an alternative to paved sidewalks along local streets."*

The Ewa Makai area is designed to be a pedestrian and bicycle-friendly environment. Arterial, collector and local access streets will be designed in accordance with new City standards with sidewalks and bike lanes or bike paths where appropriate.

A separate pedestrian and bicycle path will be provided across the open area makai of the Coral Creek golf course. This path will provide an important link for residents in the Ewa Makai area to the Barbers Point golf course and the beach and future recreation facilities at Kalaeloa. Other portions of this pathway between the Kapolei Parkway and the Barbers Point/Kalaeloa boundary will be integrated into the local roadway network and will be designed to encourage safe and convenient travel for all users.

Landscape Treatment – *"Conceptual street tree plans should be indicated in the circulation plan. Entries to the community should be identified with special landscape treatment. The rights-of-way for major arterials and major collector streets should be designed as landscaped parkways, complete with a landscaped median strip, landscaped sidewalk, and bikeways. Canopy trees should be planted to shade the sidewalk/bikepath areas. Landscaped treatment along the edges of the project should be appropriate for the natural setting and designed to provide continuity and transition from adjacent development areas."*

Landscaping of public streets, pedestrian/bike paths, community entries and development buffers in the Ewa Makai area will be based on the use of plant materials appropriate to the Ewa climate and environment. They will be similar to landscaped elements and features currently used in the Ewa by Gentry community.

As in Ewa by Gentry, entries to Ewa Makai will be identified with special landscape treatments, such as rock walls, indirect lighting, dramatic plantings, and perhaps special water features.


Examples of entry features in Ewa by Gentry.

The streetscape zones which parallel Ewa Makai's roadway network will be the most prominent elements of the community's public landscape. Consequently, their design quality will play a critical role in creating a positive, unified visual image and an attractive pedestrian environment.

Pictured here is an example of a typical landscaped sidewalk in Ewa by Gentry.

The rights-of-way for major arterials and major collector streets will be designed as landscaped parkways, complete with landscaped median strip, landscaped sidewalk and bikeways.

Shade trees will be planted along bikepaths/sidewalks on the major collector streets to create an overhead canopy which provides a sense of enclosure and tempers the visual impact of cars.

Flowering trees may be used to enhance the secondary streets and cul-de-sacs. The street tree program will conform to City and County regulations for planting and maintenance. All species used will be selected from the official street tree list published by the Department of Parks and Recreation.

Relation to Urban Land Use Map – The planned low- and medium-density areas in the Ewa Makai Master Plan will be consistent with the Ewa Urban Land Use Map shown as Exhibit A in the Ewa Development Plan.

Relation to Zoning – The planned residential areas in Ewa Makai will be consistent with the Guidelines for Appropriate Zoning set forth in Table 3.3 of the Ewa Development Plan.

f. **Non-Residential Development: Industrial Centers** – The industrial-commercial employment center in Ewa Makai-West is proposed for service-oriented light industrial use and is included for development in Phase I of the Phasing Plan for the Ewa DP area. (See Table 2.2.) It will be consistent with the planning principles set forth in Section 3.7.3.2 that refer to appropriateness of scale and environmental compatibility.

3. **PUBLIC FACILITIES AND INFRASTRUCTURE POLICIES AND PRINCIPLES**

Chapter 4 of the Ewa DP sets forth policies and principles to guide the planning and construction of proposed public and private public facility projects and infrastructure systems to carry out the vision for future development of Ewa. The Ewa Makai development will be consistent with these policies and principles as follows:

a. **Transportation Systems**

Roadway Network - One of the major elements of the future Ewa roadway network is Kapolei Parkway which is planned as a major corridor. The portion of Kapolei Parkway through Ewa by Gentry has already been completed. When remaining portions of the roadway are completed, including those portions through HASEKO's Oceanpointe community, the Ewa Makai community, and State and City properties, Kapolei Parkway will serve as a major link from Ewa Beach to the city of Kapolei. Eventually, it will serve as a link from Ewa Beach to the resort area of Ko Olina.

Bikeway System – The Ewa DP states that major bike paths should run along the OR&L right-of-way and Kapolei Parkway and along the North-South Road and Fort Weaver Road. Bike paths currently exist throughout the Ewa by Gentry community and along Fort Weaver Road and Kapolei Parkway, and will be included in the Ewa Makai development, as well.

Transit-Oriented Community Street Systems - Circulation systems within the Ewa Makai community will be designed to facilitate bicycle and pedestrian travel, allow for increased transit use, and reduce dependence on automobile travel.

b. <u>Water Allocation and System Development</u>

Adequacy of Water Supply – All necessary on-site water facilities will be provided in consultation with the Board of Water Supply (BWS) and will be built in accordance with an approved Water Master Plan. In addition, Gentry is a member of the Ewa Plain Water Development Corporation (EPWDC), a non-profit corporation responsible for planning, financing, and implementing the construction of regional source development, storage reservoirs, and distribution systems. Major portions of EPWDC's water program (including dedicated source and well facilities, storage and transmission for a water system of 6.72 million gallons per day) have already been implemented and were dedicated to BWS in 1991. It is anticipated that water supply for Ewa Makai will be provided from the Ewa Shaft, a large capacity well that BWS recently acquired from Campbell Estate.

Dual Transmission Lines/Use of Nonpotable Water – As with Ewa by Gentry, a dual water system will be developed in Ewa Makai to conserve the supply of potable water. Nonpotable water will be used where feasible for purposes such as landscape irrigation.

c. <u>Wastewater Treatment</u>

Wastewater produced by the Ewa Makai development will be connected to the Honouliuli Wastewater Treatment Plant, a municipal sewer service system.

d. <u>Drainage Systems</u>

The Ewa DP states that drainage system designs should emphasize control and minimization of non-point source pollution and the retention and/or detention of storm water on-site and in appropriate open space and wetland areas. Natural and man-made vegetated drainageways and retention basins are proposed for Ewa Makai. A drainageway that is part of the Kaloi Gulch Drainage Basin is proposed for Ewa Makai-West, connecting the Coral Creek Golf Course with Oceanpointe's planned golf course.

In Ewa Makai-East, a landscaped drainageway, recreation area, and large retention basin will be built as part of the residential subdivision. These drainage facilities will be used to detain or infiltrate storm water flows to reduce their volume and runoff rates and the amounts of sediments and pollutants transported. The retention/detention basins may be developed as part of a landscaped walkway that will double as a visual amenity, though final plans are undetermined at this time.

e. <u>School Facilities</u>

The Ewa DP states that the State Department of Education (DOE) has projected a need by 2020 for two new intermediate schools, one of which has already been built in the Villages of Kapolei. Although the Ewa DP lists East Kapolei Intermediate as the second intermediate school site, the development of East Kapolei is uncertain at this time. In cooperation with the DOE, Gentry has agreed to dedicate an 18-acre middle school site in Ewa Makai-West to service the educational needs of this growing area and to address its fair share contribution for the provision of adequate school facilities.

f. <u>Public Safety</u>

The project site is served by the Kapolei Police Station, which is located at 1100 Kamokila Boulevard in Kapolei. There is also a storefront office next to the 7-eleven store at 91-1669 Fort Weaver Road. According to the Honolulu Police Department, because of the number of residential units planned, and with the corresponding addition of pedestrian and vehicular traffic in and around the area, there will be an increase in the need for police service. It is anticipated that the revenues collected from real property taxes of the new residences and industrial-commercial center will finance the increased cost of police services needed. No additional requirements are anticipated for the Honolulu Fire Department.

<u>Availability or Adequacy of Other Public Services and Facilities</u>

In addition to the public services and facilities that are noted above, the following public services and facilities will also be available and adequate.

g. <u>Solid Waste Handling and Disposal</u>

Solid waste handling and disposal will be coordinated with the City Department of Environmental Services, Refuse Division, with written notification submitted in advance of when the refuse service is expected to begin. The design of residential communities within Ewa Makai will comply with the Division's requirements in order to enable refuse pick-up.

h. <u>Public Utilities</u>

The project will be serviced by a number of public utilities including the Hawaiian Electric Co. (HECO) for electric power, Verizon (telephone), Board of Water Supply (water and sewer), and various cable television providers including Oceanic Cable and Americast. There is also a possibility of using The Gas Company for gas service.

HECO indicated that it will be able to serve this new development from the Fort Weaver Substation which was installed in an earlier phase of the Ewa by Gentry project. Therefore, the installation of additional substation transformer capacity and extension of cables, ducts, and associated electrical facilities should encounter no significant obstacles to providing timely and reliable service.

I. Parks

The conceptual plan incorporates two neighborhood parks: an 8-acre park in Ewa Makai-West and a 3.5 acre park in Ewa Makai-East. The 8-acre park in Ewa Makai-West will be centrally located and within walking or biking distance for many area residents. The 3.5 acre park in Ewa Makai-East will be an extension of a planned 6.8 acre park in the existing Ewa by Gentry community, thereby increasing the overall park size to 10.3 acres. In addition, a 2-acre private community recreation center complex is planned in Ewa Makai-West for use by Ewa by Gentry residents, and additional private recreational areas may be developed in conjunction with individual residential developments. Master planning and development of new parks will be provided in accordance with the requirements of the City's Park Dedication Ordinance.

J. Public Agency Impact

Police Protection

The project will be served by the Kapolei Police Station, which is located at 1100 Kamokila Boulevard in Kapolei. There is also a storefront office next to the 7-11 store at 91-1669 Fort Weaver Road.

Based on a letter dated June 13, 2002 from Police Chief Lee Donahue, there will likely be an increase in calls for police services when Ewa Makai is developed. It is recommended that the Ewa Makai project can mitigate impacts on police protection services through security measures such as on-site security, design measures such as well-lit public areas and walkways, and the establishment of neighborhood watch programs. As an extension of the Ewa by Gentry community, Ewa Makai will have on-site security and will be part of an established neighborhood security watch program.

Fire Protection

In the event of a single alarm fire, the project site would be served by the Waipahu Fire Station. For a multiple alarm such as a structure fire, three engine companies and one ladder company would be sent from the Ewa Beach, Waipahu, and Kapolei Fire Stations, with the ladder company originating from the Waipahu Fire Station. The project would increase the demand for fire protection services by adding new structures and an increased population.

Emergency Medical Services (EMS)

In an emergency response, either EMS personnel or the nearest fire station is notified. EMS uses a global tracking system that places each vehicle within 30 feet of its current location.

The Ewa area is primarily serviced by two ambulances from St. Francis West and the Waipahu Fire Station. There is also a single Rapid Response Unit based at Kalaeloa. The Rapid Response Unit does not transport patients.

If needed, additional EMS vehicles respond from Waianae and Aiea. The average response time to the project site is approximately six to nine minutes.

Public Education

Based on current district boundaries, residents of Ewa Makai will be served by the Pohakea and Ewa Beach Elementary Schools, Ilima Intermediate, and Campbell High School. The proposed project will impact these facilities by increasing the school-aged population. In general, the project's impact on the area's schools fall within the projected 2007 enrollment.

The Gentry Companies has been working with the State Department of Education to determine the developer's fair share contribution to the public education system. The parties have agreed that reserving 18 acres for a new middle school meets the developer's fair share requirement.

Site Analysis

Impact on Significant Historic and Cultural Resources

Table 3.1 of the Ewa Development Plan identifies the various Significant Historic and Cultural Resources in Ewa. The following are listed as "Historic Features": Lanikuhonua; OR&L Historic Railway; Ewa Villages; and the Pearl Harbor Historic Landmark. Ewa Makai will not impact these historic features.

Identified as "Native Hawaiian Cultural and Archaeological Sites" are the Barbers Point Archaeological District and Oneula Archaeological District. These will not be impacted by the development of Ewa Makai.

The following are listed as "Significant Views and Vistas":

- Distant vistas of the shoreline from the H-1 Freeway above the Ewa Plain;
- Views of the ocean from Farrington Highway between Kahe Point and the boundary of the Waianae Development Plan Area.
- Views of the Waianae Range from H-1 Freeway between Kunia Road and Kaloi Gulch and from Kunia Road;
- Views of na pu'u o Kapolei, Palailai, and Makakilo;
- Mauka and makai views; and
- Views of central Honolulu and Diamond Head.

These views and vistas should not be affected by the development of Ewa Makai.

Impact on Ewa Development Plan Open Space Map

The development of Ewa Makai will be consistent with the Open Space Map that is included as Appendix A of the Ewa Development Plan. The Kaloi Gulch drainage channel in Ewa Makai-West, as well as the greenways along Kapolei Parkway and the Fort Weaver Road corridor, are included as part of the open space system. Although there will be smaller community and neighborhood parks in Ewa Makai, these are not shown on the map because only island-wide, regional, and district parks are shown. In addition, the open areas in Ewa Makai-East that will be part of the drainage system will provide green space, but are not currently shown on the Open Space Map.

Land Use

Table 5.1 of the Ewa Development Plan shows the general zoning district categories from the Land Use Ordinance. The following table indicates the proposed pattern of land uses in Ewa Makai in accordance with these categories.

EWA MAKAI ZONING DISTRICT CATEGORIES

Zoning District Category	Zoning District Title	Requested Designation	Current Designation	No. of Acres
Preservation	General	P-2	AG-2	14
Residential	R-5	R-5	AG-1, AG-2	93
Apartment	Low-Density	A-1	AG-1, AG-2	146
Ind-Comm Mixed Use	Ind-Comm Mixed Use	IMX-1	AG-2	30
			Total	283

Ewa Makai - West

Zoning District Category	Zoning District Title	Requested Designation	Current Designation	No. of Acres
Preservation	General	P-2	AG-2	14
Residential	R-5	R-5	AG-2	25
Apartment	Low-Density	A-1	AG-2	102.5
Ind-Comm Mixed Use	Ind-Comm Mixed Use	IMX-1	AG-2	30
			Total	171.5

Ewa Makai - East

Zoning District Category	Zoning District Title	Requested Designation	Current Designation	No. of Acres
Residential	R-5	R-5	AG-1	68
Apartment	Low-Density	A-1	AG-1	43.5
			Total	111.5

Open Space

Ewa Makai's open space and landscape system will provide attractive facilities which meet the needs of community residents, and will be consistent with the regional open space system set forth in the Ewa Development Plan.

As an extension of the Ewa by Gentry master planned community, Ewa Makai will likewise incorporate an open space network within the community. Significant acreages of open space will be retained in parks, as well as in the landscaped drainageways and retention areas that will be provide visual greenway. The community is also adjacent to agricultural lands in the West Loch Naval Magazine Blast Zone, as well as the Coral Creek, Barbers Point and Hawaii Prince golf courses, all of which are designated as part of the regional open space system. Greenway corridors include the Kapolei Parkway and Fort Weaver Road.

Ewa Makai's landscape system will provide attractive open spaces within the community.

Parks and adjacent golf courses will be part of the open space plan for Ewa Makai.

Greenway corridors will include Fort Weaver Road and Kapolei Parkway shown here.

A discussion of the open space plan for Ewa Makai as it relates to the Ewa DP can be found on pages 8 to 9 of this document.

Circulation

A hierarchy of streets is planned throughout the Ewa Makai development area. Two major arterials, Fort Weaver Road and the Kapolei Parkway, extend through the area providing the primary access to the Ewa Beach, Ocean Pointe and Iroquois Point communities. The only major collector road within the project is a continuation of Keaunui Drive extending from the east side of the Ewa by Gentry development across Fort Weaver Road to the Kapolei Parkway.

Currently two City bus lines (#41 & #42) pass through the Ewa Makai project area, both on Fort Weaver Road. In order to provide improved coverage for residents in Ewa Makai and Ewa by Gentry, Gentry will work with the City's Department of Transportation Services and its consultant(s) to implement recommendations on new transit routes and an expanded hub and spoke system to better serve the needs of these communities. Suggested routes would be along Keaunui Drive (for areas east of Fort Weaver Road), as well as through Kapolei Parkway (for areas west of Fort Weaver). This would place the vast majority of the residential units in the Ewa by Gentry development within one-quarter mile of a public bus route.

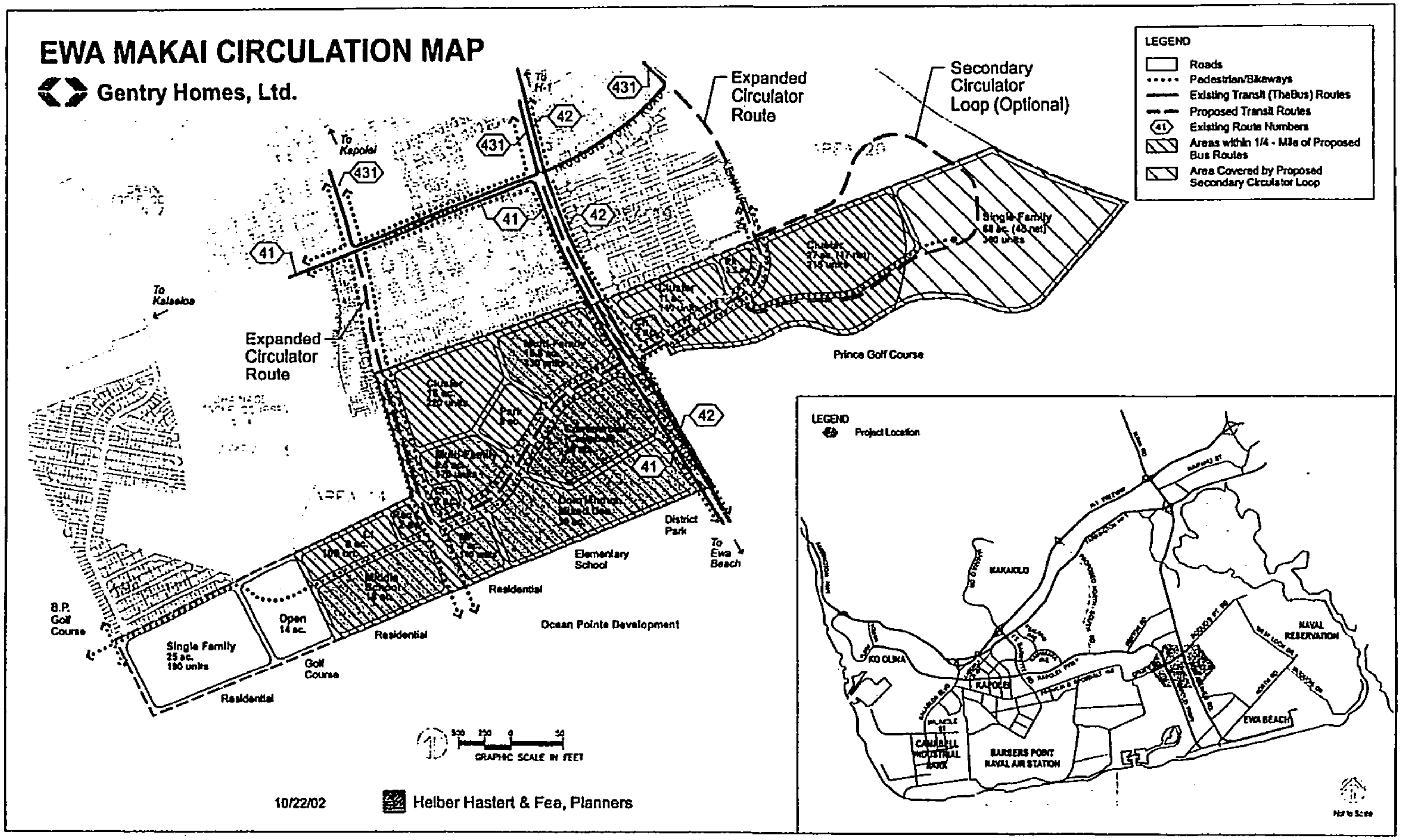
The Ewa Makai area is designed to be a pedestrian and bicycle-friendly environment. Arterial, collector and local access streets will be designed in accordance with new City standards with sidewalks and bike lanes or bike paths where appropriate.

A separate pedestrian and bicycle path will be provided across the open area makai of the Coral Creek golf course. This path will provide an important link for residents in the Ewa Makai area to the Barbers Point golf course and the beach and future recreation facilities at Kalaeloa. Other portions of this pathway between the Kapolei Parkway and the Barbers Point/Kalaeloa boundary will be integrated into the local roadway network and will be designed to encourage safe and convenient travel for all users.

On the east side of the Ewa Makai area, a landscaped drainageway will contain a separate pedestrian and bicycle path linking that residential area to the adjoining parks and regional circulation network.

Exhibit B on the following page indicates the proposed major roadways, the location of Ewa Makai in relation to the planned regional roadway network (as set forth in the Ewa Highway Master Plan), pedestrian and bicycle routes, and proposed transit routes.

Exhibit B



EWA MAKAI CIRCULATION MAP
Gentry Homes, Ltd.
LEGEND
Roads
Pedestrian/Bikeways
Existing Transit (TheBus) Routes
Proposed Transit Routes
Existing Route Numbers
Areas within 1/4 - Mile of Proposed Bus Routes
Area Covered by Proposed Secondary Circulator Loop
Expanded Circulator Route
Secondary Circulator Loop (Optional)
Expanded Circulator Route
To Kapolei
To H-1
To Kalaeloa
To Ewa Beach
431
42
41
Single Family 68 ac. (40 net) 340 units
Prince Golf Course
District Park
Elementary School
Residential
Ocean Pointe Development
B.P. Golf Course
Single Family 25 ac. 190 units
Open 14 ac.
Golf Course
Residential
GRAPHIC SCALE IN FEET
10/22/02
Helber Hastert & Fee, Planners
LEGEND
Project Location
MAKAKILO
KO OLINA
KAPOLEI
CAMPBELL INDUSTRIAL PARK
BARBERS POINT NAVAL AIR STATION
NAVAL RESERVATION
EWA BEACH
Not to Scale

Design Theme or Character

The Ewa Makai community will be a continuation of the Ewa by Gentry development and will therefore conform to similar design themes. The following pages describe what is envisioned for the Ewa Makai developments.

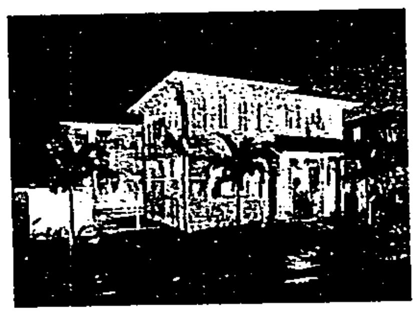
Neighborhood Structure

Ewa Makai will be developed as a series of sub-neighborhoods with each neighborhood having a distinct identity within the larger community setting. Generally, internal collector roads will divide the community into sub-neighborhoods ranging in size from 7 acres to 78 acres. A mix of residential designs and model types will be utilized within each area to promote a variety of architectural forms, attractive landscaping, and a mix of household sizes.

Single Family Residential

360 single family homes are planned for Ewa Makai-East, while 190 homes are planned for Ewa Makai-West. Most of the single family units will be sold in fee as house and lot packages, although a few custom built homes on larger lots may also be a possibility. Single family residences in Ewa Makai would take advantage of the frontage along the existing Hawaii Prince and Barbers Point Golf Courses.

Densities for single family homes in Ewa Makai will average approximately 7.5 units per acre on 5,000 s.f. lots.



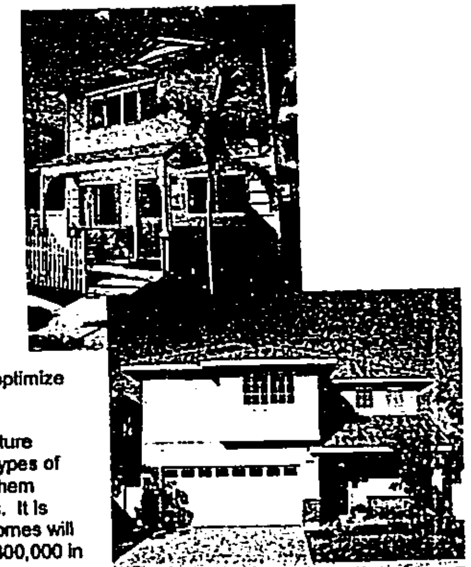
The proposed Ewa Makai single family residential subdivisions will be designed for consistency with the existing Ewa by Gentry community. Architectural and special relationships created by buildings, fencing, planting, and lighting will continue to be critical considerations when designing single family homes, as these are all inter-related elements in the total environment of the housing unit. Presently, single family densities are estimated to average 7.5 units per acre, based on lot sizes averaging 5,000 square feet. Average prices will range from $300,000 to $405,000 in 2002 dollars.

Cluster Homes

355 single family condominium homes or "cluster units" are planned for Ewa Makai-East, while 320 such homes are planned for Ewa Makai-West. These single family or duplex condominiums will be sold in fee simple on lands that are zoned A-1 Low Density Apartment.

In contrast to the more conventional layout of homes, single family condominiums are often zero-side yard units on smaller lots, with each lot being a "limited common element." Because of the small size, individual homes will be carefully designed to maximize the feel for interior space, and at the same time, optimize the limited exterior space.

Smaller houselots and reduced infrastructure costs have enabled Gentry to sell these types of units at very competitive prices, making them popular choices among new homebuyers. It is anticipated that sales prices for cluster homes will range from approximately $200,000 to $300,000 in 2002 dollars.



Single family condominiums are usually built on smaller lots, with each lot being a "limited common element." Densities average about 12.5 units per acre.

Multi-Family Residential

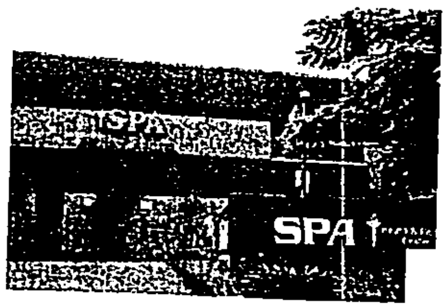
Approximately 640 multi-family homes are planned for Ewa Makai-West. It is envisioned that multi-family residential areas will consist of townhomes or low-rise apartment buildings with densities of approximately 20 units per acre, with product types being largely dependent upon market conditions at the time of sale. It is estimated that these units will sell for approximately $150,000 to $200,000 in 2002 dollars.

A typical multi-family neighborhood will consist of 2- or 3-story walk-up townhomes or apartment buildings with densities of approximately 20 units per acre.

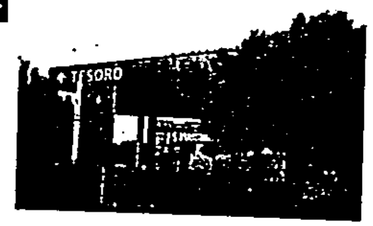
To minimize the need for vehicular transportation, the multi-family units will be located in areas proximate to public transportation facilities and a "town center" in Ewa Makai consisting of an industrial-commercial employment center, a retail-office complex, a neighborhood park, a district park (in the adjacent Ocean Pointe community), a community recreation center, churches, a middle school, and an elementary school (also in Ocean Pointe). The town center will be pedestrian and bicycle friendly to enable easy access to these destinations by those living in the multi-family homes.

Industrial-Commercial Area

A 30-acre industrial-commercial complex is intended as an adjunct to the planned 20-acre Laulani Commercial Center, and is expected to contain about 35 to 40 lots ranging in size from approximately 15,000 square feet up to 3 acres. Uses are anticipated to be similar to those found in the existing industrial-commercial developments in Kaneohe, Kalihi, Waipio, Kakaako, Mapunapuna, and Hawaii Kai. It would include warehousing, light assembly operations, wholesaling, commercial, and other permitted uses. The IMX-1 district is intended to provide for a range of uses without exposing non-industrial uses to unsafe and unhealthy environments. The IMX-1 district is intended to promote and maintain a viable mix of light industrial and commercial uses to provide employment and to serve the surrounding community.



Based on the number of lots, the lot sizes, and the anticipated operations, it is expected there will be approximately 40 major buildings within the complex. Although the proposed IMX-1 zoning allows floor area ratio (FAR) maximums of 1.5 to 2.5 (depending on the mix of industrial and non-industrial uses), it is anticipated that the average FAR for this development will be approximately 0.60. Assuming approximately 4 acres of the 30-acre site is taken up by roadways, the remaining 26 acres of developable land would generate approximately 680,000 square feet of total building floor area.

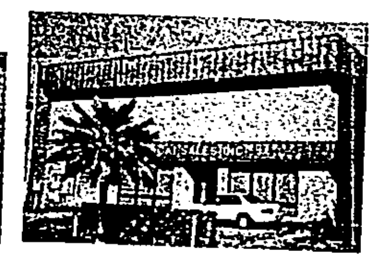


Although off-street parking requirements will vary significantly depending on the specific types of uses on each lot, most will require between 1 stall per 300 square feet and 1 stall per 1,500 square feet of floor area. Assuming an average of 1 stall per 900 square feet, approximately 756 parking stalls will be needed within the complex.

Although the zoning map for the area will establish the maximum height of buildings in the complex, it is anticipated that structures will not exceed 40 feet. Many are expected to be single-story facilities. Some may have mezzanines or second story spaces for administrative or light storage uses, and others may be "high cube" facilities.

The visibility of large building volumes from the neighboring residential area, park, and elementary school would be minimized through such means as appropriate site planning, landscaping, privacy walls, and street trees. Uses in the industrial-commercial area will be restricted to those that are compatible within the setting of a residential community, including non-polluting industries and those whose noise levels are kept at an acceptable level.

Pictured on these pages are a few examples of the types of buildings and uses found in the Gentry Business Park that might be appropriate for Ewa Makai.



Telecommunications

The Ewa Makai community will continue to be serviced by Verizon Hawaii, which provides the basic backbone infrastructure for telephone service throughout Ewa by Gentry.

All homes will come equipped with conduits for Oceanic-Time Warner to install cable television service and Roadrunner Internet access. Residents of Ewa Makai who utilize Oceanic's cable services will also be able to access the Oceanic cable channel that is available exclusively to homes in the Ewa by Gentry community. Programming on this channel is run by the Ewa by Gentry Community Association and centers around activities, special events, meetings, and other items of interest to residents of Ewa by Gentry. The community channel is a great way for Ewa by Gentry residents to keep abreast of what is happening in their neighborhood.

APPENDIX B

GEOTECHNICAL ENGINEERING EXPLORATION
EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

W.O. 4647-00 MARCH 12, 2001

Prepared for

GENTRY HOMES, LTD.

GEOLABS, INC.
Geotechnical Engineering and Drilling Services
2006 Kalihi Street • Honolulu, HI 96819

Hawaii • California • Taiwan

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

March 12, 2001
W.O. 4647-00

Mr. Jon Young
Gentry Homes, Ltd.
560 N. Nimitz Highway, Suite 213
Honolulu, HI 96817

Dear Mr. Young:

Geolabs, Inc. is pleased to submit our report entitled "Geotechnical Engineering Exploration, East Ewa Makai Project, Ewa, Oahu, Hawaii" prepared for the design of grading and structures for the proposed subdivision.

Our work was performed in general accordance with the scope of services outlined in our fee proposal of December 19, 2000.

Detailed discussion and recommendations are contained in the body of this report. If there is any point that is not clear, please contact our office.

Very truly yours,

GEOLABS, INC.

Clayton S. Mimura, P.E.
President

CSM:GS:mr

(u:\00reports\4647-00.gs1-pg30)

TABLE OF CONTENTS

ENGINEERING EXPLORATION

EAST EWA MAKAI PROJECT

EWA, OAHU, HAWAII

W.O. 4647-00 MARCH 12, 2001

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Our field exploration generally encountered a surface layer 1.5 to 15 feet thick, consisting of very stiff to hard, brown silty clay underlain by medium dense to dense coralline deposits consisting of coral-algal reef and cemented sand to the maximum depth explored of 33 feet. For the majority of the site, the depth to the top of the coralline deposits typically ranged from 1.5 to 6 feet below the existing ground surface.

Groundwater was encountered at depths of about 10 to 24 feet below the existing ground surface at the time of our field exploration. These groundwater depths correspond to elevations ranging from +0.5 to +4.5 feet Mean Sea Level (MSL).

Our laboratory testing on the near-surface silty clay materials indicated a moderate expansion potential. To reduce the potential for distress to slabs-on-grade resulting from swelling of the clayey materials, we recommend that a minimum of 24 inches of non-expansive select granular material be used below the slabs-on-grade. The on-site coralline materials may be used as non-expansive select granular fill.

Based on the results of our exploration, we believe that the proposed single-family house structures may be supported on shallow foundations. The shallow foundations should bear on properly compacted fill or in-situ material.

Four large ground depressions were noted within the project site. Prior to fill placement, the soft and loose materials at the bottoms of the ground depressions should be over-excavated to expose firm natural material.

An uncontrolled fill embankment approximately 300 feet by 700 feet with maximum fill heights of up to 20 feet is located at the southern portion of the site. The uncontrolled fill material should be removed to expose firm natural ground prior to fill placement.

The text of this report should be referred to for detailed discussion and recommendations.

INTRODUCTION

This report presents the results of our geotechnical engineering exploration performed for the proposed East Ewa Makai Project located in the District of Ewa, on the Island of Oahu, Hawaii. The site is located east of Fort Weaver Road and south of the Ewa by Gentry East Area 19 project. The general location and vicinity of the project site are shown on the Project Location Map, Plate 1.

This report summarizes our findings and geotechnical engineering recommendations resulting from our field exploration, laboratory testing, and engineering analyses. These recommendations are intended to assist in the design of the mass grading construction, single-family house structure foundations, road pavements, utilities, excavation, and fill placement only. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

PROJECT CONSIDERATIONS

The project site is located on the eastern side of Fort Weaver Road, south of Iroquois Road, in Ewa on the Island of Oahu, Hawaii. The site is bounded by Hawaii Prince Golf Course to the south and Ewa by Gentry East Area 19 project to the north.

It is proposed to develop the subject parcel into a single-family residential subdivision. It is anticipated that the proposed residences will consist of light one and two-story structures. At this time, it is proposed to mass grade the site for future residential developments.

We understand that it is desirable to use the coralline materials encountered at the project site for structural fill for this project and other projects in the area. Detailed information pertaining to the proposed project was not available at the time this report was

prepared. We anticipate that cuts and fills of up to 20 feet may be needed in order to obtain a level ground for the proposed development.

PURPOSE AND SCOPE

The purpose of our exploration was to obtain an overview of the surface and subsurface conditions at the project site to develop a soil/rock data set for the formulation of geotechnical engineering recommendations pertaining to the proposed residential development. Our work was performed in general accordance with our fee proposal dated December 19, 2000. The scope of our work included the following tasks and work efforts:

1. Mobilization and demobilization of a truck-mounted drill rig and two operators to and from the project site.
2. Drilling and sampling of 17 borings to depths of approximately 16.5 to 33 feet below the existing ground surface within the development site.
3. Coordination of the field exploration and logging of the borings by a field engineer from our firm.
4. Laboratory testing of selected soil samples obtained during the field exploration as an aid in classifying the materials encountered and evaluating their engineering properties.
5. Analyses of the field and laboratory data for the formulation of geotechnical engineering recommendations pertaining to mass grading of the area and residential structure foundations.
6. Preparation of six copies of this report summarizing our work on the project and presenting our findings and recommendations.
7. Coordination of our overall work on the project by a project engineer from our firm.
8. Quality assurance of our work and client/design team consultation by a principal engineer from our firm.
9. Miscellaneous work efforts, such as drafting, word processing and clerical support.

REGIONAL GEOLOGY

The Island of Oahu was built by the extrusion of basaltic lavas from two shield volcanoes, Waianae and Koolau. The older volcano, Waianae, is estimated to be middle to late Pliocene in age and forms the bulk of the western third of the Island. The younger shield, Koolau, is estimated to be late Pliocene to early Pleistocene (Ice Age) in age and forms the majority of the eastern two-thirds of the Island. Waianae became extinct while Koolau was still active, and its eastern flank was partially buried below Koolau lavas banking against its eastern flank. These banked or ponded lavas formed a broad plateau referred to as the Schofield Plateau.

The forces of weathering and erosion attacked this plateau, generating sediments, which were transported to the coast. In the vicinity of the project site and further south, these alluvial sediments were interbedded with marine sediments and coral-algal reef formations to form a sedimentary wedge ranging in thickness from zero feet in the area of H-1 freeway to over 1,000 feet at Ewa Beach. This wedge forms the Ewa Plain and serves as the confining formation, or "caprock" over the artesian basal equifers of southern Oahu. Deposition of these sediments has continued from earlier geologic time through the present.

EXISTING SITE CONDITIONS

The project site covers approximately 110 acres and is surrounded by a four-foot high perimeter fence. In general, the site is a relatively flat area with four large ground depressions within the project area. The site gently slopes down towards the four ground depressions at slope inclinations ranging from about 1 to 4 percent. The existing ground elevation range from about +6 to +28 feet Mean Sea Level (MSL). The ground depressions ranged in depth from 6 to 13 feet with ground surface elevation at the bottoms of the depression ranging from about +6 to +20 feet MSL.

The site was covered with dry low grass and brush, while the bottoms of the four depressed areas were covered with relatively tall green grass and brush. Hand-probing was performed at the bottom of the depressed areas with a 1/2-inch diameter steel rod. Penetrations of more than 3 feet were measured. An existing asphalt surfaced roadway

traverses the central portion of the site in a north to south direction. An unlined drainage ditch that extended into the site was observed at the western portion of the project site. Standing water was observed in the drainage ditch at the time of our field exploration. Adjacent to the drainage ditch, a fenced construction storage area about 300 feet by 300 feet was observed.

A fill embankment was observed at the south central portion of the site. The fill embankment is about 300 feet by 700 feet in plan dimension with maximum fill height of about 20 feet and extended over one of the ground depression.

SUBSURFACE CONDITIONS

The subsurface conditions at the project site were explored by drilling and sampling 17 borings, designated as Boring Nos. 1 through 17, to depths of about 16.5 to 33 feet below the existing ground surface. The approximate locations of the borings are shown on the Site Plan, Plate 2.

Our field exploration generally encountered a surface layer about 1.5 to 15 feet thick of very stiff to hard, brown silty clay underlain by medium dense to dense coralline deposits consisting of grayish-white coral-algal reef and tan cemented sand material to the maximum depth explored of 33 feet below the existing ground surface.

A surface fill layer approximately 20 feet in thickness was encountered in Boring No. 15. The surface fill layer consisted of stiff to hard silty clay with some coral and basalt gravels.

Groundwater was encountered at about 10 to 24 feet below the existing ground surface at the time of our field exploration. However, it should be noted that groundwater levels at the project site may fluctuate depending on seasonal precipitation, and other factors. Detailed descriptions of the materials encountered in the borings are presented on the Logs of Borings, Plates A-1 through A-17 of Appendix A. Results of the laboratory tests performed on selected soil samples are presented in Appendix B.

DISCUSSION AND RECOMMENDATIONS

Our field exploration generally encountered brown silty clay to depths of 1.5 to 15 feet below the existing ground surface, underlain by medium dense to very dense coralline deposits. The majority of the site was underlain by coralline deposits at relatively shallow depths ranging from about 1.5 to 6 feet below the existing ground surface. A summary of the depth to the top of coralline deposit is shown on Plate 3.

In general, we believe that the proposed residential structures may be supported on a shallow foundation system, although special considerations should be included in the grading and foundation design to reduce the swelling potential of the near-surface clay soil.

The soft and loose materials at the bottoms of the depressed areas and within the drainage ditch, and the uncontrolled fill embankment material should be removed to firm natural ground prior to fill placement.

Detailed discussion of these items and our geotechnical engineering design recommendations are presented in the following sections of this report.

Site Grading

Based on the topographic plan provided, the mass grading work will generally consist of cuts and fills less than 20 feet in the majority of the site. Items of grading that are addressed in the following subsections include: (1) Site Preparation, (2) Fills and Backfills, (3) Fill Placement and Compaction Requirements, (4) Excavation, and (5) Cut and Fill Slopes.

Site grading operations should be observed by a representative from Geolabs, Inc. It is important that a representative from our office observe the site grading operations to evaluate whether undesirable materials are encountered during the excavation process and to confirm whether the exposed soil/rock conditions are similar to those encountered in our field exploration.

Site Preparation

At the on-set of earthwork, areas within the contract grading limits should be thoroughly cleared and grubbed. Vegetation, debris, rubbish, and other unsuitable materials, should be removed and disposed of properly off-site or stockpiled in a designated area to reduce the potential for contamination of the excavated materials.

Soft and loose soils at the bottoms of the ground depressions and within the drainage ditch should be removed to expose firm material and properly compacted in accordance with the "Site Grading" section of this report.

The uncontrolled embankment fill at the southern portion of the site should be removed to expose underlying firm material and properly compacted in accordance with the "Site Grading" section of this report.

Soft and yielding areas encountered during clearing and grubbing should be over-excavated to expose firm natural material, and the resulting excavation should be backfilled with well-compacted engineered fill. The excavated soft soils may be used as fill, provided that it meets the requirements for fill material.

After clearing and grubbing, areas beneath proposed pavements and housing limits should be excavated to provide the necessary non-expansive fill thickness and pavement section. If zones of soft, loose or saturated soils are encountered at the subgrade level, deeper excavation may be required to expose the underlying firm material. The resulting excavation should be backfilled with compacted engineered fill.

Prior to filling, the existing ground should be scarified to a depth of 10 inches and moisture-conditioned to about 2 percent above the optimum moisture and compacted to a minimum of 90 percent relative compaction. For pavement subgrades, the minimum relative compaction should be 95 percent. Where shrinkage cracks are noted after compaction of the subgrade, we recommend that the soil be thoroughly moistened to close all cracks, or the subgrade should be scarified, moisture-conditioned, and re-compacted. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with well-compacted engineered fill. The excavated soft soils may be used as fill provided that it meets the requirements for fill material. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM Test Designation D 1557-91.

In areas where the cut subgrades expose coral rock formations, the subgrades should be proof-rolled with a minimum 20-ton vibratory roller or a Caterpillar D-9 bulldozer or similar heavy equipment for a minimum of 6 passes to help detect and collapse near-surface cavities. Any loose areas or cavities disclosed during clearing and proof-rolling operations should be opened, cleaned of debris, and backfilled with properly compacted fill or concrete.

Fills and Backfills

The fill materials within 2 feet below finish subgrades (structural fill) should be well-graded from coarse to fine with no particles larger than 3 inches in largest dimension and should contain between 10 and 30 percent particles passing the No. 200 sieve. The material should have a laboratory CBR value of 20 or more and should have a maximum swell of less than 1 percent when tested in accordance with ASTM Test Designation D 1883. The fill material should also be free of vegetation and deleterious materials. In general, the on-site coralline material should be suitable for this purpose.

The on-site cut materials generated from excavations into the underlying coral rock formation may be used as general fill (below 2-foot structural fill) materials, provided that they are screened of the over-sized materials (greater than 8 inches in large dimension) and processed to contain sufficient fines to produce a well-graded material. This requirement is to facilitate future utility trench excavations. Over-size

rock fragments may be disposed of in deep fill areas or broken down to smaller-sized materials and incorporated into the fill materials. If the excavated materials do not contain sufficient fines to produce a well-graded material, off-site borrow or on-site rock crushing of large-sized rock fragments or boulders should be considered to provide the required gradation and particle sizes to develop a well-graded material.

The on-site silty clay should not be used as structural fill within the top 2 feet of finish grade. These materials may be used as general fill.

Base course and select borrow subbase material should consist of crushed basalt aggregate and should conform to the City and County of Honolulu, Department of Public Works, "Standard Specifications for Public Works Construction," dated September 1986.

Imported fill should consist of low-expansive granular material, such as crushed coral, mudrock, basalt or cinder sand meeting the requirements of structural fill. Imported fill materials should be tested by Geolabs, Inc. for conformance with these recommendations prior to delivery to the project site for its intended use.

Fill Placement and Compaction Requirements

Fills and backfills should be moisture-conditioned to about 2 percent above the optimum moisture, placed in level lifts not exceeding 10 inches in loose thickness, and compacted to at least 90 percent relative compaction.

Base course and select borrow subbase materials should be moisture-conditioned to above the optimum moisture, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 95 percent relative compaction.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D 1557-91 test procedures. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

Compaction should be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment.

Because moisture-conditioning and compaction of the clayey subgrade soils are critical elements of earthwork, observations and soil density tests should be performed by Geolabs, Inc. during site grading to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compactive effort should be applied with adjustment of moisture content as necessary, to obtain the specified compaction. It should be noted that the moisture requirement of the fills and subgrades (about 2 percent above the optimum moisture) is an important requirement for the use of the on-site clayey soils.

Excavation

Based on the topographic plan and our field exploration, excavation may involve cuts into the underlying coral formation. It is anticipated that the coral rock may be excavated with normal heavy excavation equipment, such as ripping with large bulldozers, where the material is near the existing ground surface. However, deep excavations and excavations into coral formations may require the use of hoerams.

The above discussions regarding the rippability of the surface materials are based on field data obtained from the borings performed at the subject site. We recommend that contractors bidding on this project be encouraged to examine the site conditions and soil data to make their own interpretation.

Cut and Fill Slopes

Based on the subsurface conditions encountered in the borings, it appears that most of the cut slopes would expose soils consisting of very stiff to hard silty clay or medium dense to very dense coralline material. In general, we believe that cut slopes into these material may be cut at an inclination of two horizontal to one vertical (2H:1V) or flatter.

Fill slopes should be designed with a slope inclination of 2H:1V or flatter. Slope benches are recommended at maximum 20-foot vertical height intervals. Fills placed on slopes steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill against sliding. The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the above fill placement recommendations.

Fill slopes in excess of 5 feet in height should be constructed by overfilling and cutting back to the design slope ratio to obtain a well-compacted slope face. Track-rolling of slopes in excess of 5 feet in height should not be accepted. In the event that over-cutting of a slope occurs, keying and benching requirements should be implemented instead of backfilling the slope to the design grade with sliver fills. Water should be diverted away from the tops of slopes and slope planting should be provided as soon as possible to reduce the potential for erosion of the finished slopes.

Shallow House Foundations

Based on the generally competent subsoil conditions encountered at the site, we believe that shallow spread and/or continuous footings may be used for support of the proposed single-family residential houses.

An allowable bearing pressure of 3,000 (psf) pounds per square foot may be utilized for the design of single-family residential house foundations bearing on properly compacted fill or recompacted on-site material. This bearing value is for dead-plus-live loads and may be increased by one-third (1/3) for transient loads, such as those caused by wind or seismic forces. Footings should have a minimum width of 12 inches and should be embedded a minimum of 12 inches below the existing grade. For footings constructed near tops of slopes or on sloping ground, the footings should be embedded deep enough to provide a minimum horizontal set-back distance of 5 feet measured from the outside edge of the footings to the slope face.

We estimate that settlements for footings bearing on properly compacted fill or recompacted on-site material as recommended herein, to be less than one (1) inch total. Differential settlement is estimated to be less than one-half (½) inch.

Soft and/or loose materials encountered at the bottom of footing excavations should be over-excavated to expose the underlying firm materials. The over-excavation should be backfilled with select granular material compacted to a minimum of 95 percent relative compaction, or the footing bottom may be deepened to the underlying firm materials.

Footings located adjacent to retaining walls should be embedded deep enough to avoid surcharging the retaining wall foundations, or the retaining walls should be designed to resist the additional structural loads.

Foundations located next to utility trenches or easements should be embedded below a 1H:1V imaginary plane extending upward from the bottom edge of the utility trench or as deep as the inverts of the utility lines. This requirement is necessary to avoid surcharging adjacent below-grade structures with additional structural loads and to reduce the potential for foundation settlement.

Lateral loads acting on the structure may be resisted by passive earth pressure acting against the near-vertical faces of the foundation system and by frictional resistance developed between the bottom of the foundation and the bearing soil. Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 300 psf. This assumes that the soil around the footings is relatively undisturbed or well-compacted. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should

be neglected. For footings bearing on properly compacted structural fill material, a coefficient of friction of 0.4 may be used.

We recommend that footing excavations be observed by a representative from Geolabs, Inc. prior to placement of reinforcement steel and concrete to confirm the foundation bearing conditions and the required embedment depths.

Slabs-On-Grade

Our field exploration disclosed that the project site is generally underlain by near-surface clayey soils with moderate swelling potential. Unless floor slabs are properly designed and constructed, there is a potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of these soils due to changes in the moisture content. To reduce the potential for structural distress resulting from the shrinking and swelling of the subgrade soils, we recommend that the subgrade soils be properly prepared and capped with at least 24 inches of non-expansive structural fill material.

The area adjacent to the slabs should be backfilled tightly against the slab and graded to divert water away from the slab to reduce the potential for water ponding around the foundation.

The structural fill should be placed immediately after the moisture-conditioning and compaction of the clayey subgrade soils. The prepared structural fill and the underlying subgrade soils should be wetted and kept moist prior to final placement of concrete. Subgrade soils should be prepared in accordance with the recommendations presented in the "Site Grading" section of this report. Compaction requirements for the subgrade soils and select granular fill are also discussed in the same section of this report.

We recommend that a minimum 4-inch thick layer of cushion fill be placed below the slab. The cushion fill, consisting of No. 3B Fine gravel (ASTM C 33, No. 67 gradation) or Basaltic Termite Barrier (BTB), should provide more uniform support of the slabs and should serve as a capillary break. To reduce future moisture infiltration and subsequent damage to floor coverings, an impervious moisture barrier may be considered on top of the No. 3B Fine gravel or BTB cushion layer. Flexible floor coverings, such as carpet or sheet vinyl, should be considered since they can better mask minor slab cracking. It is also recommended that interior walls be designed to incorporate some flexibility to accommodate small amount of possible ground movements.

For slabs-on-grade that will be subjected to vehicular traffic, such as single-family residential driveways, the 4-inch gravel/BTB cushion layer and the vapor barrier may be omitted. For the design of structural slabs, a modulus of subgrade reaction of 100 pounds per square inch per inch of deflection (pci) may be used for the compacted subgrade material. A minimum slab thickness of 4.5 inches may be used for preliminary design purposes, provided that rebar reinforcement is provided. For house and garage slabs, we recommend that rebar reinforcement be utilized. For driveway slabs, we recommend that, as a minimum, heavy-duty welded-wire fabric be utilized. Provisions should be made for proper load transfer across the slab joints, which are subjected to vehicular traffic. The thickened edges of slabs adjacent to any unpaved area should be embedded at least 12 inches below the lowest adjacent grade.

Exterior concrete walkways and street sidewalks may be used for this project. For these concrete slabs, we recommend a minimum 4-inch thick slab thickness. The 4-inch gravel/BTB cushion layer and the vapor barrier may also be omitted for these slabs. Control joints should be provided at intervals equal to the width of the walkways or sidewalks and at right-angle intersections.

Subgrade soils should be prepared in accordance with the recommendations presented in the "Site Grading" section of this report. Compaction requirements for the subgrade soils and select granular fill are also discussed in the same section of this report.

Pavement Design

Asphaltic concrete pavements are anticipated for the proposed roads. Based on the variable CBR values of the on-site silty clay material, the recommended pavement section

consists of 2 inches of asphaltic concrete, 6 inches of base course, and 0 to 14 inches of select borrow subbase material. The select borrow thickness may be reduced where coralline material is encountered at the finished subgrade level.

Based on the average CBR value of the on-site natural clayey subgrade material, the following pavement section may be used for preliminary budgeting purposes until the finish subgrade material is verified and laboratory testing of this material is conducted.

Asphaltic Concrete Pavements

2.0-Inch Asphaltic Concrete
6.0-Inch Base Course (95 Percent Relative Compaction)
6.0-Inch Select Borrow Subbase (95 Percent Relative Compaction)
14.0-Inch Total Pavement Thickness on Compacted Subgrade

The subgrade soil under the pavement area should be moisture-conditioned to about 2 percent above the optimum moisture, and compacted to at least 95 percent relative compaction. The subgrade should be kept moist prior to placement of select borrow subbase and base course. Base course and select borrow subbase materials should consist of crushed basalt aggregate compacted to not less than 95 percent relative compaction. CBR and density tests should be performed on the actual subgrade soils encountered during construction to confirm the adequacy of the above sections.

Aggregate base course and select borrow subbase materials should meet the material requirements for Base Course and Subbase Course as specified in Sections 30 and 31, respectively, of the Standard Specifications for Public Works Construction, Department of Public Works, City and County of Honolulu, September 1986. Imported fill material should be tested for conformance with these recommendations prior to delivery to the project site for its intended use.

Paved areas should be sloped and drainage gradients maintained to carry surface water off the site. Surface water ponding should not be allowed on the site during or after construction. Where concrete curbs are used to isolate landscaping in or adjacent to the pavement areas, we recommend that the curbs extend a minimum of 2 inches into the subgrade soil to reduce migration of landscape water into the pavement section. Alternatively, a subdrain system could be constructed to collect excessive water from landscaping irrigation. For long-term performance, we recommend a subdrain system be constructed adjacent to the paved/landscaped areas.

Utilities

It is anticipated that utilities will be constructed for the proposed project. The methods and equipment to be used for excavation should be determined by the contractor, subject to practical limits and safety considerations. The excavation should comply with all applicable local, state, and federal safety requirements. Trench shoring design and installation should be the responsibility of the Contractor. Trench shoring and bracing should conform to the appropriate health and safety requirements.

In general, for support of the utility lines, we recommend that a granular bedding consisting of 6 inches of No. 3B Fine gravel (ASTM C 33, No. 67 gradation) be used under the pipes. The initial backfill up to about 1 foot above the pipes should consist of free-draining backfills, such as No. 3B Fine gravel, to reduce the potential for damaging the pipes from compaction of the backfill. It is critical that a free-draining granular material be used to reduce the potential for formation of voids below the haunches of pipes and to provide adequate support for the sides of the pipes. The use of on-site soils as backfill immediately around utility pipes is not recommended.

The upper portion of the trench backfill from the level 1 foot above the pipes to the finish subgrade should consist of the approved on-site soils or select granular material. The backfill material should be moisture-conditioned to at least 2 percent above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 90 percent relative compaction to reduce the potential for future ground subsidence. The upper 2 feet of the trench backfill below the pavement subgrade should be compacted to not less than 95 percent relative compaction. Mechanical

compaction equipment should be used to compact the materials at the project site. Water tamping, jetting, or ponding should not be used to compact the backfill material.

Design Review

Drawings and specifications for the proposed construction should be forwarded to Geolabs, Inc. for review and written comments prior to advertisement for bid. This review is necessary to evaluate adherence of the plans and specifications to the intent of the foundation and earthwork recommendations provided herein. If this review is not made, Geolabs, Inc. cannot assume responsibility for misinterpretation of the recommendations presented.

Construction Observation

It is recommended that Geolabs, Inc. be retained to provide geotechnical engineering services during construction of the proposed project. The items of construction monitoring that are critical which require "Special Inspection" include observation of excavations, subgrade preparation, fill placement and compaction, trench backfill, and footing construction. Other aspects of earthwork construction should also be observed by a representative from Geolabs, Inc. This is to observe compliance with the intent of the design concepts, specifications, or recommendations and to expedite suggestions for design changes that may be required in the event that subsurface conditions differ from those anticipated at the time this report was prepared. The recommendations provided in this report are contingent upon such observations. If the actual soil conditions encountered during construction are different from those assumed or considered in this report, then appropriate modifications to the design should be made.

LIMITATIONS

The analyses and recommendations submitted in this report are based in part upon information obtained from the field borings. Variations of conditions between and beyond the field borings may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to reevaluate the recommendations presented in this report.

The boring locations in the field were determined by taping from structures indicated on the Topographic Plan transmitted by Gentry Homes, Ltd. on January 22, 2001. The elevations of the borings were estimated from the same plan. The locations and elevations of the field borings should be considered accurate only to the degree implied by the methods used.

The stratification breaks shown on graphic representations of the borings depict the approximate boundaries between soil/rock types and, as such, may denote a gradual transition. Water level data from the borings were measured at the times shown on the graphic representations and/or presented in the text of this report. These data have been reviewed and interpretations made in the formulation of this report. However, it must be noted that fluctuation may occur due to variation in seasonal rainfall, and other factors.

This report has been prepared for the exclusive use of Gentry Homes, Ltd. and their project consultants for specific application to the East Ewa Makai project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of assisting the design engineers and architect in the preparation of the subdivision single-family house structure foundations design, road pavements design, and mass grading recommendations for the proposed project. Therefore, this report may not contain sufficient data, or the proper information, for use to form the basis for preparation of construction cost estimates or contract bidding. A contractor wishing to bid on this project should retain a competent geotechnical engineer to assist in the interpretation of this report and/or performance of site-specific exploration for bid estimating purposes.

The owner/client should be aware that unanticipated soil conditions are commonly encountered. Unforeseen soil conditions, such as perched groundwater, soft deposits, hard layers or cavities, may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly

constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

PLATES AND APPENDICES

The following plates and appendices are attached and complete this report:

Plate 1	-	Project Location Map
Plate 2	-	Site Plan
Plate 3	-	Summary of Top of Coralline Deposit
Appendix A	-	Field Exploration
Plate A	-	Boring Log Legend
Plates A-1 thru A-17	-	Logs of Borings
Appendix B	-	Laboratory Testing
Plates B-1 thru B-10	-	Laboratory Test Data

-o0o0o0o0o0o0o0o0o-

Respectfully submitted,

GEOLABS, INC.

CLAYTON S. MIMURA
LICENSED PROFESSIONAL ENGINEER
No. 4176-C
HAWAII, U.S.A.

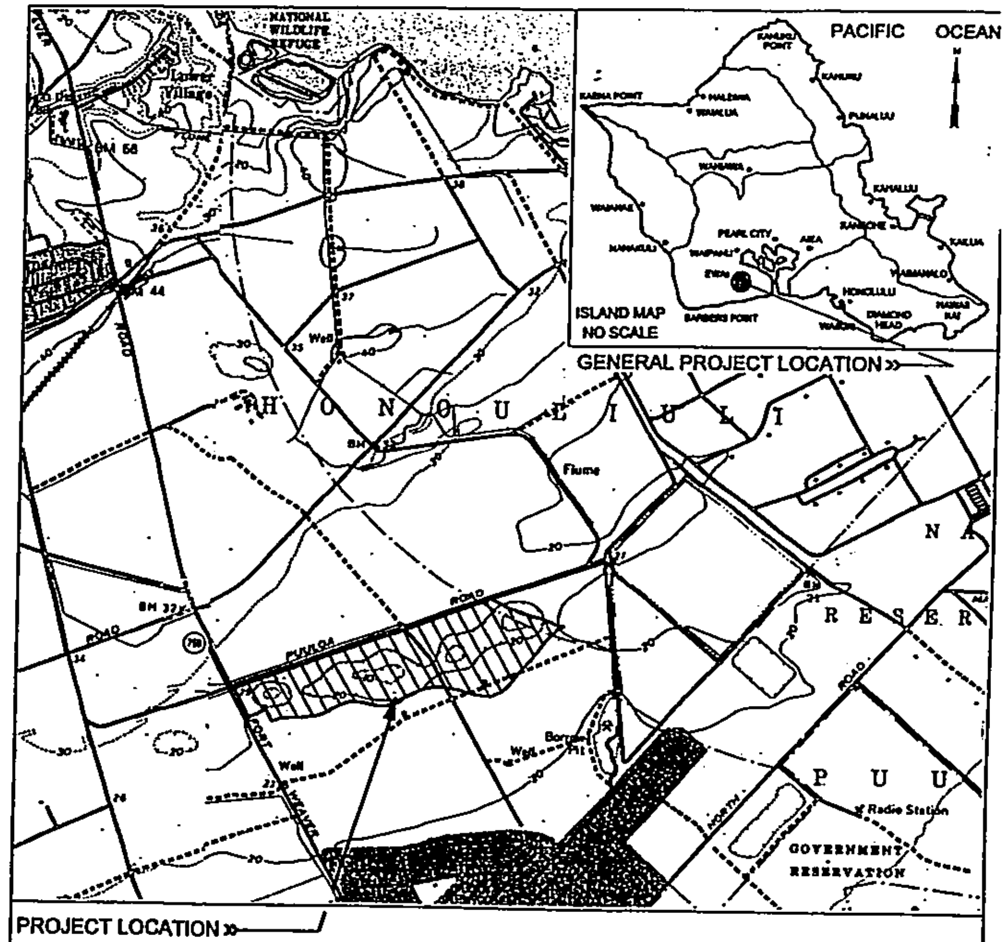
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

By Clayton S. Mimura
Clayton S. Mimura, P.E.
President

CSM:GS:mr

(u:\01reports\4647-00.gs1-p26)

PLATES

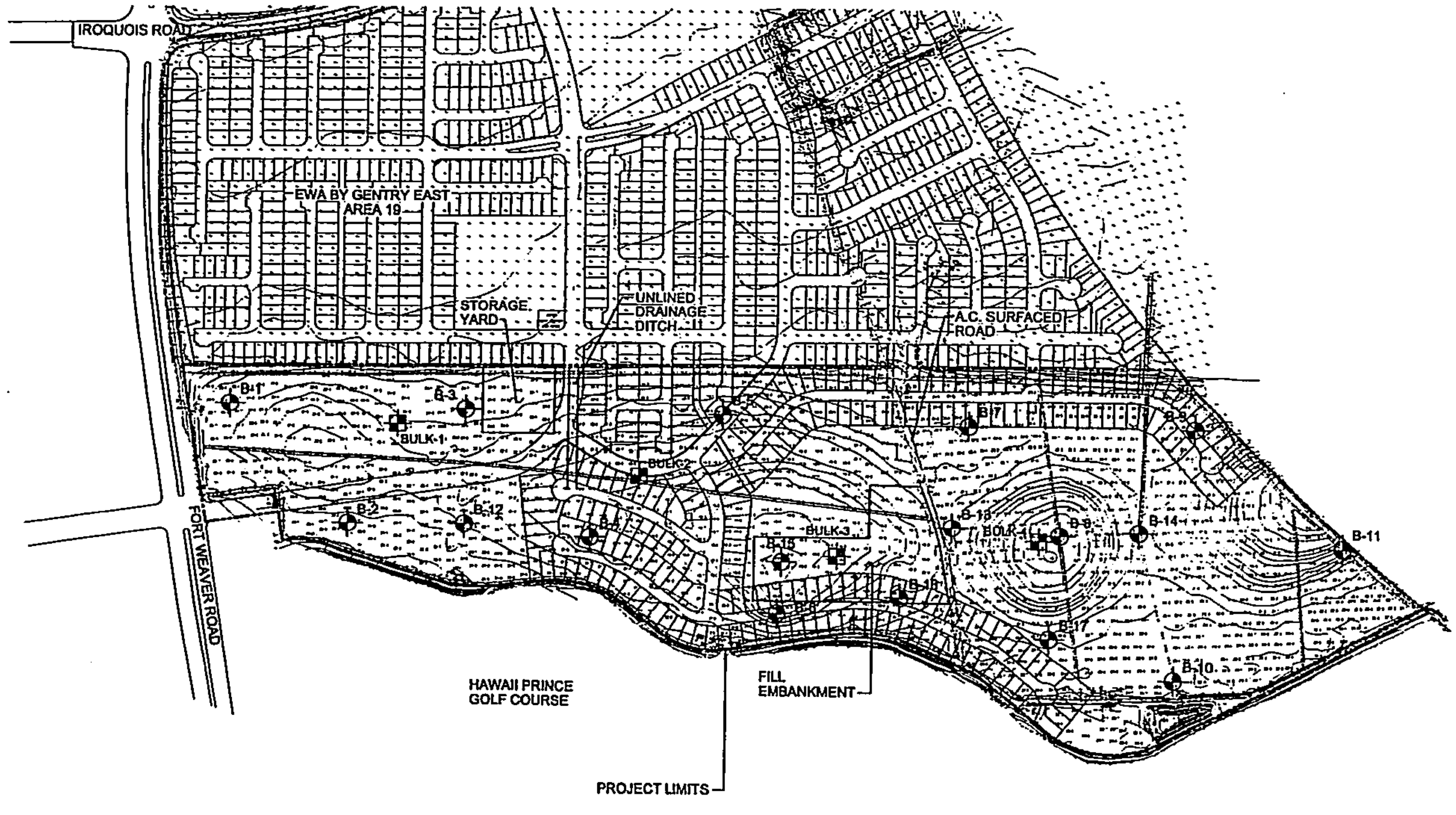


2000 1000 0 2000 FT.
GRAPHIC SCALE

REFERENCE: U.S.G.S. QUADRANGLE MAPS; EWA & PEARL HARBOR, OAHU, HAWAII (1983).

PROJECT LOCATION MAP
EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

GEOLABS, INC. Geotechnical Engineering		
DATE FEBRUARY 2001	DRAWN BY TSK	PLATE
SCALE 1" = 2,000'	W.O. 4647-00	1



LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE BULK SAMPLE LOCATION

REFERENCE: TOPOGRAPHIC PLAN TRANSMITTED BY GENTRY HOMES, LTD. ON JANUARY 22, 2001.

0 200 400 800 1200 FT.

GRAPHIC SCALE

SITE PLAN

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2001	TSK	
SCALE	W.O.	
1" = 400'	4647-00	2

SUMMARY OF TOP OF CORALLINE DEPOSIT

East Ewa Makai Project
Ewa, Oahu, Hawaii

Boring Number	Ground Surface Elevation (ft. MSL)	Depth to Coralline Deposit (feet)	Top of Coralline Deposit Elevation (ft. MSL)
B-1	25	4	21
B-2	25	5.5	19.5
B-3	24.5	4	20.5
B-4	20.5	6	14.5
B-5	22	3	19
B-6	15.5	15	0.5
B-7	23.5	1.5	22
B-8	10.5	8.5	2
B-9	22	2	20
B-10	23.5	2	21.5
B-11	15	2	17
B-12	23	4.5	18.5
B-13	21.5	1.5	20
B-14	21.5	2	19.5
B-15	24.5	20	4.5
B-16	23.5	3.5	20
B-17	22.5	1.5	21

(u:\01reports\4647-00.gs1-p30)

APPENDIX A

Field Exploration

APPENDIX A

Field Exploration

The subsurface conditions at the site were explored by drilling and sampling 17 borings, designated as Boring Nos. 1 through 17, to depths of about 16.5 to 33.0 feet below the existing ground surface at the approximate locations shown on the Site Plan, Plate 2. The borings were drilled using a truck-mounted drill rig equipped with auger and coring equipment.

The materials encountered in the borings were classified by visual and textural examination in the field by our field engineer, who monitored the drilling operations on a near-continuous basis. These classifications were further reviewed visually and by testing in the laboratory. Soils were classified in general conformance with the Unified Soil Classification System, as shown on Plate A. Graphic representations of the materials encountered are provided on the Logs of Borings, Plates A-1 through A-17.

Relatively "undisturbed" soil samples were obtained in general accordance with ASTM Test Designation D 3550-84, Ring-Lined Barrel Sampling of Soils, by driving a 3-inch OD Modified California sampler with a 140-pound hammer falling 30 inches. In addition, some samples were obtained from the drilled borings in general accordance with ASTM Test Designation D 1586-84, Penetration Test and Split-Barrel Sampling of Soils, by driving a 2-inch OD standard penetration sampler using the same hammer and drop. The blow counts needed to drive the sampler the second and third 6 inches of an 18-inch drive are shown as the "Penetration Resistance" on the Logs of Boring at the appropriate sample depths.

Core samples of coral materials encountered at the site were obtained using diamond core drilling techniques in general accordance with ASTM Standard Practice D 2113-83, Diamond Core Drilling for Site Investigation. Core drilling is a rotary drilling method that uses a hollow bit to cut into the rock formation. The rock material left in the hollow core of the bit is mechanically recovered for examination and description.

Recovery (REC) is used as a subjective guide to the interpretation of the relative quality of rock masses. Recovery is defined as the actual length of material recovered from a coring attempt versus the length of the core attempt. For example, if 3.7 feet of material is recovered from a 5.0-foot core run, the recovery would be 74 percent and would be shown on the Logs of Borings as REC = 74%.

The Rock Quality Designation (RQD) is also a subjective guide to the relative quality of rock masses. RQD is defined as the percentage of the core run that is sound material in excess of 4 inches in length without discontinuities, discounting drilling-induced fractures or breaks. If 2.5 feet of sound material is recovered from a 5.0-foot core run, the RQD would be 50 percent and would be shown on the Logs of Borings as RQD = 50%. It should be noted that RQD does not apply to coral material. However, the RQD values of the coral material are included in the boring logs for rough characterization of the coral material.

Rock Quality	RQD (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

The rippability of a rock mass is a function of the relative hardness of the rock, its relative quality, brittleness, and fissile characteristics. A dense basalt with a high RQD value would be very difficult to rip and would probably require more arduous methods of excavation.

(u:\01reports\4647-00.gs1-pg 27)

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 1

Approximate Ground Surface Elevation (feet MSL): 25 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Unit Weight (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	USCS	Description
	17	88			40		CH	Brown SILTY CLAY, damp, very stiff
	17				44			grades to hard
			33	0				Grayish white CORAL-ALGAL REEF, severely fractured, slightly to moderately weathered, medium dense (coral formation)
								Tan CEMENTED SAND, closely fractured, slightly to moderately weathered, medium dense to dense (sandstone)
			70	23				
			57	0				
								White CORAL-ALGAL REEF, severely fractured, slightly weathered, medium dense to dense (coral formation)
								Boring terminated at 30 feet

* Elevations estimated from Topographic plan transmitted by Gentry Homes, Ltd. on January 22, 2001.

Date Started:	January 19, 2001	Water Level: ∇	22.4 ft. 1/19/01 1219 HRS
Date Completed:	January 19, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	30 feet	Drilling Method:	4" Auger & NX Coring
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 1

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 2

Approximate Ground Surface Elevation (feet MSL): 25 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Unit Weight (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	USCS	Description
LL=46 PI=23	17	88			50		CH	Brown SILTY CLAY, damp, very stiff
	17				42			grades to hard
	7	106			80		GM	Tannish white mottling SILTY GRAVEL with sand, very dense, damp (coral formation)
	12				60/.5'		GC	Grayish white mottling CLAYEY GRAVEL with sand, very dense, moist (coral formation)
	9				60/.5'			Tan with white mottling CEMENTED SAND with silt, very dense, very moist (sandstone)
	10				42			Tan with white mottling CEMENTED SAND dense (sandstone)
	27				18			Tan CEMENTED SAND, medium dense (sandstone)
								Boring terminated at 26.5 feet

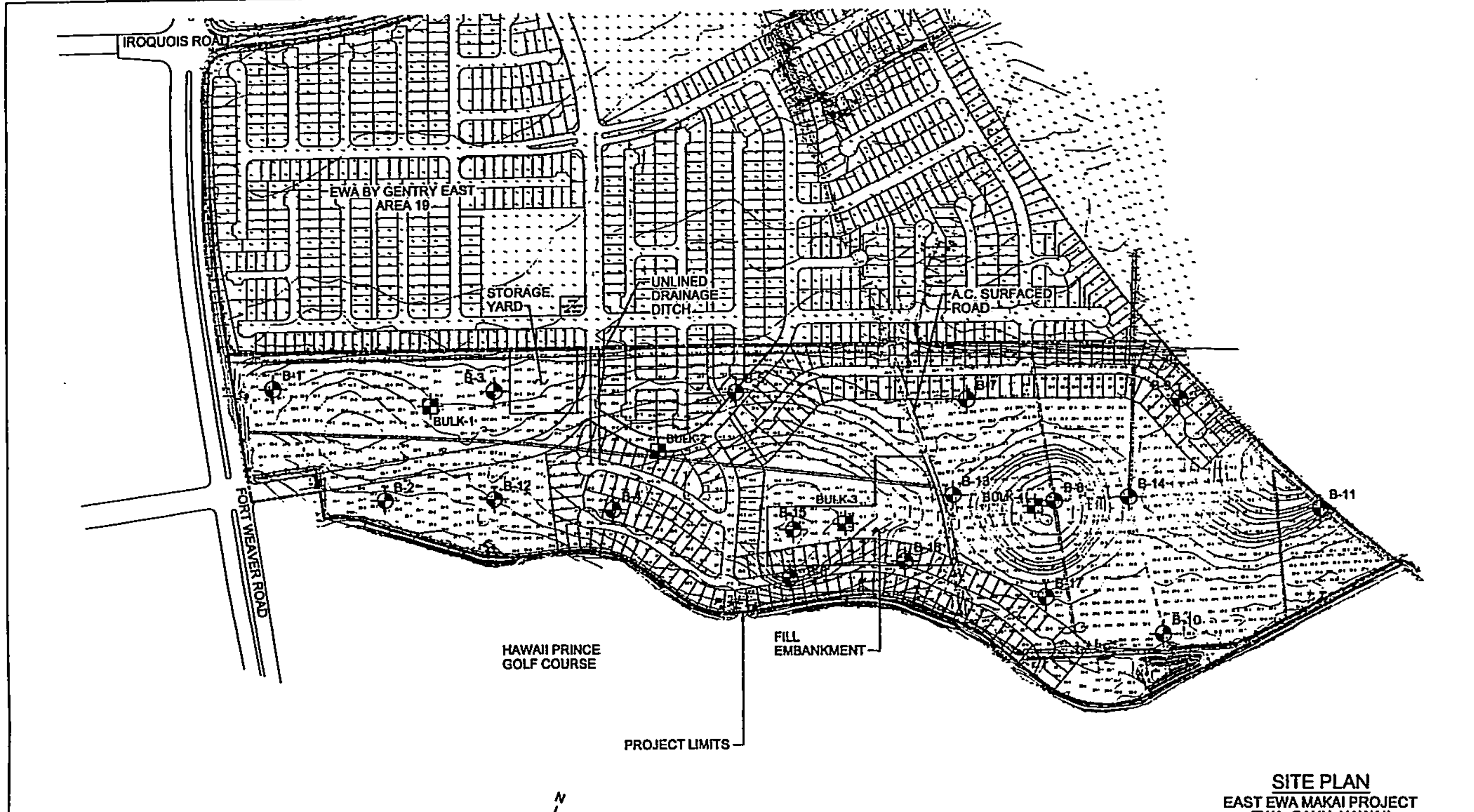
Date Started:	January 18, 2001	Water Level: ∇	20.4 ft. 1/18/01 1410 HRS
Date Completed:	January 18, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	26.5 feet	Drilling Method:	4" Auger
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 2

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

CORRECTION

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



LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE BULK SAMPLE LOCATION

REFERENCE: TOPOGRAPHIC PLAN TRANSMITTED BY GENTRY HOMES, LTD. ON JANUARY 22, 2001.

0 200 400 800 1200 FT.

GRAPHIC SCALE

SITE PLAN

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

GEOLABS, INC. Geotechnical Engineering		
DATE: FEBRUARY 2001	DRAWN BY: TSK	PLATE
SCALE: 1" = 400'	W.O.: 4547-00	2

SUMMARY OF TOP OF CORALLINE DEPOSIT

East Ewa Makai Project
Ewa, Oahu, Hawaii

Boring Number	Ground Surface Elevation (ft. MSL)	Depth to Coralline Deposit (feet)	Top of Coralline Deposit Elevation (ft. MSL)
B-1	25	4	21
B-2	25	5.5	19.5
B-3	24.5	4	20.5
B-4	20.5	6	14.5
B-5	22	3	19
B-6	15.5	15	0.5
B-7	23.5	1.5	22
B-8	10.5	8.5	2
B-9	22	2	20
B-10	23.5	2	21.5
B-11	15	2	17
B-12	23	4.5	18.5
B-13	21.5	1.5	20
B-14	21.5	2	19.5
B-15	24.5	20	4.5
B-16	23.5	3.5	20
B-17	22.5	1.5	21

(u:\01reports\4647-00.gs1-p30)

APPENDIX A

Field Exploration

GEOLABS, INC. Geotechnical Engineering	EAST EWA MAKAI PROJECT EWA, OAHU, HAWAII	Log of Boring 1

Approximate Ground Surface Elevation (feet MSL): 25 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	USCS	Description
							CH	Brown SILTY CLAY, damp, very stiff
	17	88			40			
	17				44			grades to hard
			33	0				Grayish white CORAL-ALGAL REEF, severely fractured, slightly to moderately weathered, medium dense (coral formation)
								Tan CEMENTED SAND, closely fractured, slightly to moderately weathered, medium dense to dense (sandstone)
			70	23				
			57	0				
								White CORAL-ALGAL REEF, severely fractured, slightly weathered, medium dense to dense (coral formation)
								Boring terminated at 30 feet

* Elevations estimated from Topographic plan transmitted by Gentry Homes, Ltd. on January 22, 2001.

Date Started:	January 19, 2001	Water Level: ∇	22.4 ft. 1/19/01 1219 HRS
Date Completed:	January 19, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	30 feet	Drilling Method:	4" Auger & NX Coring
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 1

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC. Geotechnical Engineering	EAST EWA MAKAI PROJECT EWA, OAHU, HAWAII	Log of Boring 2

Approximate Ground Surface Elevation (feet MSL): 25 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	USCS	Description
							CH	Brown SILTY CLAY, damp, very stiff
LL=46 PI=23	17	88			50			
	17				42			grades to hard
	7	106			80			
							GM	Tannish white mottling SILTY GRAVEL with sand, very dense, damp (coral formation)
	12				60/.5'		GC	Grayish white mottling CLAYEY GRAVEL with sand, very dense, moist (coral formation)
								Tan with white mottling CEMENTED SAND with silt, very dense, very moist (sandstone)
	9				60/.5'			
	10				42			Tan with white mottling CEMENTED SAND dense (sandstone)
	27				18			Tan CEMENTED SAND, medium dense (sandstone)
								Boring terminated at 26.5 feet

Date Started:	January 18, 2001	Water Level: ∇	20.4 ft. 1/18/01 1410 HRS
Date Completed:	January 18, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	26.5 feet	Drilling Method:	4" Auger
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 2

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

APPENDIX A

Field Exploration

The subsurface conditions at the site were explored by drilling and sampling 17 borings, designated as Boring Nos. 1 through 17, to depths of about 16.5 to 33.0 feet below the existing ground surface at the approximate locations shown on the Site Plan, Plate 2. The borings were drilled using a truck-mounted drill rig equipped with auger and coring equipment.

The materials encountered in the borings were classified by visual and textural examination in the field by our field engineer, who monitored the drilling operations on a near-continuous basis. These classifications were further reviewed visually and by testing in the laboratory. Soils were classified in general conformance with the Unified Soil Classification System, as shown on Plate A. Graphic representations of the materials encountered are provided on the Logs of Borings, Plates A-1 through A-17.

Relatively "undisturbed" soil samples were obtained in general accordance with ASTM Test Designation D 3550-84, Ring-Lined Barrel Sampling of Soils, by driving a 3-inch OD Modified California sampler with a 140-pound hammer falling 30 inches. In addition, some samples were obtained from the drilled borings in general accordance with ASTM Test Designation D 1586-84, Penetration Test and Split-Barrel Sampling of Soils, by driving a 2-inch OD standard penetration sampler using the same hammer and drop. The blow counts needed to drive the sampler the second and third 6 inches of an 18-inch drive are shown as the "Penetration Resistance" on the Logs of Boring at the appropriate sample depths.

Core samples of coral materials encountered at the site were obtained using diamond core drilling techniques in general accordance with ASTM Standard Practice D 2113-83, Diamond Core Drilling for Site Investigation. Core drilling is a rotary drilling method that uses a hollow bit to cut into the rock formation. The rock material left in the hollow core of the bit is mechanically recovered for examination and description.

Recovery (REC) is used as a subjective guide to the interpretation of the relative quality of rock masses. Recovery is defined as the actual length of material recovered from a coring attempt versus the length of the core attempt. For example, if 3.7 feet of material is recovered from a 5.0-foot core run, the recovery would be 74 percent and would be shown on the Logs of Borings as REC = 74%.

The Rock Quality Designation (RQD) is also a subjective guide to the relative quality of rock masses. RQD is defined as the percentage of the core run that is sound material in excess of 4 inches in length without discontinuities, discounting drilling-induced fractures or breaks. If 2.5 feet of sound material is recovered from a 5.0-foot core run, the RQD would be 50 percent and would be shown on the Logs of Borings as RQD = 50%. It should be noted that RQD does not apply to coral material. However, the RQD values of the coral material are included in the boring logs for rough characterization of the coral material.

Rock Quality	RQD (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

The rippability of a rock mass is a function of the relative hardness of the rock, its relative quality, brittleness, and fissile characteristics. A dense basalt with a high RQD value would be very difficult to rip and would probably require more arduous methods of excavation.

(u:\01reports\4647-00.gs1-pg 27)

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **3**

Approximate Ground Surface Elevation (feet MSL): 24.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	15	87			50					CH	Brown SILTY CLAY, very stiff, damp
	16				71						grades to hard
	6				54		5			SM	Grayish white CORALLINE SILTY SAND with gravel, dense to very dense, damp (coral formation)
	7				50/.5'		10				
	11				42		15				
	7				80		20				Tan CEMENTED SAND, very dense, damp (sandstone)
	23				31		25				grades to medium dense
											Boring terminated at 26.5 feet
							30				
							35				

Date Started:	January 24, 2001	Water Level: ∇ 23.3 ft. 1/24/01 1148 HRS	Plate
Date Completed:	January 24, 2001		
Logged By:	L. Wang	Drill Rig: CME-55	A - 3
Total Depth:	26.5 feet	Drilling Method: 4" Auger	
Work Order:	4647-00	Driving Energy: 140 lb. wt., 30 in. drop	

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **4**

Approximate Ground Surface Elevation (feet MSL): 20.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	16	87			41					CH	Brown SILTY CLAY, very stiff, damp
	18				36						grades to hard
	18				26		5				grades to very stiff
			74	29							Light tan CORAL-ALGAL REEF with shell fragments, moderately fractured, slightly to moderately weathered, dense (coral formation)
							10				
			62	7						SM	Brown SILTY SAND with white coralline gravel (alluvium/coral detritus)
							15				Light tan CORAL-ALGAL REEF, closely fractured, slightly to moderately, dense (coral formation)
							20				grades to grayish white, severely fractured
			50	0							
							25				Boring terminated at 25 feet
							30				
							35				

Date Started:	January 19, 2001	Water Level: ∇ 18.9 ft. 1/19/01 1404 HRS	Plate
Date Completed:	January 19, 2001		
Logged By:	L. Wang	Drill Rig: CME-55	A - 4
Total Depth:	25 feet	Drilling Method: 4" Auger & NX Coring	
Work Order:	4647-00	Driving Energy: 140 lb. wt., 30 in. drop	

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 5

Approximate Ground Surface Elevation (feet MSL): 22 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
							0	CH	Brown SILTY CLAY, very stiff, damp
	18	91			57				
	18				50/.3'				grades to hard
								SM	Grayish white CORALLINE SILTY SAND with some gravel, dense, damp (coral formation)
	6				42		5		
	4				68		10	GM	Grayish white CORALLINE SANDY GRAVEL with silt, very dense, damp (coral formation)
									Tan CEMENTED SAND, very dense, moist (sandstone)
	7				100/.3'		15		
	28				14		20		grades to medium dense
	19				33		25		grades to dense
									Boring terminated at 26.5 feet

Date Started:	January 18, 2001
Date Completed:	January 18, 2001
Logged By:	L. Wang
Total Depth:	26.5 feet
Work Order:	4647-00
Water Level: ∇	19.2 ft. 1/18/01 1235 HRS; 19.4 ft. 1/18/01 1248 HRS
Drill Rig:	CME-55
Drilling Method:	4" Auger
Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 5

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 6

Approximate Ground Surface Elevation (feet MSL): 15.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	23	79			28		0	CH	Brown with black mottling CLAY, very stiff, moist
	32				14				grades to stiff
	33				11		5		
									grades with some coral gravel
LL=59 PI=47	24				27		10		grades to very stiff, wet
	27				42		15	CL	Brown SANDY CLAY with traces of coralline gravel, hard
								GM	Tannish white CORALLINE SILTY GRAVEL, dense (coral formation)
	14				55		20		
									Boring terminated at 21.5 feet

Date Started:	January 24, 2001
Date Completed:	January 24, 2001
Logged By:	L. Wang
Total Depth:	21.5 feet
Work Order:	4647-00
Water Level: ∇	13.5 ft. 1/24/01 1009 HRS
Drill Rig:	CME-55
Drilling Method:	4" Auger
Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 6

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **7**

Approximate Ground Surface Elevation (feet MSL): 23.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	USCS	Description
	7	81			52/.5'		MH	Brown CLAYEY SILT, very stiff, damp
			52	0				Grayish white CORAL-ALGAL REEF, closely fractured, slightly weathered, dense to very dense (coral formation)
			44	0				Tan CEMENTED SAND, closely to severely fractured, slightly to moderately weathered, medium dense to dense (sandstone)
								Grayish white CORAL-ALGAL REEF, severely fractured, moderately weathered, medium dense (coral formation)
			100	17				White CORAL, moderately fractured, slightly weathered, medium dense to dense (coral formation)
								Grayish white CORAL-ALGAL REEF, closely to moderately fractured, slightly to moderately weathered, medium dense to dense (coral formation)
								Boring terminated at 25 feet

Date Started: January 22, 2001
Date Completed: January 22, 2001
Logged By: L. Wang
Total Depth: 25 feet
Work Order: 4647-00

Water Level: ∇ 22.9 ft. 1/22/01 1113 HRS
Drill Rig: CME-55
Drilling Method: 4" Auger & NX Coring
Driving Energy: 140 lb. wt., 30 in. drop

Plate A - 7

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **8**

Approximate Ground Surface Elevation (feet MSL): 10.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	USCS	Description
	18	79			46		CH	Brown CLAY, very stiff, damp
	21				30			
LL=69 PI=47	29				13			grades to moist, stiff
	30				29		GM	Tannish white SILTY GRAVEL with sand, medium dense, wet (coral formation)
	41				7		CL	Tan SANDY CLAY with some gravel, medium stiff
								Boring terminated at 18.5 feet

Date Started: January 23, 2001
Date Completed: January 23, 2001
Logged By: L. Wang
Total Depth: 18.5 feet
Work Order: 4647-00

Water Level: ∇ 9.9 ft. 1/23/01 1430 HRS
Drill Rig: CME-55
Drilling Method: 4" Auger
Driving Energy: 140 lb. wt., 30 in. drop

Plate A - 8

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 9

Approximate Ground Surface Elevation (feet MSL): 22 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	18	76			28/.5' +50/.3'		0	CH	Brown SILTY CLAY, hard, damp
								GM	Tannish white CORALLINE SILTY GRAVEL, dense, damp (coral formation)
	4				38		5		
	3				48/.5' +50/.3'		10		grades to very dense
	4				27		15		Tan CEMENTED SAND, medium dense, damp (sandstone)
	19				17		20		grades to medium dense, wet
	17				70		25	GM	Tannish white SILTY GRAVEL, very dense (coral formation)
									Boring terminated at 26.5 feet

Date Started:	January 23, 2001	Water Level: ▽	20.4 ft. 1/23/01 1130 HRS 20.5 ft. 1/23/01 1145 HRS
Date Completed:	January 23, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	26.5 feet	Drilling Method:	4" Auger
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 9

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 10

Approximate Ground Surface Elevation (feet MSL): 23.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	14				50/.4'		0	MH	Brown CLAYEY SILT, hard, damp
			39	7					Grayish white CORAL-ALGAL REEF with brown clay coating,, severely fractured, moderately weathered, medium dense (coral formation)
							10		Light tan CORAL-ALGAL REEF, moderately fractured, moderately weathered, dense (coral formation)
									Light tan CEMENTED SAND, moderately to severely fractured, slightly to moderately weathered, medium dense (sandstone)
			100	17					Light tan CORAL-ALGAL REEF, closely to severely fractured, slightly to moderately weathered, medium dense to dense (coral formation)
			30	0			15		grades to grayish white
							25		Boring terminated at 25 feet

Date Started:	January 23, 2001	Water Level: ▽	23.1 ft. 1/23/01 1440 HRS
Date Completed:	January 23, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	25 feet	Drilling Method:	4" Auger & NX Coring
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 10

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **11**

Approximate Ground Surface Elevation (feet MSL): 15 *

Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	3				60/.4'					MH	Brown CLAYEY SILT, very stiff, damp
		82	44	11			5				Grayish white CORAL-ALGAL REEF, severely fractured, slightly to moderately weathered, medium dense to dense (coral formation)
			38	0			10				Tan with white mottling CEMENTED SAND, moderately fractured, slightly to moderately weathered, dense (sandstone) grades to closely fractured
							15				
							20				grades to severely fractured
											Boring terminated at 21 feet
							25				
							30				
							35				

Date Started: January 22, 2001	Water Level: ▽ Not Encountered		Plate
Date Completed: January 22, 2001			
Logged By: L. Wang	Drill Rig: CME-55		
Total Depth: 21 feet	Drilling Method: 4" Auger & NX Coring		
Work Order: 4647-00	Driving Energy: 140 lb. wt., 30 in. drop		A - 11

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/13/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **12**

Approximate Ground Surface Elevation (feet MSL): 23 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	17	82			34					CH	Brown SILTY CLAY, very stiff, damp
	18				30					MH	Reddish brown CLAYEY SILT with sand, very stiff, damp
	6				64/.5'		5			SW/GM	Grayish white CORALLINE SILTY SAND AND GRAVEL, very dense, damp (coral formation)
	9				21		10				grades to medium dense
	8				40/.5' +50/.4'		15				
	12				34		20				Tan CEMENTED SAND, dense, very moist (sandstone)
					17		25			GM	Tannish white SILTY GRAVEL with sand, medium dense (coral formation)
											Boring terminated at 26.5 feet
							30				
							35				

Date Started: January 24, 2001	Water Level: ▽ 22.4 ft. 1/24/01 1300 HRS		Plate
Date Completed: January 24, 2001			
Logged By: L. Wang	Drill Rig: CME-55		
Total Depth: 26.5 feet	Drilling Method: 4" Auger		
Work Order: 4647-00	Driving Energy: 140 lb. wt., 30 in. drop		A - 12

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/13/01

GEOLABS, INC. Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **13**

Approximate Ground Surface Elevation (feet MSL): 21.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	19	68			35/.3'		0	CH	Brown SILTY CLAY, hard, damp
	10				19			GM	Grayish white CORALLINE SILTY GRAVEL with sand, medium dense, damp (coral formation)
	11				22		5		
	14				50/.3'		10		grades to very dense
	6				29		15		Tan CEMENTED SAND, medium dense, moist (sandstone)
	30				8		20		grades to loose, wet
	24				38		25	GM	Tannish white SILTY GRAVEL with sand, very dense (coral formation)
									Boring terminated at 26.5 feet

Date Started:	January 24, 2001
Date Completed:	January 24, 2001
Logged By:	L. Wang
Total Depth:	26.5 feet
Work Order:	4647-00
Water Level:	⊽ 20.1 ft. 1/24/01 1433 HRS
Drill Rig:	CME-55
Drilling Method:	4" Auger
Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 13

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC. Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **14**

Approximate Ground Surface Elevation (feet MSL): 21.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	4	97			27/.5' +35/.2'		0	CH	Brown SILTY CLAY, hard, damp
	8				50/.3'			SM	Grayish white CORALLINE SILTY SAND, very dense, damp (coral formation)
	9				53/.5'		5	SM/GM	Grayish white CORALLINE SILTY SAND AND GRAVEL very dense, damp (coral formation)
	5				68/.5'		10		
	25				24		20	GM	Grayish white SILTY GRAVEL with sand, dense to medium dense, wet (coral formation)
	20				20		25		grades to loose
									Boring terminated at 26.5 feet

Date Started:	January 25, 2001
Date Completed:	January 25, 2001
Logged By:	L. Wang
Total Depth:	26.5 feet
Work Order:	4647-00
Water Level:	⊽ 21.1 ft. 1/25/01 0931 HRS
Drill Rig:	CME-55
Drilling Method:	4" Auger
Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 14

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 15

Approximate Ground Surface Elevation (feet MSL): 24.5 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Unit Weight (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	USCS	Description
	18	106			58		CH	Brown SILTY CLAY with traces of coral, hard, moist (fill)
LL=54 PI=33	18				73			grades to very hard
	20	83			69			
	20				14			grades with some basalt gravel, stiff, moist
	27	91			38	2.5		grades to very stiff
	23				27		GM	Grayish white CORALLINE SILTY GRAVEL, medium dense, wet (coral formation)
	21				34		CL	Yellowish brown to brown SANDY CLAY with some gravel, hard (alluvium/coral detritus)
							GM	Grayish white CORALLINE SILTY GRAVEL with sand, very dense (coral formation)
	21				80/.5'			Boring terminated at 33 feet

Depth (feet): 5, 10, 15, 20, 25, 30, 35

Date Started:	January 25, 2001	Water Level: ▽	24.1 ft. 1/25/01 1420 HRS
Date Completed:	January 25, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	33 feet	Drilling Method:	4" Auger
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 15

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring 16

Approximate Ground Surface Elevation (feet MSL): 23.5 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Unit Weight (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	USCS	Description
	17	82			61		CH	Brown SILTY CLAY, hard to very hard, damp
	17				20/.0'		SM	White CORALLINE SILTY SAND with gravel, very dense, damp (coral formation)
	6				50/.2'			
	7				41		GM	Tan CORALLINE SILTY GRAVEL with sand, dense, moist (coral formation)
	18				37			grades to grayish white
	19				22		GM	Tan CORALLINE SILTY GRAVEL with sand, medium dense (coral formation)
								Boring terminated at 26.5 feet

Depth (feet): 5, 10, 15, 20, 25, 30, 35

Date Started:	January 25, 2001	Water Level: ▽	22.2 ft. 1/25/01 1539 HRS
Date Completed:	January 25, 2001		
Logged By:	L. Wang	Drill Rig:	CME-55
Total Depth:	26.5 feet	Drilling Method:	4" Auger
Work Order:	4647-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 16

LOG OF BORING - UPDATED 4647-00.GPJ GEOLABS.GDT 3/1/01

GEOLABS, INC.
Geotechnical Engineering

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Log of Boring **17**

Approximate Ground Surface Elevation (feet MSL): 22.5 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Unit Weight (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	4	90			50/.4'			CH	Brown SILTY CLAY, hard, damp
	7				52/.5'			SM	Grayish white CORALLINE SILTY SAND, very dense, damp (coral formation)
	8				19		5		
	7				50/.3'		10	GM	Tannish white CORALLINE SILTY GRAVEL with sand, very dense, damp (coral formation)
	18				10		15		grades to medium dense
								GM	Grayish white CORALLINE SILTY GRAVEL with sand, loose, moist (coral formation)
	19				18		20		
	19				12		25		
									Boring terminated at 28.5 feet
							30		
							35		

Date Started:	January 25, 2001
Date Completed:	January 25, 2001
Logged By:	L. Wang
Total Depth:	28.5 feet
Work Order:	4847-00

Water Level: ∇ 23 ft. 1/25/01 1101 HRS

Drill Rig:	CME-55
Drilling Method:	4" Auger
Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 17

APPENDIX B

Laboratory Testing

APPENDIX B

Laboratory Testing

Moisture content (ASTM D 2216) and unit weight determinations (ASTM D 2937) were performed on selected soil samples as an aid in the classification and evaluation of soil properties. The results of these tests are presented on the Logs of Borings at the appropriate sample depths.

Nine one-inch ring swell tests were performed on relatively undisturbed samples to evaluate the swelling potential of the soils under surcharge pressures. These tests were run on air-dried samples. Results of these swell tests are presented on Plate B-1.

Four Atterberg Limits Tests (ASTM D 4318) were performed on selected samples of the soils to evaluate the liquid and plastic limits and to aid in soil classification. Results of these tests are summarized on the Logs of Borings at the appropriate sample depths. Graphic representations of the test results are provided on Plate B-2.

Six California Bearing Ratio (CBR) tests (ASTM D 1883) were performed on bulk samples of near-surface soils to evaluate the strength characteristics for pavement subgrade support. Results of these CBR tests are presented on Plates B-3 through B-8.

Two Modified Proctor compaction tests (ASTM D 1557) were performed on the near-surface soil to determine the maximum dry densities and optimum moistures of the on-site soils. Results of these tests are presented on Plates B-9 through B-10.

(u:\00reports\4647-00.gs1-pg.28)

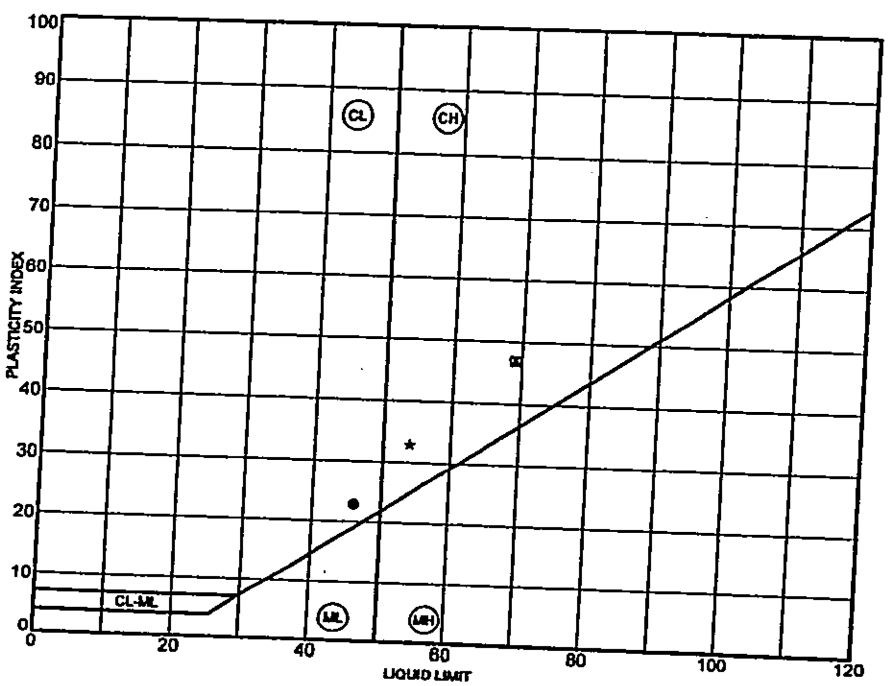
SUMMARY OF ONE-INCH RING SWELL TESTS

East Ewa Makai Project
Ewa, Oahu, Hawaii

Location	Depth (feet)	Soil Description	Dry Density (pcf)	Moisture Contents Initial (%)	Moisture Contents Air-Dried (%)	Moisture Contents Final (%)	Ring Swell (%)
B-1	1.0 – 2.5	Brown Silty Clay	83.8	20.6	N/A	37.9	2.8
B-3	1.0 – 2.5	Brown Silty Clay	82.2	21.0	N/A	42.8	2.6
B-4	1.0 – 2.5	Brown Silty Clay	93.4	24.1	N/A	38.6	4.6
B-5	1.0 – 2.5	Brown Silty Clay	83.1	21.6	N/A	41.5	3.5
B-6	1.0 – 2.5	Brown w/Black Mottling Clay	76.2	25.8	N/A	42.9	0.4
B-9	1.0 – 2.5	Brown Silty Clay	86.2	12.0	N/A	39.0	2.0
B-14	1.0 – 2.1	Brown Silty Clay	100.0	5.2	N/A	26.5	0.3
B-15	1.0 – 2.5	Brown Silty Clay	99.2	20.2	N/A	36.7	9.7
B-16	1.0 – 2.1	Brown Silty Clay	81.6	17.4	N/A	40.9	4.1

NOTES: Relatively undisturbed samples were tested in a 2.4-inch diameter by one-inch high ring. The samples were allowed to air-dry overnight, then was saturated for 24 hours under a surcharge pressure of 55 psf.

(u:\01\reports\4647-00.gs1-pg.38)



	Sample	Depth (ft)	LL	PL	PI	Description
●	B-2	1.0 - 2.5	46	23	23	Brown SILTY CLAY
⊠	B-6	10.0 - 11.5	69	22	47	Brown with black mottling CLAY
▲	B-8	5.0 - 6.5	69	22	47	Brown CLAY
*	B-15	3.0 - 4.5	54	21	33	Brown SILTY CLAY

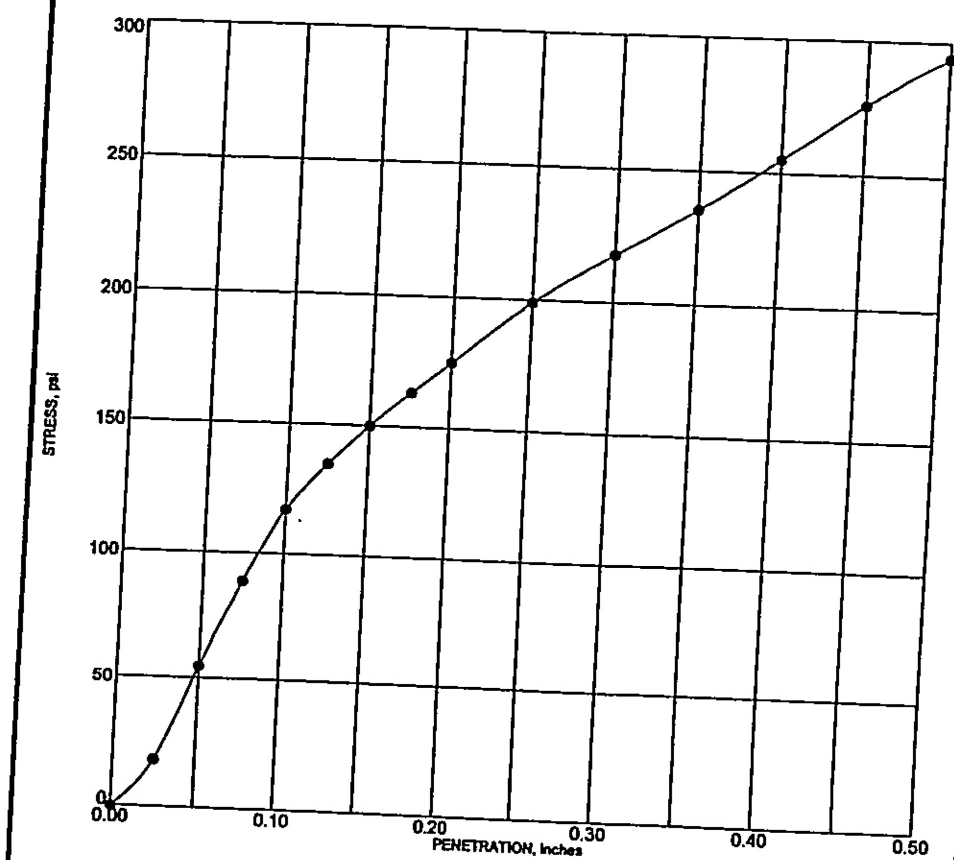
GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

ATTERBERG LIMITS TEST RESULTS - ASTM D 4318

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 2

G ATTERBERG 4647-00.GPJ GEOLABS.GDT 2/27/01



Sample: BULK-1
Depth: SURFACE
Description: Brown SILTY CLAY

Corr. CBR @ 0.1"	12.5
Swell (%)	0.96

Molding Dry Density (pcf)	103.2	Hammer Wt. (lbs)	10
Molding Moisture (%)	23.0	Hammer Drop (inches)	18
Days Soaked	3	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

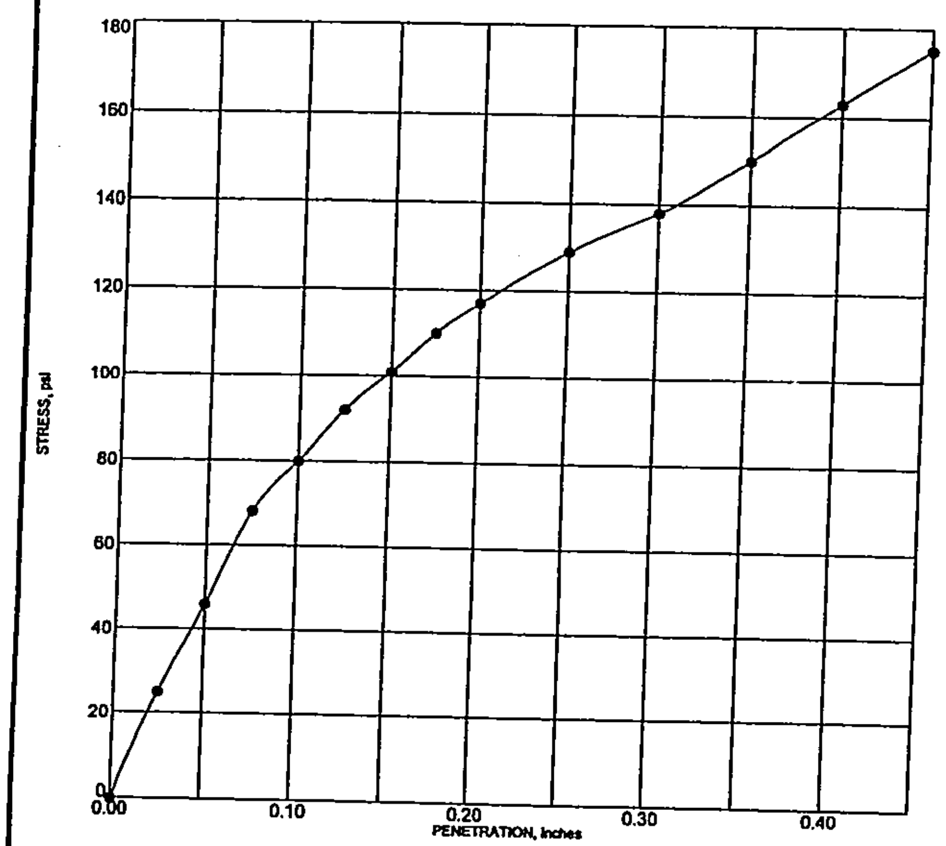
GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

CALIFORNIA BEARING RATIO - ASTM D 1883

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 3

G CBR 4647-00.GPJ GEOLABS.GDT 2/27/01



Corr. CBR @ 0.1"	8.0
Swell (%)	2.30

Sample: BULK-2
Depth: SURFACE
Description: Brown SILTY CLAY

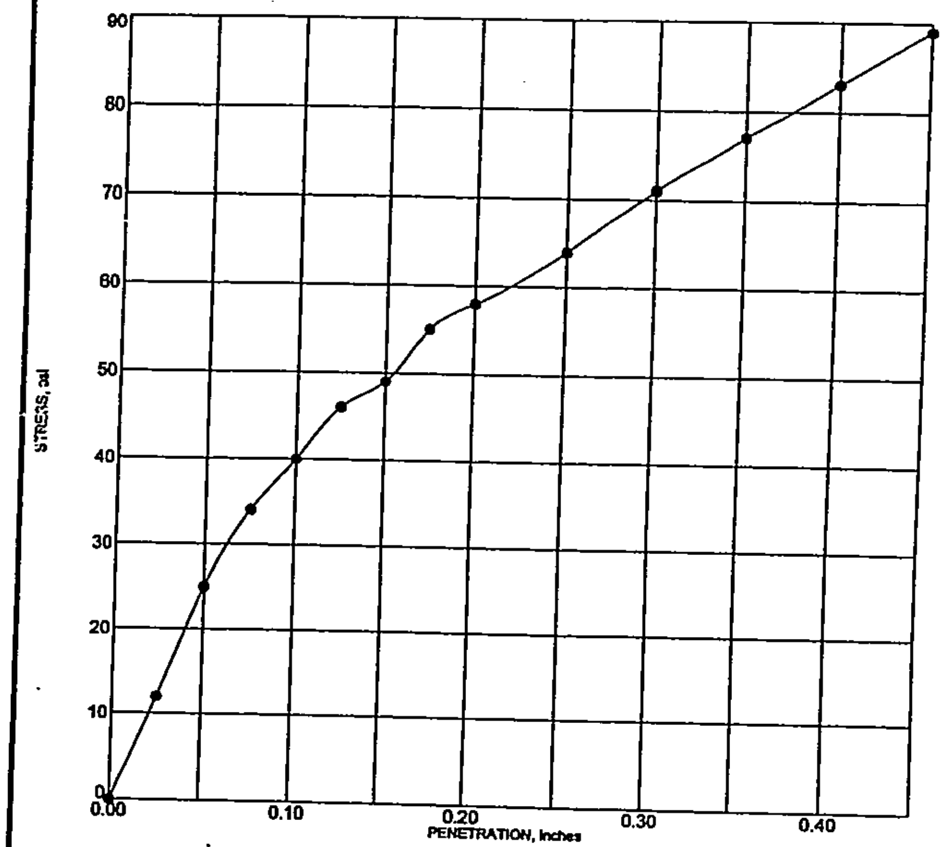
Molding Dry Density (pcf)	99.7	Hammer Wt. (lbs)	10
Molding Moisture (%)	22.8	Hammer Drop (inches)	18
Days Soaked	3	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

CALIFORNIA BEARING RATIO - ASTM D 1883

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 4



Corr. CBR @ 0.1"	4.0
Swell (%)	3.70

Sample: BULK-3
Depth: SURFACE
Description: Brown SILTY CLAY

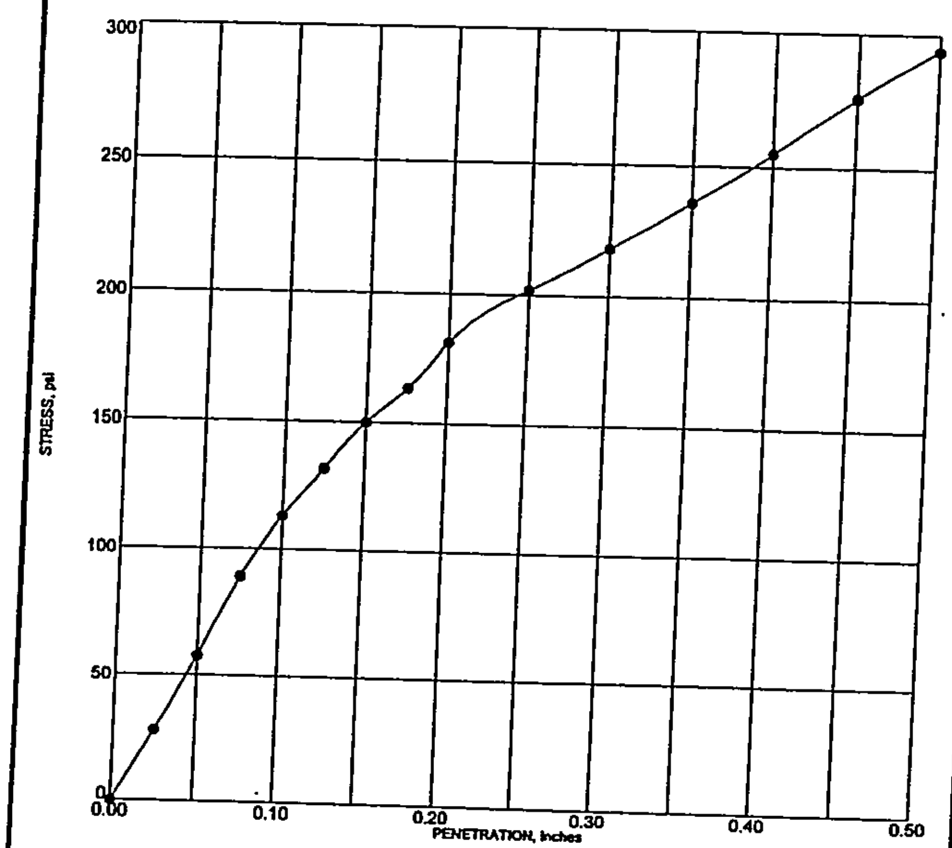
Molding Dry Density (pcf)	112.6	Hammer Wt. (lbs)	10
Molding Moisture (%)	19.3	Hammer Drop (inches)	18
Days Soaked	4	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

CALIFORNIA BEARING RATIO - ASTM D 1883

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 5



Corr. CBR @ 0.1"	11.3
Swell (%)	1.72

Sample: BULK-4
Depth: SURFACE
Description: Reddish brown CLAYEY SILT

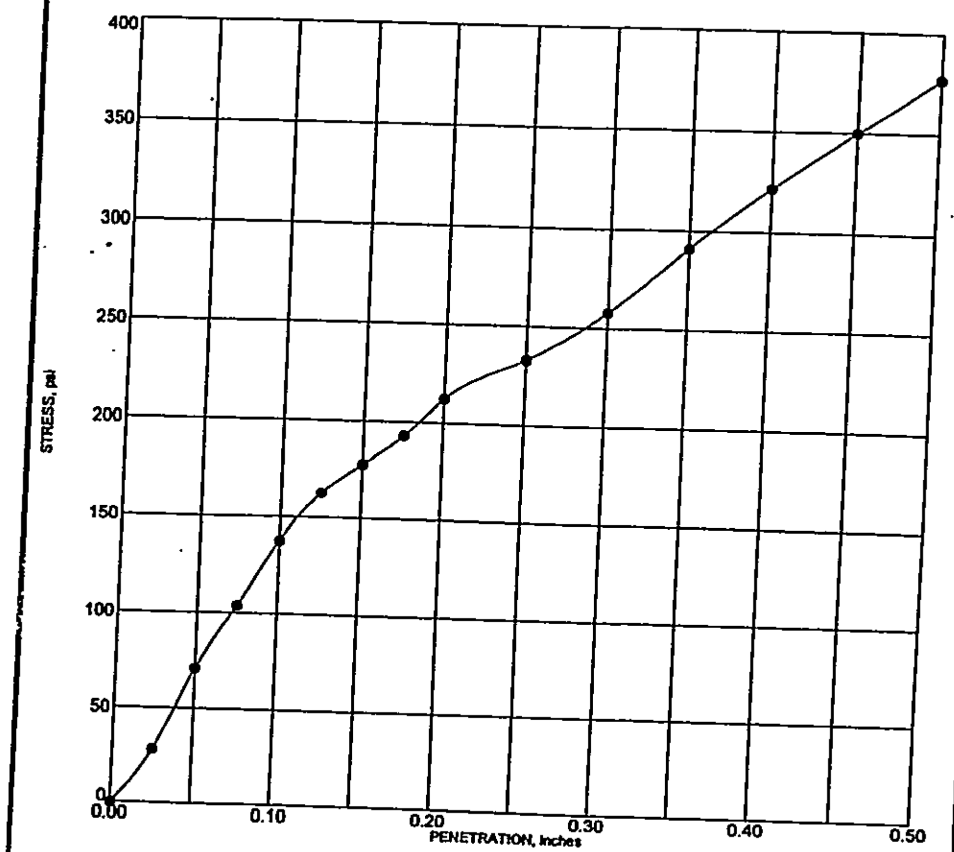
Molding Dry Density (pcf)	100.6	Hammer Wt. (lbs)	10
Molding Moisture (%)	20.3	Hammer Drop (inches)	18
Days Soaked	2	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

CALIFORNIA BEARING RATIO - ASTM D 1883

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 6



Corr. CBR @ 0.1"	13.8
Swell (%)	1.42

Sample: BULK-5
Depth: SURFACE
Description: Reddish brown CLAYEY SILT

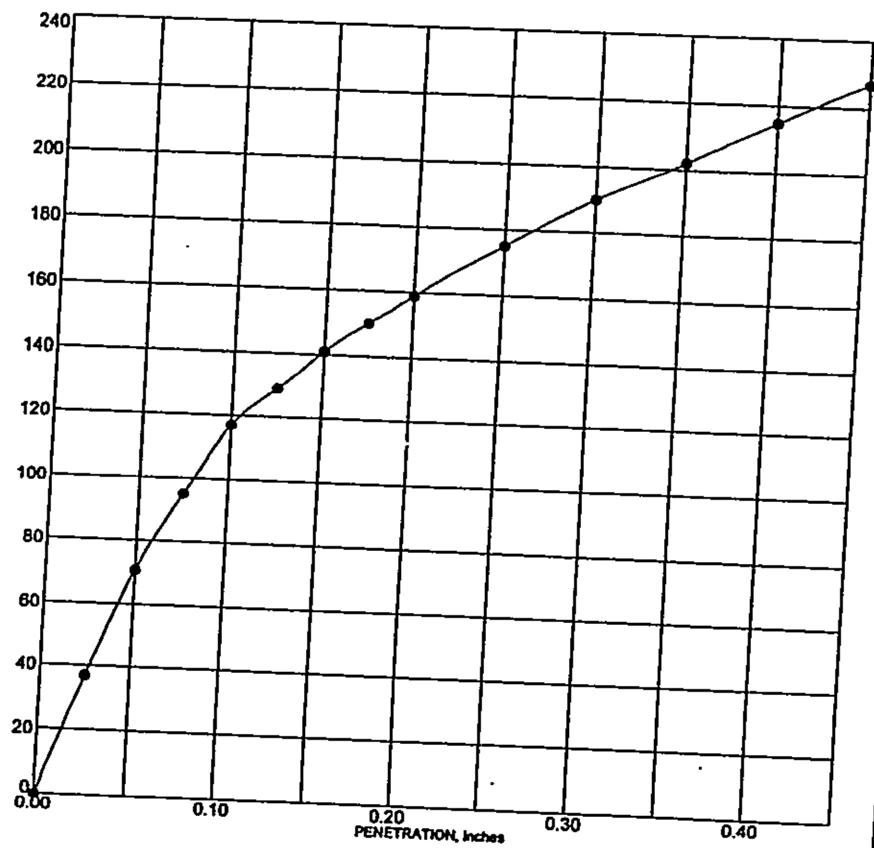
Molding Dry Density (pcf)	99.3	Hammer Wt. (lbs)	10
Molding Moisture (%)	21.1	Hammer Drop (inches)	18
Days Soaked	2	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

CALIFORNIA BEARING RATIO - ASTM D 1883

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 7



Corr. CBR @ 0.1"	11.7
Swell (%)	1.90

Sample: BULK-6
Depth: SURFACE
Description: Reddish brown CLAYEY SILT

Molding Dry Density (pcf)	100.2	Hammer Wt. (lbs)	10
Molding Moisture (%)	22.6	Hammer Drop (inches)	18
Days Soaked	3	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

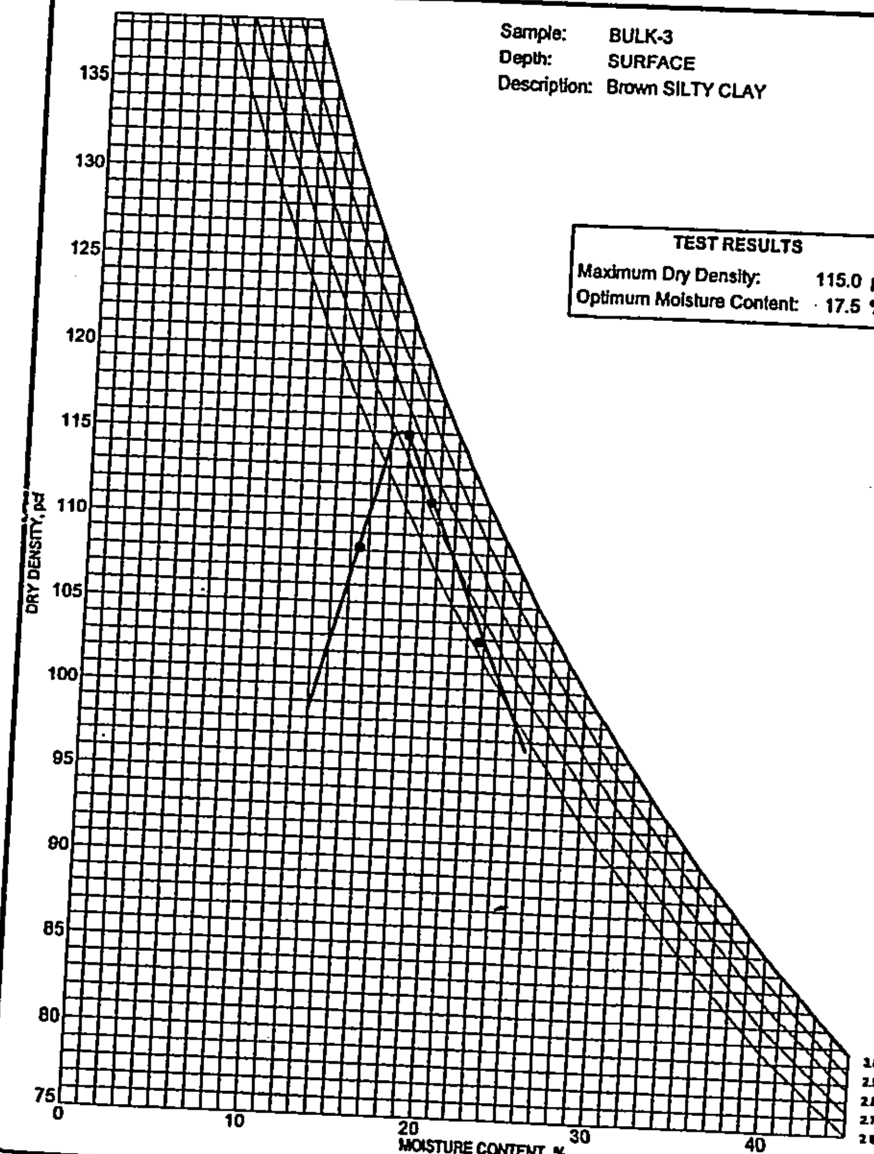
GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

CALIFORNIA BEARING RATIO - ASTM D 1883

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 8

Sample: BULK-3
Depth: SURFACE
Description: Brown SILTY CLAY



TEST RESULTS

Maximum Dry Density:	115.0 pcf
Optimum Moisture Content:	17.5 %

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

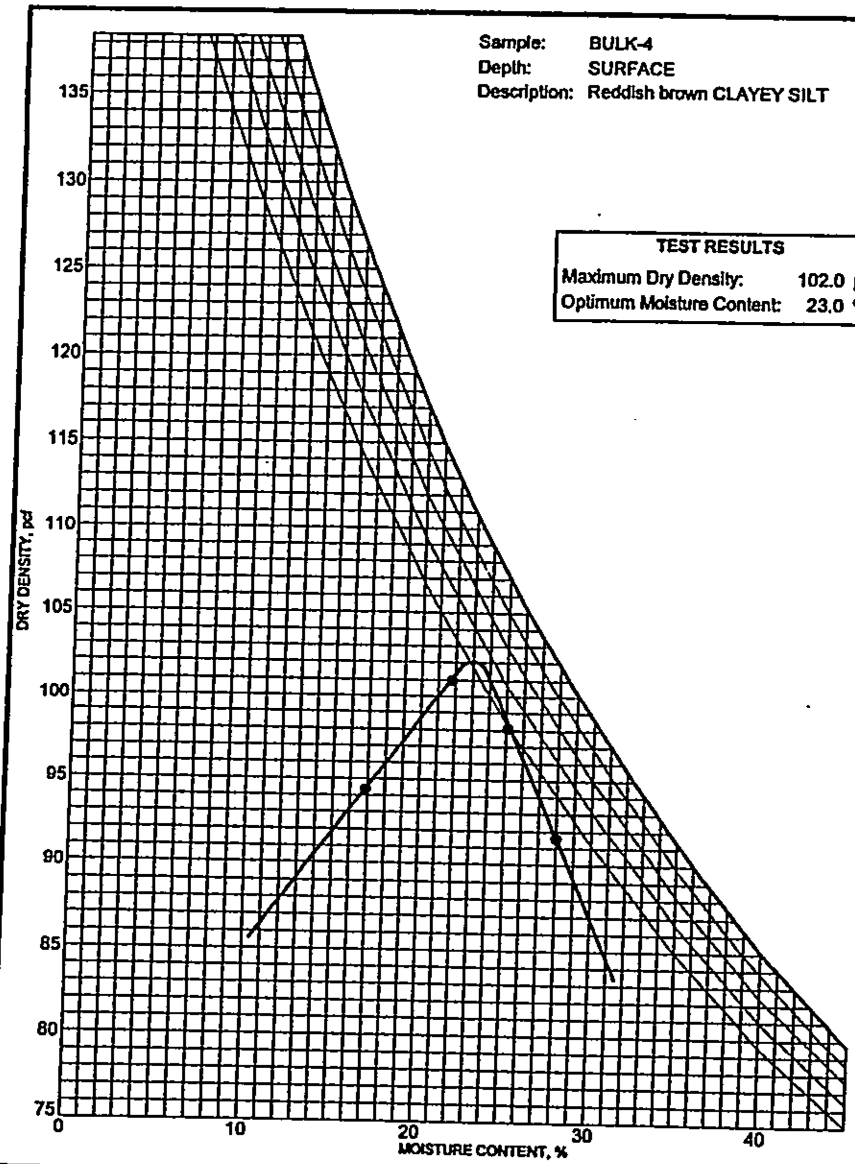
MOISTURE-DENSITY RELATIONSHIP - ASTM D 1557 A

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate B - 9

Sample: BULK-4
Depth: SURFACE
Description: Reddish brown CLAYEY SILT

TEST RESULTS	
Maximum Dry Density:	102.0 pcf
Optimum Moisture Content:	23.0 %



GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 4647-00

MOISTURE-DENSITY RELATIONSHIP - ASTM D 1557 C

EAST EWA MAKAI PROJECT
EWA, OAHU, HAWAII

Plate
B - 10

APPENDIX C

'Ewa Makai: Impact on Agriculture

Decision Analysts Hawaii, Inc.

'Ewa Makai: Impact on Agriculture

PREPARED FOR:

Gentry Investment Properties

PREPARED BY:

Decision Analysts Hawaii, Inc.

February 2002

Contents

Executive Summary

1. Project Proposal

Located in the 'Ewa District of O'ahu and straddling Fort Weaver Road, the 'Ewa Makai project (the Project) is a 283-acre residential community being proposed by Gentry Investment Properties as a southern continuation of the existing 'Ewa by Gentry community. It will be an infill project sandwiched between two existing urban areas: (1) on the north, the Project will abut the 'Ewa by Gentry residential community and Coral Creek Golf Course; (2) on the south, the Project will abut the Ocean Pointe residential community and golf course and the Hawai'i Prince Golf Course.

2. Agricultural Conditions

The property is fallow sugarcane land, about 86 acres of which are well-suited for growing low-elevation crops. This evaluation is based on the favorable soil conditions and ratings over 31% of the site, the gently-sloping terrain, the very sunny climate, good access, and the short trucking distance to the Honolulu markets and to shipping terminals.

However, crop farming could be limited by a lack of access to a large volume of low-cost irrigation water and by nuisance problems with neighboring residential communities.

3. Impact on Existing Ranching Operations

Currently, nearly all of the property is leased to Ralph's Ranch, which also leases about 500 acres in Kunia and Kahuku. About 75 head of cattle and a half dozen horses graze on the total acreage, and another 10 or so horses are penned. The 'Ewa acreage provides sufficient grass to graze about 20 head, more or less, depending on rainfall and supplemental feed. The ranch is operated as a hobby by a father and son and has no employees.

Development of the Project is expected to have a modest impact on ranch operations, possibly reducing the size of the herd by a dozen or more head.

4. Impact on the Growth of Diversified Agriculture

The Project will commit about 283 acres of agricultural land to a non-agricultural use. However, this commitment will not adversely affect the growth of diversified agriculture. This conclusion is based on the following findings:

— Ample land is available for diversified agriculture

A vast amount of land has been released from plantation agriculture (about 236,200 acres since 1968), and this release of land has far outpaced the demand for land for diversified crops (an increase of about 38,500 acres over this same period). The net decrease in crop land amounted to 197,700 acres. While some of the released land has been converted or is scheduled to be converted to non-agricultural uses, most of it remains available for diversified crops. Thus, ample land is available in Hawai'i to accommodate the growth of diversified agriculture.

— Land is not the limiting factor to the growth of diversified agriculture

Consistent with the above, the limiting factor to the growth of diversified agriculture is *not* the *land supply*, but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

These findings also apply to O'ahu. In particular, most of the 22,500 acres released from sugar production during the 1990s remains available. Fields in Kunia and 'Ewa have been leased, but markets for crops grown on the land are still being developed. On the North Shore, various crops are being explored, but most of the former sugarcane land remains fallow.

With regard to the Project, it will involve the loss of far too little good agricultural land to adversely affect the availability of land to farmers on O'ahu or in other parts of Hawai'i, or to adversely affect the growth of diversified agriculture in Hawai'i.

5. Offsetting and Comparative Benefits

While the Project will result in urban development on some good agricultural land, this loss to agriculture will be offset by the following benefits: new homes for about 1,865 families, about 1,500 jobs at the industrial-commercial center, 30 acres of community facilities, and 11.5 acres of new parks.

For comparison, the current grazing operation supports a fraction of one job, while 283 acres planted in crops could support about 35 jobs.

6. Consistency with State and County Policies

State and County plans call for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture. To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to diversified agriculture, the Project will reduce the availability of agricultural land by a small amount. However, because of the vast amount of land that has been released from plantation agriculture, ample agricultural land is available on O'ahu and other islands to accommodate the growth of diversified agriculture. Thus, the Project will *not* limit the potential growth of diversified agriculture.

Thus, the Project will not conflict with the major thrust of the agriculture portions of State and County policies.

'EWA MAKAI: IMPACT ON AGRICULTURE

1. INTRODUCTION

The 'Ewa Makai project (the Project) is a residential community being proposed by Gentry Investment Properties on approximately 283 acres of agricultural land. The impact of the Project on agriculture is analyzed in this report.

The material covers the location of the Project and neighboring land uses, a general description of the Project, State and County land classifications, the agricultural conditions of the site, potential crops, recent agricultural uses of the land, the impact of the Project on existing ranch operations and on the growth of diversified agriculture, offsetting and comparative benefits of the Project, and consistency of the Project with State and County agricultural policies.

Appendix A provides information on Hawaii's agricultural land market, while Appendix B provides information on State and County objectives, policies, and guidelines related to agricultural lands.

2. PROJECT LOCATION AND NEIGHBORING LAND USES

Located in the 'Ewa District of O'ahu below 'Ewa by Gentry, the property is comprised of two parcels, one on each side of Fort Weaver Road:[1]

— TMK: 9-1-10:7: 'Ewa Makai-West (114.617 acres)

— TMK: 9-1-68:5: 'Ewa Makai-East (167.997 acres)

'Ewa Makai will be an infill project sandwiched between two existing urban areas. On the north, the Project will abut the 'Ewa by Gentry residential community and Coral Creek Golf Course. On the south, the Project will abut the Ocean Pointe residential community and golf course and the Hawai'i Prince Golf Course. The west end of the Project abuts the Barbers Point Golf Course, while the east end abuts the U.S. Navy Explosive Safety Zone for the West Loch Naval Magazine. This safety zone is agricultural land which could be planted in crops.

3. PROJECT DESCRIPTION

The Project will be a 283-acre southern continuation of the existing 'Ewa by Gentry community. The Conceptual Master Plan for the Project includes the following components:[1]

— 1,865 homes on 189 acres (550 single-family detached homes, 675 single-family detached homes, and 640 multi-family homes).

— 24 acres of community facilities (a middle school, a recreation center, and two church sites).

— 30 acres for a commercial/industrial complex that will provide an estimated 1,500 full-time and part-time jobs at full development.

— 11.5 acres of parks.

— 14 acres for infrastructure and drainage.

— 14.5 acres of roadways.

4. LAND CLASSIFICATIONS

Currently, all of the Project area is in the State Agricultural District. At the County level, 'Ewa Makai-West is zoned AG-2 (General Ag) and Makai-East is zoned AG-1 (Restricted Ag).[1]

Project implementation will require redistricting all 283 acres to the State Urban District.[1] At the County level, Project implementation will require rezoning to: R-5 Residential (104 acres), A-1 Apartment (124 acres), P-2 General Preservation (25 acres), and IMX-1 Industrial-Commercial Mixed Use (30 acres).

5. AGRICULTURAL CONDITIONS

5.a. Soil Types

The Project area contains three soil types as determined by the Soil Conservation Service, now known as the Natural Resources Conservation Service (NRCS):[2]

		Acres
EmA	'Ewa silty clay loam, moderately shallow, 0 to 2 percent slopes.	65.1
EmB	'Ewa silty clay loam, moderately shallow, 2 to 6 percent slopes.	21.4
MnC	Mamala stony silty clay loam, 0 to 12 percent slopes.	196.1

5.b. Soil Ratings

Three classification systems are commonly used to rate soils in Hawai'i: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawai'i, and (3) Overall Productivity Rating.

5.b.(1) Land Capability Grouping (NRCS Rating)

The 1972 Land Capability Grouping by the United States Department of Agriculture NRCS, rates soils according to eight levels, ranging from the highest classification level, I, to the lowest level, VIII.[2]

Assuming that the land is irrigated, soil types EmA and EmB—which cover about 30.6% of the Project area—have land capability ratings of IIs and IIe, respectively. The II indicates that the soils have moderate limitations that reduce the choice of crops that can be grown successfully, or indicates that moderate conservation practices are required. The subclassification "s" indicates that the limitation is due to stoniness, unfavorable texture, shallowness, or low water-holding capacity; the subclassification "e" indicates a risk of erosion.

Soil MnC, which covers 69.4% of the Project area, has a land capability rating of IIIs, which indicates that the soils have severe limitations that reduce the options on plants, require special conservation practices, or both.

5.b.(2) Agricultural Lands of Importance in the State of Hawai'i (ALISH)

The ALISH ratings were developed in 1977 by the NRCS, the University of Hawai'i (UH) College of Tropical Agriculture and Human Resources, and the State of Hawai'i, Department of Agriculture.[3] This system classifies agricultural land into three categories: (a) Prime, which is best suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment; (b) Unique, which is non-Prime agricultural land currently being used for the production of specific high-value crops; and (c) Other, which is non-Prime and non-Unique agricultural land that is important to the production of crops.

Approximately 30.6% of the Project area is rated Prime (soil types EmA and EmB), and 69.4% is rated Other (soil type MnC).

5.b.(3) Overall Productivity Rating (LSB Rating)

In 1972, the UH Land Study Bureau (LSB) developed the Overall Productivity Rating, which classifies soils according to five levels with A representing the class of highest productivity and E the lowest.[4]

About 23.2% of the Project area is rated A and the remaining 76.8% is rated C.

5.b.(4) Summary Evaluation of Soil Quality

About 23% to 31% of the Project area is comprised of higher quality soils. The remaining lands have lower quality (stony) soils, but they are still suitable for crop farming.

5.c. Soil Characteristics

Consistent with the above soil ratings, the better agricultural lands exhibit a number of favorable characteristics: they are good for machine tilling; slopes are gentle (see below); and the soils are moderately fine in texture, not stony, more than 30 inches deep, and well-drained.[4]

Most of the lower-quality lands have characteristics quite similar to the more highly rated soils in the Project area, except that the soils are moderately good for machine tilling, stony, and less than 30 inches deep.

5.d. Elevation

The elevation of the Project area ranges from about 20 to 35 feet above mean sea level.[1] At this elevation, the land is suitable for crops that are generally referred to as "low-elevation crops," as opposed to "high-elevation crops"(such as those being grown in Kula, Maui or Waimea on the Big Island).

5.e. Slopes

Except for two pronounced sumps near the eastern boundary of 'Ewa Makai-East, slopes are approximately 1%.[1]

5.f. Climatic Conditions

5.f.(1) Solar Radiation

The Project area receives considerable sunshine, with an average daily insolation exceeding 500 calories per square centimeter.[5]

5.f.(2) Temperatures

The average low temperatures range from about 60°F in the winter to about 70° in the summer, while the average high temperature ranges from just under 80° in the winter to just under 90° in the summer.[6]

5.f.(3) Rainfall

Average annual rainfall in the Project area is slightly more than 20 inches.[7]

5.g. Irrigation Water

Access to a large volume of low-cost irrigation water may no longer be available to irrigate crops in the Project area because groundwater recharge from diversified crops in 'Ewa is far less than it was when the surrounding land was planted in sugarcane.

5.h. Road Access

The fields are reached via Fort Weaver Road and former canehaul roads.

5.i. Locational Advantages

The Project area is well located for serving the Honolulu consumer market and export markets. This is due to the short trucking distance to Honolulu markets, Honolulu Airport, and Honolulu Harbor.

5.j. Nuisance Issues

Given the nearby homes at 'Ewa Gentry and Ocean Pointe, nuisances arising from farm operations could become an issue for both residents and farm operators if the land were to be farmed. Some residents close to farming operations would be likely to complain about occasional noise, dust, chemical spraying, etc. In turn, addressing the complaints could adversely affect farming operations.

5.k. Summary

As much as 86 acres of the Project area are well-suited for growing low-elevation crops. This evaluation is based on the favorable soil conditions and ratings over 31% of the site, the gently-sloping terrain, the very sunny climate, good access, and the short trucking distance to the Honolulu markets and to shipping terminals.

However, crop farming could be limited by a lack of access to a large volume of low-cost irrigation water and by nuisance problems with neighboring residential communities.

6. POTENTIAL CROPS

Based on the above agronomic conditions, the Project area is suitable for low-elevation crops commercially grown in Hawai'i, including but not limited to: asparagus, beans (green, bush, and snap), bell peppers, bittermelon, cantaloupe, Chinese peas, cucumbers, daikon, dry onions, eggplant, flowers/nursery products, ginger root, green onions, green peppers, head and semi-head lettuces, herbs, honeydew melons, limes, lotus root, lychee, Manoa lettuce, mango, mustard cabbage, Oriental squash, parsley, pumpkins, seed crops, sweet corn, sweet potatoes, tangerines, andwatermelons.[8]

7. RECENT AGRICULTURAL USES

For approximately 100 years ending in the early 1990s, the land was used for cultivating sugarcane. Since the closure of O'ahu Sugar Co., Ltd., limited grazing has occurred on the property (see below).

8. IMPACT ON EXISTING RANCH OPERATIONS

Currently, nearly all of the property is leased to Ralph's Ranch, which also leases about 500 acres in Kunia and Kahuku.[9] About 75 head of cattle and a half dozen horses graze on the total acreage, and another 10 or so horses are penned. The 'Ewa acreage provides sufficient grass to graze about 20 head, more or less, depending on rainfall and supplemental feed. The ranch is operated as a hobby by a father and son and has no employees.

Development of the Project is expected to have a modest impact on ranch operations, possibly reducing the size of the herd by a dozen or more head.

9. IMPACT ON THE GROWTH OF DIVERSIFIED AGRICULTURE

The Project will commit about 283 acres of agricultural land to a non-agricultural use. However, this commitment will not adversely affect the growth of diversified agriculture. This conclusion is based on the following findings from Appendix A:

— Ample land is available for diversified agriculture

A vast amount of land has been released from plantation agriculture (about 236,200 acres since 1968), and this release of land has far outpaced the demand for land for diversified crops (an increase of about 38,500 acres over this same period). The net decrease in crop land amounted to 197,700 acres. While some of the released land has been converted or is scheduled to be converted to non-agricultural uses, most of it remains available for diversified crops. Thus, ample land is available in Hawai'i to accommodate the growth of diversified agriculture.

— Land is not the limiting factor to the growth of diversified agriculture

Consistent with the above, the limiting factor to the growth of diversified agriculture is *not* the *land supply*, but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

These findings also apply to O'ahu. Since 1968, the contraction and eventual closure of Kahuku Planation Co. O'ahu Sugar Co., Ltd., and Waialua Sugar Co., Inc. released about 37,860 acres. Also, most of the 22,500 acres released from sugar production during the 1990s remain available. Fields in Kunia and 'Ewa are regarded as among the best farmland in Hawai'i. These lands have been leased, but markets for crops grown on the land are still being developed. On the North Shore, various crops are being explored, but most of the former sugarcane land remains fallow.

With regard to the Project, it will involve the loss of far too little good agricultural land to adversely affect the availability of land to farmers on O'ahu or in other parts of Hawai'i, or to adversely affect the growth of diversified agriculture in Hawai'i.

10. Offsetting and Comparative Benefits

While the Project will result in urban development on some good agricultural land, this loss to agriculture will be offset by the following benefits: new homes for about 1,865 families, about 1,500 jobs at the industrial-commercial center, 30 acres of community facilities, and 11.5 acres of new parks.[1]

For comparison, the current grazing operation supports a fraction of one job, while 283 acres planted in crops could support about 35 jobs (based on 12.5 farm jobs per 100 acres).[10]

11. Consistency with State and County Agricultural Policies

The *Hawaii State Constitution*, the *Hawaii State Plan*, the *State Agriculture Functional Plan*, and the *General Plan of the City and County of Honolulu* call for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture (see Appendix B). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to plantation agriculture, no existing sugarcane or pineapple plantation will be impacted by the Project.

With regard to diversified agriculture, the Project will reduce the availability of agricultural land. However, because of the vast amount of land that has been released from plantation agriculture since the late 1960s, ample agricultural land is available on O'ahu and on other islands to accommodate the growth of diversified agriculture. Thus, the Project will *not* limit the potential growth of diversified agriculture.

Regarding policies "...to preserve and protect agricultural lands," discussions in the "Agriculture" portion of the *State Functional Plan* recognize that redesignation of lands from Agriculture to Urban should be allowed "... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in ..." agriculture; that is, when an "overriding public interest exists." The enormous contraction in plantation agriculture—resulting in the supply of agricultural land far exceeding demand—constitutes a major change in economic and social conditions. Furthermore, the proposed Project will provide benefits (about 1,865 homes, about 1,500 jobs, etc.) that far exceed those provided by current grazing operations (less than 1 job) or could be provided by diversified agriculture (about 35 jobs). Even with the Project, there will be no loss in existing or potential agricultural employment in view of the availability of agricultural land on O'ahu and throughout the State.

In summary, the Project will not conflict with the major thrust of the plantation-agriculture portions or the diversified-agriculture portions of State and County policies.

12. References

[1] Gentry Investment Properties.

[2] U.S. Department of Agriculture, Soil Conservation Service in cooperation with The University of Hawai'i Agricultural Experiment Station. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawai'i.* Washington, D.C. August 1972.

[3] Harold L. Baker. *Agricultural Lands of Importance in the State of Hawai'i.* University of Hawai'i College of Tropical Agriculture and Human Resources, Honolulu, Hawai'i. 1977.

[4] Land Study Bureau. *Detailed Land Classification – Island of Oahu.* Honolulu, Hawai'i. December 1972.

[5] State of Hawai'i, Department of Business and Economic Development. *Oahu Sunshine Map.*

[6] Department of Geography, University of Hawai'i. *Atlas of Hawai'i, Second Edition.* University of Hawai'i Press. Honolulu, Hawai'i. 1983.
[7] Department of Geography, University of Hawai'i. *Atlas of Hawai'i, Third Edition.* University of Hawai'i Press. Honolulu, Hawai'i. 1998.
[8] Hawai'i Agricultural Statistics Service. *Statistics of Hawaiian Agriculture.* Honolulu, Hawai'i. Annual.
[9] Ralph's Ranch.
[10] Estimated by Decision Analysts Hawai'i, Inc.

APPENDIX A:
HAWAI'I'S AGRICULTURAL LAND MARKET

INTRODUCTION

Presented below and in Figure A-1 is an overview of the agricultural land market in Hawai'i. The discussion includes the release of land from plantation agriculture (i.e., sugarcane and pineapple), the growth in land requirements for diversified crops (i.e., all crops other than sugarcane and pineapple), and the availability of land for diversified crops.

RELEASE OF LAND FROM PLANTATION AGRICULTURE

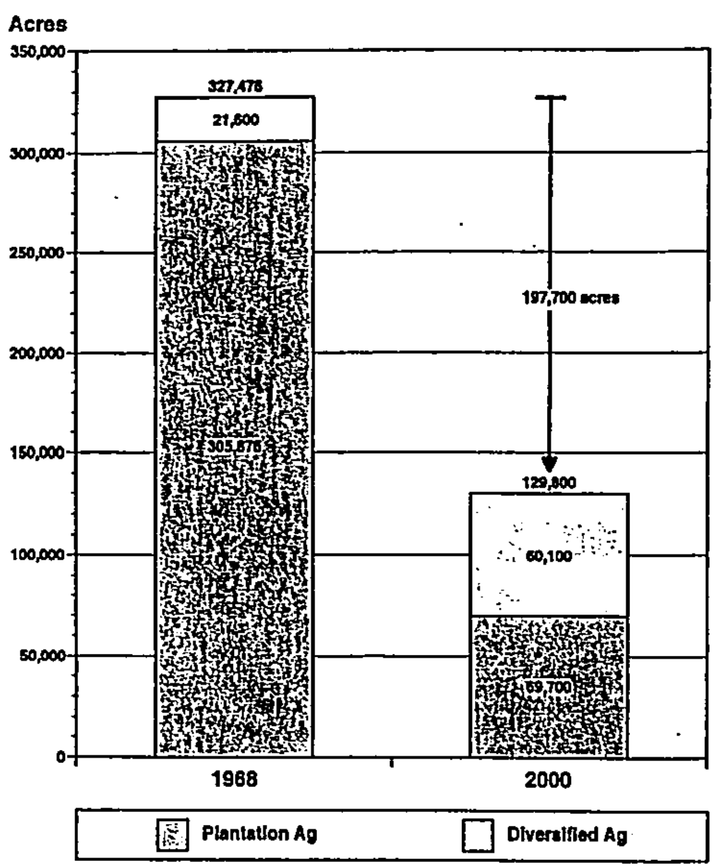
Because Hawai'i's sugar and pineapple industries have contracted substantially over the past three decades, an enormous and growing supply of farmland is available for diversified agriculture and other land uses. As shown in Figure A-1, land in plantation agriculture has declined from about 305,900 acres in 1968 to about 68,700 acres in 2000, for a 32-year decrease of about 236,200 acres (an average decrease of about 7,400 acres per year).[1,2]

On Oahu, the contraction and eventual closure of Kahuku Plantation Co., O'ahu Sugar Co., Ltd. and Waialua Sugar Co., Inc. released about 37,860 acres since 1968.[3]

GROWTH IN LAND REQUIREMENTS FOR DIVERSIFIED CROPS

Land requirements to accommodate the growth of diversified crops are modest compared to the available supply. As plantation agriculture was contracting, Statewide land requirements for diversified crops grew from 21,600 acres in 1968 to 60,100 acres in 2000, for a 32-year increase of 38,500 acres (an average increase of 1,200 acres per year).[1,2] Even this increase in diversified-crop acreage is high in that it includes many fields planted in grasses that are mowed for cattle feed rather than placing cattle on the fields and including the land in the inventory of grazing land.

Figure A-1. Acres in Crop: 1968 and 2000



Although a great many crops can be grown in Hawai'i's year-round subtropical climate, the modest growth in land requirements for diversified crops reflects the fact that few of them can be grown profitably on a large scale. The primary reasons for this are given below.[4]

—Hawai'i's subtropical climate is not well-suited to the commercial production of major crops that grow better in the temperate mainland climates.

—For certain crops, special hybrids adapted to Hawai'i's subtropical climate are yet to be developed.

—Crop pests are more prevalent and more expensive to control in Hawai'i than they are on the mainland where the cold winters kill many pests.

—Fruit-fly infestations prevent exports of many crops, or require expensive treatment.

—Most soils in Hawai'i have low nutrient levels and therefore require high expenditures for fertilizer.

—Hawai'i suffers from high farm-labor costs, largely because the agriculture industry must compete against the visitor industry and related industries for its labor.

—High overseas transportation costs increase the cost of importing agricultural supplies and equipment and, for export crops, shipping produce to market.

—For a number of crops, consumption volumes in Hawai'i are too small to support large, efficient farms (i.e., the volumes are too small to realize economies of scale).

—Trends towards crops that are certified as safe and towards a single supplier of many food items favor large farms.

—Hawai'i farmers must compete against highly efficient mainland and foreign farms which, in a number of cases, can deliver produce to Hawai'i more cheaply than it can be produced locally. This is due to economies of scale and, in comparison to Hawai'i, low costs for land, labor, supplies, fertilizer, pest control, equipment, etc.

AVAILABILITY OF LAND FOR DIVERSIFIED AGRICULTURE

As indicated in Figure A-1, a vast amount of land has been released from plantation agriculture, and this release of land has far outpaced the demand for land for diversified crops. As a result, the amount of land in crops has declined from about 327,500 acres in 1968 to an estimated 129,800 acres in 2000, for a net release of about 197,700 acres (an average decrease of about 6,200 acres per year).[1,2]

Some of this land has been converted or is scheduled to be converted to urban, forestry or other uses. But, the majority of the 197,700 acres remains available for diversified crops. Much of this land is fallow, is used for grazing, or is in some other low-value land-holding operation. A major issue Statewide is how to use productively the vast amount of high-quality agricultural land that has become available.

On O'ahu, most of the 22,500 acres released from sugar production during the 1990s remain available. Fields in Kunia and 'Ewa are regarded as among the best farmland in the State, based on the high solar radiation, high quality soils, and the short trucking distance to the large Honolulu market and, for export markets, to the Honolulu International Airport and Honolulu Harbor.[5] These lands have been leased, but markets for crops grown on the land are still being developed.[6] On the North Shore, various crops are being explored, but most of the former sugarcane land remains fallow.[7]

SUMMARY

In summary, ample land is available on all islands to accommodate the growth of diversified agriculture. Furthermore, the limiting factor to the growth of diversified agriculture is *not* the *land supply*, but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

REFERENCES

[1] Schmitt, Robert C. *Historical Statistics of Hawai'i.* The University Press of Hawai'i, Honolulu, Hawai'i. 1977.

[2] Hawai'i Agricultural Statistics Service. *Statistics of Hawaiian Agriculture.* Honolulu, Hawai'i. Annual.

[3] Decision Analysts Hawai'i, Inc. *Hawai'i's Sugar Industry: Problems, Outlook and Urban Growth Issues.* State of Hawai'i, Department of Planning and Economic Development. Honolulu, Hawai'i. April 1981.

[4] Decision Analysts Hawai'i, Inc. *Hawai'i's Sugar Industry and Sugarcane Lands: Outlook, Issues and Options.* April 1989.

[5] Decision Analysts Hawai'i, Inc. *Agricultural Lands of Kunia and Central 'Ewa: Agronomic and Locational Advantages, Potential Crops, Crop Budgets.* December 1993.

[6] Discussions with farmers.

[7] Decision Analysts Hawai'i, Inc. "North Shore Planning District, O'ahu: Agricultural Resources, Situation and Outlook." July 1997.

APPENDIX B:
STATE AND COUNTY OBJECTIVES, POLICIES AND GUIDELINES RELATED TO AGRICULTURAL LANDS

HAWAII STATE CONSTITUTION (Article XI, Section 3):

The State shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands. The legislature shall provide standards and criteria to accomplish the foregoing.

Lands identified by the State as important agricultural lands needed to fulfill the purposes above shall not be reclassified by the State or rezoned by its political subdivisions without meeting the standards and criteria established by the legislature and approved by a two-thirds vote of the body responsible for the reclassification or rezoning action.

HAWAII STATE PLAN (Chapter 226, Hawaii Revised Statutes, as amended):[1,2]

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

(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:

(1) Viability in Hawaii's sugar and pineapple industries.

(2) Growth and development of diversified agriculture throughout the State.

(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.

(b) To achieve the agricultural objectives, it shall be the policy of the State to:

(2) Encourage agriculture by making best use of natural resources.

(10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

(16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.

Section 226-103 Economic priority guidelines.

(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:

(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.

(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.

(10) Support the continuation of land currently in use for diversified agriculture.

Section 226-104 Population growth and land resources priority guidelines.

(b) Priority guidelines for regional growth distribution and land resource utilization:

(2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

Section 226-106 Affordable Housing

Priority guidelines for the provision of affordable housing:

(1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of low- and moderate-income and gap-group households.

AGRICULTURE STATE FUNCTIONAL PLAN (1991)[3]

(Functional plans are guidelines for implementing the State Plan. They are approved by the Governor, but not adopted by the State Legislature.)

Objective H: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.

Policy H(2): Conserve and protect important agricultural lands in accordance with the Hawaii State Constitution.

Action H(2)(a): Propose enactment of standards and criteria to identify, conserve, and protect important agricultural lands and lands in agricultural use.

Action H(2)(c): Administer land use district boundary amendments, permitted land uses, infrastructure standards, and other planning and regulatory functions on important agricultural lands and lands in agricultural use, so as to ensure the availability of agriculturally suitable lands and promote diversified agriculture.

CITY AND COUNTY OF HONOLULU

GENERAL PLAN, Objectives and Policies (Resolution No. 87-211)[4]

Economic Activity

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

Policy 1. Assist the agricultural industry to ensure the continuation of agriculture as an important source of income and employment.

Policy 2. Support agricultural diversification in all agricultural areas on Oahu.

Policy 3. Support the development of markets for local products, particularly those with the potential for economic growth.

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

Policy 5. Maintain agricultural land along the Windward, North Shore, and Waianae coasts for truck farming, flower growing, aquaculture, livestock production, and other types of diversified agriculture.

Policy 6. Encourage the more intensive use of productive agricultural land.

Policy 7. Encourage the use of more efficient production practices by agriculture, including the efficient use of water.

Policy 8. Encourage the more efficient use of nonpotable water for agricultural use.

REFERENCES

[1] State of Hawaii, Office of State Planning, Office of the Governor. *The Hawaii State Plan, 1991.* Honolulu, Hawaii. 1991.

[2] Act 25, S.B. No. 1158, April 15, 1993.

[3] Hawaii Department of Agriculture. *The Hawaii State Plan: Agriculture, State Functional Plan.* Honolulu, Hawaii. 1991.

[4] City and County of Honolulu, Department of General Planning. *General Plan Objectives and Policies.* Honolulu, Hawaii. 1992.

APPENDIX D

Potable Water Master Plan for Ewa by Gentry

Prepared for:

Gentry Homes, Ltd.
P. O. Box 295
Honolulu, Hawaii 96809

Prepared by:

Tom Nance Water Resource Engineering
680 Ala Moana Boulevard - Suite 406
Honolulu, Hawaii 96813

September 2000

Table of Contents

List of Figures

List of Tables

Introduction

This report is an update of the Ewa by Gentry Water Master Plan. The last previous revision of this water master plan, prepared by Belt Collins Hawaii (BCH), is dated June 9, 1994 and was approved by the Board of Water Supply (BWS) on August 5, 1994 (letter from Kazu Hayashida of BWS to Trina Onuma of BCH). This master plan revision incorporates the following changes and updates:

1. The parcels formerly known as Laulani and Fairways have been incorporated in the Ewa by Gentry land use plan and in this water master plan.

2. Updated development unit counts and supply requirements in conformance with the current Ewa by Gentry Land Use Plan and BWS design criteria are included.

3. Water use in Ewa Beach is based on actual consumption rates provided by BWS. This represents a significant reduction from the average, maximum day, and peak rates for Ewa Beach that were used in prior water master plans for Ewa by Gentry, HASEKO's Ewa Marina, and the Ewa Water Master Plan by the Ewa Plain Water Development Corporation (EPWDC).

4. BWS is contemplating converting the 16-inch potable main in Fort Weaver Road to non-potable use. This master plan includes hydraulic analyses with and without this possible conversion.

Ewa by Gentry Land Use Plan and Water Supply Requirements

Figure 1 presents the Ewa by Gentry Land Use Plan which includes the former Laulani and Fairways parcels. Table 1 lists each of the development areas, identifying the type of development, number of units, average water use, and average demand. The average water use tally is used to define source of supply requirements. At full build-out, the project will require an average supply from wells of 4.0019 MGD. Gentry's share of the first six Honouliuli wells developed by EPWDC and dedicated to BWS is 2.30384 MGD. The remaining 1.69806 MGD is expected to be provided by new well development or by the Ewa Shaft (also known as EP 15 & 16) if BWS completes its purchase from Campbell Estate.

The average demand, which includes a 20 percent allowance for uncertainty for those areas served by a dual system, is used to define reservoir storage requirements and pipeline sizing. Gentry's ultimate storage requirement, defined by its maximum day demand (1.5 times average demand) is 6.3411 MGD. Its share of storage in the 1.0 MG and Honouliuli 440 and 5.0 MG Honouliuli 228 tanks constructed by EPWDC and dedicated to BWS is 3.1075 MGD. Its remaining 3.2336 MGD storage requirement will be provided in the second (5.5 MG) Honouliuli 228 tank.

Key Aspects Incorporated in the Hydraulic Analyses in This Master Plan

Figure 2 is a hydraulic schematic of the pipe system analyzed in this master plan and Table 2 lists all of the pipe nodes and drafts on the system. The areal coverage is essentially identical to analyses in EPWDC's 1987 Ewa Water Master Plan for the Fort Weaver Road corridor. Key aspects incorporated in all of the pipe network analyses in this water master plan update are as follows:

Table 1

Development Type, No. of Units, and Average Demand for Ewa by Gentry (Includes the Former Laulani and Fairways Areas - Refer to Figure 1)

Area No.	Name and/or Type of Development	No. of Units	Average Water Use: Use Rate (GPD/Unit)	Average Water Use: Req'd Supply (MGD)	Average Demand: Use Rate (GPD/Unit)	Average Demand: Demand (MGD)
1A	Multi-Family (Palm Villas I)	352	276	0.0972	331	0.1165
1B	MF (Palm Court)	88	276	0.0243	331	0.0291
1C	MF (Palm Court)	312	276	0.0861	331	0.1033
2A	Single Family (Soda Creek I)	413	500	0.2065	500	0.2065
2B	SF (Soda Creek 2)	46	500	0.0230	500	0.0230
3	MF (Arbors)	289	276	0.0798	331	0.0957
4	MF (Palm Villas 2)	384	276	0.1060	331	0.1271
5	SF (Kula Lei)	199	500	0.0995	500	0.0995
5F	SF	6	500	0.0030	500	0.0030
6	SF (Sun Terra on the Park)	182	500	0.0910	500	0.0910
7	SF (Sun Terra South)	289	500	0.1445	500	0.1445
8	MF (Coronado)	156	276	0.0446[a]	331	0.0546[a]
8A	MF	100	276	0.0276	331	0.0331
9	Commercial (Future)	6.67 Ac.	3000	0.0200	3000	0.0200
10	MF (Sun Rise)	408	276	0.1126	331	0.1350
11	Geiger Park	10.07 Ac.	BWS Appr'd	0.0040	BWS Appr'd	0.0040
12	Chester (MF-Sun Terra)	451	276	0.1245	331	0.1493
13	SF	97	453[f]	0.0439	453[f]	0.0439
14	SF (Future)	125	453[f]	0.0566	453[f]	0.0566
15	Industrial (Future)	12.08 Ac.	4000	0.0483	4000	0.0483
17	SF (Future)	420	500	0.2100	500	0.2100
18	SF	305	500	0.1525	500	0.1525
19	SF (Future)	274	500	0.1370	500	0.1370
19A	Park (Future)	5.99 Ac.	--	0.0011[b]	--	0.0011[b]
20	SF (Future)	453	500	0.2265	500	0.2265
21	MF(SF Detached)	304	500	0.1520	500	0.1520
22	Park (Future)	12.05 Ac.	4000	0.0482[c]	4000	0.0482[c]
23/24	MF & SF: Suncrest (MF)	64	276	0.0177	331	0.0212
	: Shores (MF)	36	276	0.0099	331	0.0119
	: Avalon (MF)	46	276	0.0127	331	0.0152
	: Lombard (SF)	143	500	0.0715	500	0.0715
25	School (Holomua)	8.02 Ac.	4000	0.0320	4000	0.0320
26	SF (Lofts, Aili Cove, & Aili Court)	316	500	0.1605[d]	500	0.1605[d]
27A	SF (Sea Breeze & Meridian)	109	500	0.0545	500	0.0545
27B	SF (Meridian)	113	500	0.0565	500	0.0565
27C	SF (Future)	60	500	0.0300	500	0.0300
28	SF (Future)	191	500	0.0955	500	0.0955
29	Park (Future)	5.89 Ac.	--	0.0002[e]	--	0.0002[e]
30	MF (Future)	181	276	0.0500	331	0.0599
30A	Community Center (Future)	0.60 Ac.	--	0.0012	--	0.0012
31	SF (Future)	284	500	0.1420	500	0.1420
32	Church (Future)	3.23 Ac.	4000	0.0129	4000	0.0129
33	MF (Future)	250	276	0.0690	331	0.0828
33A	Park (Future)	3.24 Ac.	--	0.0002[e]	--	0.0002[e]
34	SF (Future)	260	500	0.1300	500	0.1300
35	Commercial (Future)	20.00 Ac.	3000	0.0600	3000	0.0600
36	Commercial (Future)	29.78 Ac.	3000	0.0893	3000	0.0893
37	MF (Future)	200	276	0.0552	331	0.0662
38	Park (Future)	8.00 Ac.	4000	0.0320[c]	4000	0.0320[c]
39	School (Future)	6.00 Ac.	4000	0.0240	4000	0.0240
40	SF (Future)	200	500	0.1000	500	0.1000
41	MF (Future)	200	276	0.0552	331	0.0662
42	MF (Future)	560	276	0.1546	331	0.1854
43	Kaloi Gulch Drainage	13.86 Ac.	--	0.0000	--	0.0000
44	SF (Future)	190	500	0.0950	500	0.0950
GC3	Coral Creek Clubhouse	--	--	0.0200	--	0.0200
	Totals			4.0019		4.2274

Notes:
[a] Includes 1500 GPD for the Recreation Center.
[b] An allowance for the sewage pump station and a park comfort station.
[c] Park is to be irrigated by the BWS system.
[d] Includes 2480 GPD for three Recreation Centers.
[e] An allowance for a comfort station. The park is to be irrigated with non-potable water.
[f] Use rate approved by BWS (May 21, 1999 letter from BWS to Gentry)

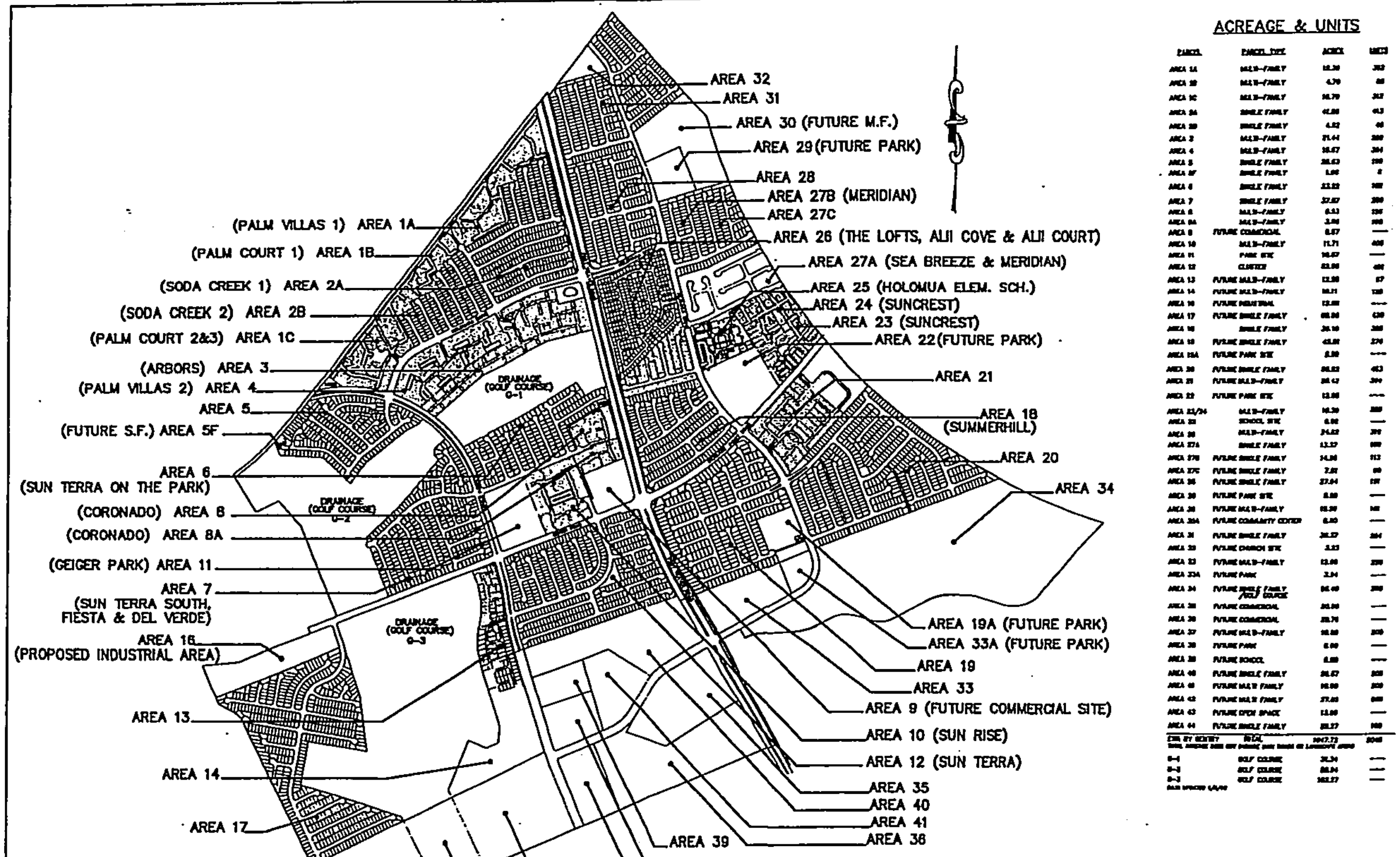


FIGURE 1
LAND USE PLAN FOR EWA BY GENTRY

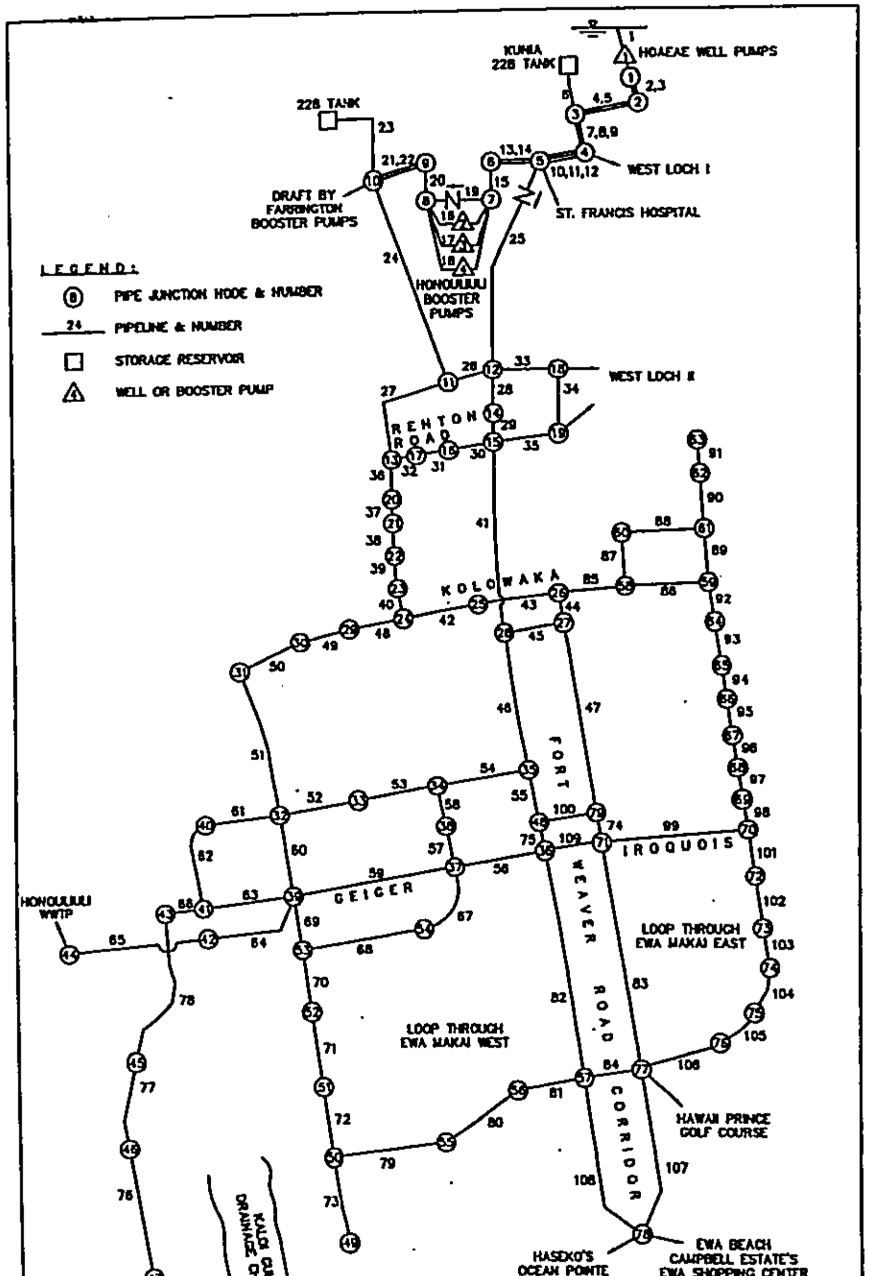


FIGURE 2
HYDRAULIC SCHEMATIC OF THE
FORT WEAVER CORRIDOR AND EWA BY GENTRY

Table 2

Information on Junction Nodes of the
Fort Weaver Road Corridor Hydraulic Model
(Node Locations are Shown on Figure 2)

Node No.	Elevation (Feet MSL)	Area Served	Average Demand (MGD)	Peak (GPM)
1	120	None	0.0000	0
2	76	None	0.0000	0
3	77	None	0.0000	0
4	60	West Loch Phase I	0.4500	937
5	65	St. Francis Hospital	0.0900	187
6	65	None	0.0000	0
7	88	None	0.0000	0
8	93	None	0.0000	0
9	102	None	0.0000	0
10	175	Draft by Farrington Booster	30 (2 Pumps On)	20,830
11	55	None	0.0000	0
12	26	Campbell Estate's Honouliuli Uses	0.2262	471
13	45	Ewa Villages and Campbell's Industrial	0.1500	312
14	46	None	0.0000	0
15	45	Campbell Estate's Fort Weaver Residential	0.1200	250
16	45	Ewa Villages	0.1500	312
17	46	Ewa Villages	0.0600	125
18	29	West Loch Phase II	0.2250	469
19	30	West Loch Phase III	0.2250	469
20	38	Gentry's Area 1A	0.1165	243
21	37	One-Third of Gentry's Area 2A	0.0685	143
22	36	One-Third of Gentry's Area 2A	0.0688	143
23	35	One-Third of Gentry's Area 2A	0.0689	144
24	34	None	0.0000	0
25	33	None	0.0000	0
26	28	None	0.0000	0
27	28	None	0.0000	0
28	27	None	0.0000	0
29	36	Gentry's Area 3	0.0957	199
30	36	Gentry's Areas 1B, 2B, and 4	0.1792	373
31	37	Gentry's Areas 1C, 5, and 5F	0.2058	429
32	34	None	0.0000	0
33	33	Gentry's Areas 6 and 11	0.0650	135
34	31	Gentry's Areas 8 and 8A	0.0877	183
35	34	None	0.0000	0
36	34	None	0.0000	0
37	34	None	0.0000	0
38	33	Gentry's Areas 9 and 10	0.1550	323
39	33	None	0.0000	0
40	33	Gentry's Area 7	0.1446	301
41	34	None	0.0000	0
42	34	Coral Creek Golf Course	0.0200	42
43	34	Gentry's Area 16	0.0483	101
44	33	Honouliuli WWTP	0.5000	1,042
45	30	Half of Gentry's Area 17	0.1050	219
46	25	Half of Gentry's Area 17	0.1050	219
47	25	Gentry's Area 44	0.0950	198
48	25	Gentry's Area 43	0.0000	0
49	25	Gentry's Area 42	0.1854	386
50	28	Gentry's Area 37	0.0662	138
51	27	Gentry's Areas 14, 38, and 39	0.1126	235
52	28	Gentry's Area 40	0.1000	208
53	29	Gentry's Area 13	0.0439	91
54	31	Gentry's Area 12	0.1493	311
55	27	Gentry's Areas 36 and 41	0.1555	324
56	27	Gentry's Area 35	0.0600	125
57	28	None	0.0000	0
58	32	None	0.0000	0
59	31	None	0.0000	0
60	31	Gentry's Area 25	0.0955	199
61	31	Gentry's Area 29	0.0002	0
62	32	Gentry's Areas 30 and 30A	0.0611	127
63	30	Gentry's Areas 31 and 32	0.1549	323
64	30	Gentry's Areas 27B and 27C	0.0865	180
65	30	Gentry's Area 28 With Recreation Centers	0.1605	334
66	30	Gentry's Areas 22, 23, 24, 26, and 27A	0.2846	630
67	30	One-Third of Gentry's Area 18	0.0508	106
68	30	One-Third of Gentry's Area 18	0.0508	106
69	31	One-Third of Gentry's Area 18	0.0509	106
70	32	None	0.0000	0
71	34	None	0.0000	0
72	32	Gentry's Area 21	0.1520	317
73	31	Gentry's Areas 19 and 19A	0.1281	268
74	30	Gentry's Area 20	0.2265	472
75	30	Gentry's Areas 33A and 34	0.1302	271
76	28	Gentry's Area 23	0.0826	172
77	28	Hawaii Prince Golf Course	0.0150	31
78	28	HASEKO's Ocean Pointe, Campbell Estate's Shopping Center, Ewa Beach, & BWS Oversizing	5.2647	10,958
79	35	None	0.0000	0
80	35	None	0.0000	0

1. All hydraulic analyses assume full use of the Farrington Booster, represented as a 30 MGD (20,833 GPM) draft from Node 10.

2. The drafts for Ewa Villages, West Loch Phase I, West Loch Phase II, and St. Francis Hospital are based on actual use rates provided by BWS and are distributed as follows:

Development	Average Demand (MGD)	Peak (GPM)	Draft at Nodes
Ewa Villages	0.30	625	13, 16, & 17
West Loch Phase I	0.45	938	4
West Loch Phase II	0.45	938	18 & 19
St. Francis Hospital	0.09	187	5

3. Drafts for Campbell Estate projects in the Fort Weaver Corridor, exclusive of the former Laulani and Fairways projects, are as follows:

Campbell Estate Water Demands in the Fort Weaver Road Corridor

Development	Average Demand (MGD)	Peak (GPM)	Draft at Node
Honouliuli Mixed Uses	0.2262	471	12
Industrial in Ewa Villages	0.0600	125	13
Fort Weaver Residential	0.1200	250	15
Ewa Shopping Center	0.0090	19	78

4. Demand for the Honouliuli WWTP is at the west end of the 12-inch line in Geiger Road (Node 44). Average demand is 0.50 MGD and the peak flowrate is 1042 GPM.

5. Average demand use for the Hawaii Prince Golf Club is 0.015 MGD. Its peak flowrate of 31 GPM draws from Node 77.

6. Draft for HASEKO's Ocean Pointe (formerly Ewa Marina) occurs at the makai end of the system modeled (Node 78). The draft rate (3.2557 MGD average and 2261 GPM peak) is taken from its September 1998 BWS-approved "Potable Water Master Plan for the Ewa Marina Project". The two supplements to that master plan, dated October 21, 1998 and November 4, 1998, did not change this demand rate.

7. Average water use in Ewa Beach, as provided by BWS, is currently 0.916 MGD. This is significantly less than the rates used in previous EPWDC, Gentry, and HASEKO water master plans. Analyses herein are based on an average of 1.0 MGD and peak of 2083 GPM at Node 78.

8. All analyses include 12-inch pipeline loops through the former Laulani and Fairways parcels and a 12-inch pipeline across Fort Weaver Road (Pipe No. 84 on Figure 2) to connect these loops.

9. BWS' proposed conversion of the 16-inch Fort Weaver main to non-potable use includes a new 12-inch, 210-foot long pipeline across Fort Weaver Road at the Geiger-Iroquois intersection (Pipe No. 109 on Figure 2). This pipe is closed for hydraulic analyses with the 16-inch Fort Weaver main still in service and open for analyses with the 16-inch main converted to non-potable use.

10. The June 1994 Gentry Water Master Plan identified the 4000 GPM fire flow requirement for the industrial parcel on the makai side of Geiger Road (Area 16 on Figure 1) as the most critical for fire protection. In addition to this, hydraulic analyses herein also examine fire flow at two other locations in Ewa by Gentry: 2000 GPM fire flow for the commercial area in the former Laulani parcel (Area 38 on Figure 1 and Node 55 on Figure 2); and 1500 GPM fire flow for the multi-family parcel in the former Fairways (Area 33 on Figure 1 and Node 76 on Figure 2).

Description and Results of the Three Pipe Network Analyses Conducted

To determine velocities with and without the conversion of the 16-inch Fort Weaver main to non-potable use, the three pipe network analyses described below were run. Each of these files contains the same four analyses in the following sequence: peak flow; fire flow at Area 16 (Node 43); fire flow at Area 38 (Node 55); and fire flow at Area 33 (Node 76).

File "EPWDC" (Results in Appendix A). This analysis was made to simulate the existing pipe network with the addition of the proposed loop pipelines through the former Laulani and Fairways parcels and a new 16- and 12-inch line in Geiger Road. This analysis assumes that the conversion of the 16-inch Fort Weaver main to non-potable use does not occur. All of the pipelines except Pipe No. 109 on the hydraulic schematic (Figure 2) are open. EPWDC's 1987 Ewa Water Master Plan allocated 1.0 MGD average demand and 3.0 MGD peak flowrate to BWS through the 42- and 36-inch transmission main it installed and dedicated to BWS. The allocation was made to accommodate an expected increase of water use in Ewa Beach as a result of Ohana zoning. Although the case could be made that West Loch Phase II and the Ewa Villages Redevelopment already use a portion of this allocation, the entire amount was placed as a draft at the makai end of the system (Node 78).

In addition to the adequacy of fire flow, other critical results to examine are the provision of sufficient peak pressure for HASEKO's Ocean Pointe at Node 78 and to have an acceptable peak velocity in the 30-inch main across Fort Weaver at Kolowaka (Pipe No. 43). Table 3 summarizes these critical results: residual peak pressure available to HASEKO of 66.79 psi is about 3 psi greater than the 63.77 psi used in HASEKO's approved water master plan; the peak velocity is 7.46 fps in Pipe 43 across Fort Weaver is somewhat greater than BWS' 6 fps criterion; and the residual fire flow pressures at critical points in Ewa by Gentry are substantially greater than BWS' 20 psi criterion.

Table 3

Key Results of the Pipe Network Analyses

File Name	Appendix	Peak Flow Analysis: Velocity in Pipe 43 Across Fort Weaver at Kolowaka (FPS)	Peak Flow Analysis: Pressure @ Node 78 (PSI)	Residual Fire Flow Pressures (PSI): 4000 GPM @ Node 43	Residual Fire Flow Pressures (PSI): 2000 GPM @ Node 55	Residual Fire Flow Pressures (PSI): 1500 GPM @ Node 76
EPWDC	A	7.46	66.79	49.14	71.76	74.74
CONVERT	B	8.19	64.98	42.29	69.91	74.16
OHANA	C	7.27	69.11	43.63	71.09	75.33

File "CONVERT" (Results in Appendix B). This run simulates conversion of the 16-inch Fort Weaver main to non-potable use as currently proposed by BWS. This was done using the "EPWDC" file and closing Pipeline Nos. 29, 41, 46, 55, 75, 82, and 108 along Fort Weaver Road and opening Pipe No. 109 across Fort Weaver Road at the Geiger-Iroquois intersection. All demands remain the same as in EPWDC, including the Ohana zoning allocation to BWS at Node 78. As summarized in Table 3, the velocity in Pipe No. 43 is increased from 7.46 to 8.19 fps and the residual pressure at Node 78 is decreased from 66.79 to 64.98 psi. This is still about 1.2 psi greater than in HASEKO's approved water master plan. Adequate fire flow protection to Gentry's Industrial parcel (Area 16) and other areas is maintained.

File "OHANA" (Results in Appendix C). The "OHANA" run is identical to the "CONVERT" analysis except that the 1.0 MGD average, 3.0 MGD peak draft allocated by EPWDC to BWS has been removed from Node 78. There is some indication that this allocation may never be utilized there. As a result, peak velocity in the line across Fort Weaver Road at Kolowaka is reduced to 7.27 fps and the peak pressure for HASEKO at Node 78 is increased to 69.11 psi.

Summary Conclusions and Recommendations

1. Completion of the Ewa by Gentry development, including the incorporation of the former Laulani and Fairways parcels, will require 1.69806 MGD of well supply and 3.2336 MG of reservoir storage.

2. The Laulani and Fairways areas can be served by 12-inch pipeline loops through each of these parcels and a 12-inch connection across Fort Weaver Road. A new Fort Weaver main will not be required.

3. The conversion of the 16-inch main to non-potable use as proposed by BWS can generally be accommodated.

4. Peak pressures available to HASEKO's Ocean Pointe are higher than in the 1987 Ewa Water Master Plan and HASEKO's 1996 water master plan.

Appendix A

Analysis of the
Existing Fort Weaver Road Corridor
With 12-Inch Looped Pipelines
Through Laulani and Fairways

File: EPWDC

```
* * * * * * * * * *   K Y P I P E 2   * * * * * * * * * *
*  University of Kentucky Hydraulic Analysis Program   *
* Distribution of Pressure and Flows in Piping Networks *
*         1000 PIPE VERSION - 1.10    (08/25/92)        *
* * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

DATE: 8/ 2/2000
TIME: 8:21:34

INPUT DATA FILENAME -------------- EPWDC.DAT
TABULATED OUTPUT FILENAME -------- EPWDC.OUT
POSTPROCESSOR RESULTS FILENAME --- EPWDC.RES

S U M M A R Y   O F   O R I G I N A L   D A T A

U N I T S   S P E C I F I E D

FLOWRATE .... = gallons/minute
HEAD (HGL) .... = feet
PRESSURE .... = psig

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	FGN-HGL (ft)
1-FGPU	0	1	30.0	36.0	130.00	.00	10.00
2	1	2	1000.0	30.0	130.00	.00	
3	1	2	1000.0	12.0	110.00	.00	
4	2	3	2500.0	36.0	130.00	.00	
5	2	3	2500.0	30.0	130.00	.00	
6-FG	0	3	2600.0	20.0	120.00	.00	223.00
7	3	4	1350.0	36.0	130.00	.00	
8	3	4	1350.0	30.0	130.00	.00	
9	3	4	1350.0	20.0	120.00	.00	
10	4	5	1650.0	36.0	130.00	.00	
11	4	5	1650.0	30.0	130.00	.00	
12	4	5	1650.0	20.0	120.00	.00	
13	5	6	1850.0	36.0	130.00	.00	
14	5	6	1850.0	30.0	130.00	.00	
15	6	7	370.0	30.0	130.00	.00	
16-PU	7	8	20.0	30.0	130.00	.00	
17-PU	7	8	20.0	30.0	130.00	.00	
18-PU	7	8	20.0	30.0	130.00	.00	
19-CV	7	8	20.0	30.0	130.00	.00	
20	8	9	70.0	30.0	130.00	.00	
21	9	10	3000.0	30.0	130.00	.00	
22	9	10	3000.0	30.0	130.00	.00	
23-FG	0	10	4530.0	42.0	130.00	.00	223.00
24	10	11	8250.0	42.0	130.00	.00	
25-CV	5	12	7150.0	16.0	120.00	.00	
26	11	12	1900.0	16.0	120.00	.00	

27	11	13	3750.0	42.0	130.00	.00
28	12	14	2850.0	16.0	120.00	.00
29	14	15	650.0	16.0	120.00	.00
30	16	15	1300.0	16.0	120.00	.00
31	17	16	700.0	16.0	120.00	.00
32	13	17	200.0	16.0	120.00	.00
33	12	18	2000.0	12.0	110.00	.00
34	18	19	1800.0	12.0	110.00	.00
35	15	19	3200.0	12.0	110.00	.00
36	13	20	1250.0	36.0	130.00	.00
37	20	21	230.0	36.0	130.00	.00
38	21	22	200.0	36.0	130.00	.00
39	22	23	200.0	36.0	130.00	.00
40	23	24	380.0	36.0	130.00	.00
41	15	28	2480.0	16.0	120.00	.00
42	24	25	1100.0	36.0	130.00	.00
43	25	26	180.0	30.0	130.00	.00
44	26	27	100.0	36.0	130.00	.00
45	28	27	150.0	16.0	120.00	.00
46	28	35	2000.0	16.0	120.00	.00
47	27	79	2450.0	36.0	130.00	.00
48	24	29	110.0	16.0	120.00	.00
49	29	30	730.0	12.0	110.00	.00
50	30	31	970.0	12.0	110.00	.00
51	31	32	1700.0	12.0	110.00	.00
52	33	32	570.0	12.0	110.00	.00
53	34	33	580.0	12.0	110.00	.00
54	35	34	800.0	12.0	110.00	.00
55	35	48	730.0	16.0	120.00	.00
56	36	37	700.0	12.0	110.00	.00
57	38	37	350.0	12.0	110.00	.00
58	34	38	700.0	12.0	110.00	.00
59	37	39	1300.0	12.0	110.00	.00
60	32	39	870.0	12.0	110.00	.00
61	32	40	1140.0	12.0	110.00	.00
62	40	41	1150.0	12.0	110.00	.00
63	39	41	1390.0	12.0	110.00	.00
64	39	42	1480.0	12.0	110.00	.00
65	42	44	122.0	12.0	110.00	.00
66	41	43	890.0	16.0	120.00	.00
67	37	54	1000.0	12.0	110.00	.00
68	54	53	1030.0	12.0	110.00	.00
69	39	53	730.0	12.0	110.00	.00
70	53	52	805.0	12.0	110.00	.00
71	52	51	400.0	12.0	110.00	.00
72	51	50	580.0	12.0	110.00	.00
73	50	49	965.0	12.0	110.00	.00
74	79	71	150.0	36.0	130.00	.00
75	48	36	170.0	16.0	120.00	.00
76	47	46	1390.0	8.0	110.00	.00
77	45	46	1390.0	12.0	110.00	.00
78	43	45	1390.0	12.0	110.00	.00
79	55	50	1015.0	12.0	110.00	.00
80	56	55	1000.0	12.0	110.00	.00
81	57	56	465.0	12.0	110.00	.00
82	36	57	2000.0	16.0	120.00	.00
83	71	77	2000.0	36.0	130.00	.00
84	77	57	150.0	12.0	110.00	.00
85	26	58	360.0	12.0	110.00	.00
86	58	59	630.0	12.0	110.00	.00
87	58	60	650.0	8.0	110.00	.00
88	60	61	650.0	8.0	110.00	.00
89	59	61	550.0	12.0	110.00	.00
90	61	62	720.0	12.0	110.00	.00
91	62	63	950.0	12.0	110.00	.00
92	59	64	310.0	12.0	110.00	.00

93	64	65	420.0	12.0	110.00	.00
94	65	66	320.0	12.0	110.00	.00
95	66	67	570.0	12.0	110.00	.00
96	68	67	400.0	12.0	110.00	.00
97	69	68	250.0	12.0	110.00	.00
98	70	69	330.0	12.0	110.00	.00
99	71	70	1320.0	12.0	110.00	.00
100	79	48	40.0	16.0	120.00	.00
101	70	72	410.0	12.0	110.00	.00
102	72	73	390.0	12.0	110.00	.00
103	73	74	780.0	12.0	110.00	.00
104	75	74	465.0	12.0	110.00	.00
105	76	75	810.0	12.0	110.00	.00
106	77	76	700.0	12.0	110.00	.00
107	77	78	1580.0	36.0	130.00	.00
108	57	78	1580.0	16.0	120.00	.00
109-XX	71	36	210.0	12.0	110.00	.00

P U M P   D A T A

THERE IS A PUMP IN LINE 1 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
415.00	.00
230.00	6700.00
105.00	9450.00

THERE IS A PUMP IN LINE 16 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 17 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 18 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

J U N C T I O N   N O D E   D A T A

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	CONNECTING PIPES					
1		.00	120.00	1	2	3			
2		.00	75.00	2	3	4	5		
3		.00	77.00	4	5	6	7	8	9

4	937.00	50.00	7	8	9	10	11	12
5	187.00	85.00	10	11	12	13	14	25
6	.00	95.00	13	14	15			
7	.00	98.00	15	16	17	18	19	
8	.00	98.00	16	17	18	19	20	
9	.00	102.00	20	21	22			
10	20830.00	175.00	21	22	23	24		
11	.00	55.00	24	26	27			
12	471.00	25.00	25	26	28	33		
13	312.00	45.00	27	32	36			
14	.00	45.00	28	29				
15	250.00	45.00	29	30	35	41		
16	312.00	45.00	30	31				
17	125.00	45.00	31	32				
18	469.00	20.00	33	34				
19	469.00	30.00	34	35				
20	243.00	38.00	36	37				
21	143.00	37.00	37	38				
22	143.00	36.00	38	39				
23	144.00	35.00	39	40				
24	.00	34.00	40	42	48			
25	.00	33.00	42	43				
26	.00	28.00	43	44	85			
27	.00	28.00	44	45	47			
28	.00	27.00	41	45	46			
29	199.00	35.00	48	49				
30	373.00	36.00	49	50				
31	429.00	37.00	50	51				
32	.00	34.00	51	52	60	61		
33	198.00	33.00	52	53				
34	183.00	31.00	53	54	58			
35	.00	34.00	46	54	55			
36	.00	34.00	56	75	82	109		
37	.00	34.00	56	57	59	67		
38	323.00	33.00	57	58				
39	.00	33.00	59	60	63	64	69	
40	301.00	33.00	61	62				
41	.00	34.00	62	63	66			
42	42.00	34.00	64	65				
43	101.00	34.00	66	78				
44	1042.00	33.00	65					
45	219.00	30.00	77	78				
46	219.00	28.00	76	77				
47	198.00	25.00	76					
48	.00	35.00	55	75	100			
49	386.00	25.00	73					
50	138.00	26.00	72	73	79			
51	235.00	27.00	71	72				
52	208.00	28.00	70	71				
53	91.00	29.00	68	69	70			
54	311.00	31.00	67	68				
55	324.00	27.00	79	80				
56	125.00	27.00	80	81				
57	.00	28.00	81	82	84	108		
58	.00	32.00	85	86	87			
59	.00	31.00	86	89	92			
60	199.00	31.00	87	88				
61	8.00	31.00	88	89	90			
62	127.00	32.00	90	91				
63	323.00	38.00	91					
64	180.00	30.00	92	93				
65	334.00	30.00	93	94				
66	530.00	30.00	94	95				

67	106.00	30.00	95	96		
68	106.00	30.00	96	97		
69	106.00	30.00	97	98		
70	.00	32.00	98	99	101	
71	.00	34.00	74	83	99	109
72	317.00	32.00	101	102		
73	288.00	31.00	102	103		
74	472.00	30.00	103	104		
75	271.00	30.00	104	105		
76	172.00	29.00	105	106		
77	31.00	28.00	83	84	106	107
78	10968.00	20.00	107	108		
79	.00	35.00	47	74	100	

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

NUMBER OF PIPES ....(p) = 109
NUMBER OF JUNCTION NODES ....(j) = 79
NUMBER OF PRIMARY LOOPS ....(l) = 28
NUMBER OF FIXED GRADE NODES ....(f) = 3
NUMBER OF SUPPLY ZONES ....(z) = 1

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 4 TRIALS WITH AN ACCURACY = .00248

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8644.54	.02	143.80	.00	2.72	.65
2	1	2	8033.68	1.39	.00	.00	3.65	1.39
3	1	2	610.86	1.39	.00	.00	1.73	1.39
4	2	3	5338.99	.67	.00	.00	1.68	.27
5	2	3	3305.56	.67	.00	.00	1.50	.27
6-FG	0	3	12789.11	71.28	.00	.00	13.06	27.41
7	3	4	11803.27	1.57	.00	.00	3.72	1.16
8	3	4	7307.78	1.57	.00	.00	3.32	1.16
9	3	4	2322.60	1.57	.00	.00	2.37	1.16
10	4	5	11287.29	1.77	.00	.00	3.56	1.07
11	4	5	6988.30	1.77	.00	.00	3.17	1.07
12	4	5	2221.07	1.77	.00	.00	2.27	1.07
13	5	6	12543.59	2.41	.00	.00	3.95	1.30
14	5	6	7766.07	2.41	.00	.00	3.52	1.30
15	6	7	20309.65	2.86	.00	.00	9.22	7.73
16-PU	7	8	6769.88	.02	77.75	.00	3.07	1.01
17-PU	7	8	6769.88	.02	77.75	.00	3.07	1.01

18-PU	7	8	6769.88	.02	77.75	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20309.65	.54	.00	.00	9.22	7.73
21	9	10	10154.83	6.42	.00	.00	4.61	2.14
22	9	10	10154.83	6.42	.00	.00	4.61	2.14
23-PG	0	10	23784.35	9.11	.00	.00	5.51	2.01
24	10	11	23264.00	15.92	.00	.00	5.39	1.93
25-XXCV	5	12						
26	11	12	2271.22	6.29	.00	.00	3.62	3.31
27	11	13	20992.78	5.98	.00	.00	4.86	1.60
28	12	14	1107.91	2.50	.00	.00	1.77	.88
29	14	15	1107.91	.57	.00	.00	1.77	.88
30	16	15	1350.19	1.64	.00	.00	2.15	1.26
31	17	16	1662.19	1.30	.00	.00	2.65	1.86
32	13	17	1787.19	.42	.00	.00	2.85	2.12
33	12	18	692.31	3.50	.00	.00	1.96	1.75
34	18	19	223.31	.39	.00	.00	.63	.22
35	15	19	245.69	.82	.00	.00	.70	.26
36	13	20	18893.59	3.48	.00	.00	5.95	2.78
37	20	21	18650.59	.62	.00	.00	5.88	2.72
38	21	22	18507.59	.54	.00	.00	5.83	2.68
39	22	23	18364.59	.53	.00	.00	5.79	2.64
40	23	24	18220.59	.99	.00	.00	5.74	2.60
41	15	28	1962.41	6.26	.00	.00	3.13	2.53
42	24	25	16433.19	2.36	.00	.00	5.18	2.15
43	25	26	16433.19	.94	.00	.00	7.46	5.22
44	26	27	14728.15	.18	.00	.00	4.64	1.75
45	28	27	144.22	.00	.00	.00	.23	.02
46	28	35	1818.18	4.38	.00	.00	2.90	2.19
47	27	79	14872.38	4.37	.00	.00	4.69	1.79
48	24	29	1787.40	.23	.00	.00	2.85	2.12
49	29	30	1588.40	5.94	.00	.00	4.51	8.14
50	30	31	1215.40	4.81	.00	.00	3.45	4.96
51	31	32	786.40	3.76	.00	.00	2.23	2.21
52	33	32	561.73	.68	.00	.00	1.59	1.19
53	34	33	759.73	1.20	.00	.00	2.16	2.08
54	35	34	1378.57	5.01	.00	.00	3.91	6.26
55	35	48	439.61	.12	.00	.00	.70	.16
56	36	37	1432.18	4.70	.00	.00	4.06	6.72
57	38	37	112.84	.02	.00	.00	.32	.06
58	34	38	435.84	.52	.00	.00	1.24	.74
59	37	39	786.10	2.88	.00	.00	2.23	2.21
60	32	39	695.80	1.54	.00	.00	1.97	1.77
61	32	40	652.33	1.79	.00	.00	1.85	1.57
62	40	41	351.33	.57	.00	.00	1.00	.50
63	39	41	385.67	.82	.00	.00	1.09	.59
64	39	42	1084.00	5.94	.00	.00	3.07	4.01
65	42	44	1042.00	.45	.00	.00	2.96	3.73
66	41	43	737.00	.37	.00	.00	1.18	.41
67	37	54	758.92	2.07	.00	.00	2.15	2.07
68	54	53	447.92	.80	.00	.00	1.27	.78
69	39	53	12.24	.00	.00	.00	.03	.00
70	53	52	369.15	.44	.00	.00	1.05	.55
71	52	51	161.15	.05	.00	.00	.46	.12
72	51	50	-73.85	.02	.00	.00	.21	.03
73	50	49	386.00	.57	.00	.00	1.09	.59
74	79	71	12696.77	.20	.00	.00	4.00	1.33
75	48	36	2615.21	.73	.00	.00	4.17	4.30
76	47	46	-198.00	1.72	.00	.00	1.26	1.24
77	45	46	417.00	.95	.00	.00	1.18	.68
78	43	45	636.00	2.08	.00	.00	1.80	1.49
79	55	50	597.85	1.35	.00	.00	1.70	1.33
80	56	55	921.85	2.97	.00	.00	2.61	2.97
81	57	56	1046.85	1.75	.00	.00	2.97	3.76
82	36	57	1183.03	1.98	.00	.00	1.89	.99
83	71	77	11692.13	2.29	.00	.00	3.69	1.14

84	77	57	801.54	.34	.00	.00	2.27	2.29
85	26	58	1705.04	3.34	.00	.00	4.84	9.28
86	58	59	1307.80	3.58	.00	.00	3.71	5.68
87	58	60	397.24	2.93	.00	.00	2.54	4.50
88	60	61	198.24	.81	.00	.00	1.27	1.24
89	59	61	259.76	.16	.00	.00	.74	.28
90	61	62	450.00	.57	.00	.00	1.28	.79
91	62	63	323.00	.40	.00	.00	.92	.43
92	59	64	1048.04	1.17	.00	.00	2.97	3.77
93	64	65	868.04	1.12	.00	.00	2.46	2.66
94	65	66	534.04	.35	.00	.00	1.51	1.08
95	66	67	4.04	.00	.00	.00	.01	.00
96	68	67	101.96	.02	.00	.00	.29	.05
97	69	68	207.96	.05	.00	.00	.59	.19
98	70	69	313.96	.13	.00	.00	.89	.40
99	71	70	1004.64	4.60	.00	.00	2.85	3.49
100	79	48	2175.60	.12	.00	.00	3.47	3.06
101	70	72	690.68	.71	.00	.00	1.96	1.74
102	72	73	373.68	.22	.00	.00	1.06	.56
103	73	74	85.68	.03	.00	.00	.24	.04
104	75	74	386.32	.28	.00	.00	1.10	.59
105	76	75	657.32	1.29	.00	.00	1.86	1.59
106	77	76	829.32	1.71	.00	.00	2.35	2.44
107	77	78	10030.28	1.36	.00	.00	3.16	.86
108	57	78	937.72	1.02	.00	.00	1.50	.64
109-XX	71	36						

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	153.78	120.00	33.78	14.64
2		.00	152.40	75.00	77.40	33.54
3		.00	151.72	77.00	74.72	32.38
4		937.00	150.15	50.00	100.15	43.40
5		187.00	148.38	85.00	63.38	27.47
6		.00	145.97	95.00	50.97	22.09
7		.00	143.12	98.00	45.12	19.55
8		.00	220.85	98.00	122.85	53.24
9		.00	220.31	102.00	118.31	51.27
10		20830.00	213.89	175.00	38.89	16.85
11		.00	197.97	55.00	142.97	61.95
12		471.00	191.68	25.00	166.68	72.23
13		312.00	191.98	45.00	146.98	63.69
14		.00	189.18	45.00	144.18	62.48
15		250.00	188.61	45.00	143.61	62.23
16		312.00	190.26	45.00	145.26	62.94
17		125.00	191.56	45.00	146.56	63.51
18		469.00	188.18	20.00	168.18	72.88
19		469.00	187.79	30.00	157.79	68.38
20		243.00	188.50	38.00	150.50	65.22
21		143.00	187.88	37.00	150.88	65.38
22		143.00	187.34	36.00	151.34	65.58
23		144.00	186.82	35.00	151.82	65.79
24		.00	185.83	34.00	151.83	65.79
25		.00	183.46	33.00	150.46	65.20
26		.00	182.52	28.00	154.52	66.96
27		.00	182.34	28.00	154.34	66.88
28		.00	182.35	27.00	155.35	67.32
29		199.00	185.59	35.00	150.59	65.26
30		373.00	179.65	36.00	143.65	62.25
31		429.00	174.84	37.00	137.84	59.73

32	.00	171.07	34.00	137.07	59.40
33	198.00	171.75	33.00	138.75	60.12
34	183.00	172.95	31.00	141.95	61.51
35	.00	177.96	34.00	143.96	62.38
36	.00	177.12	34.00	143.12	62.02
37	.00	172.41	34.00	138.41	59.98
38	323.00	172.43	33.00	139.43	60.42
39	.00	169.54	33.00	136.54	59.17
40	301.00	169.29	33.00	136.29	59.06
41	.00	168.71	34.00	134.71	58.38
42	42.00	163.60	34.00	129.60	56.16
43	101.00	168.35	34.00	134.35	58.22
44	1042.00	163.14	33.00	130.14	56.40
45	219.00	166.27	30.00	136.27	59.05
46	219.00	165.32	28.00	137.32	59.51
47	198.00	163.60	25.00	138.60	60.06
48	.00	177.85	35.00	142.85	61.90
49	386.00	168.49	25.00	143.49	62.18
50	138.00	169.07	26.00	143.07	61.99
51	235.00	169.05	27.00	142.05	61.55
52	208.00	169.10	28.00	141.10	61.14
53	91.00	169.54	29.00	140.54	60.90
54	311.00	170.34	31.00	139.34	60.38
55	324.00	170.42	27.00	143.42	62.15
56	125.00	173.39	27.00	146.39	63.44
57	.00	175.14	28.00	147.14	63.76
58	.00	179.18	32.00	147.18	63.78
59	.00	175.60	31.00	144.60	62.66
60	199.00	176.25	31.00	145.25	62.94
61	8.00	175.44	31.00	144.44	62.59
62	127.00	174.88	32.00	142.88	61.91
63	323.00	174.47	38.00	136.47	59.14
64	180.00	174.43	30.00	144.43	62.59
65	334.00	173.32	30.00	143.32	62.10
66	530.00	172.97	30.00	142.97	61.95
67	106.00	172.97	30.00	142.97	61.95
68	106.00	172.99	30.00	142.99	61.96
69	106.00	173.04	30.00	143.04	61.98
70	.00	173.17	32.00	141.17	61.17
71	.00	177.77	34.00	143.77	62.30
72	317.00	172.46	32.00	140.46	60.86
73	288.00	172.24	31.00	141.24	61.20
74	472.00	172.21	30.00	142.21	61.62
75	271.00	172.49	30.00	142.49	61.74
76	172.00	173.77	29.00	144.77	62.73
77	31.00	175.48	28.00	147.48	63.91
78	10968.00	174.12	20.00	154.12	66.79
79	.00	177.97	35.00	142.97	61.95

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8644.54
6	12789.11
23	23784.35

NET SYSTEM INFLOW = 45218.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 45218.00

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
10	20833.00
43	4050.00

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00045

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE, CV -CHECK VALVE, FG -FIXED GRADE NODE, RV -REGULATING VALVE, PU -PUMP LINE, TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	NODE NOS. #2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8546.69	.02	148.40	.00	2.69	.64
2	1	2	7942.74	1.36	.00	.00	3.60	1.36
3	1	2	603.95	1.36	.00	.00	1.71	1.36
4	2	3	5278.55	.66	.00	.00	1.66	.26
5	2	3	3268.14	.66	.00	.00	1.48	.26
6-FG	0	3	12332.60	66.64	.00	.00	12.59	25.63
7	3	4	11497.96	1.50	.00	.00	3.62	1.11
8	3	4	7118.79	1.50	.00	.00	3.23	1.11
9	3	4	2262.54	1.50	.00	.00	2.31	1.11
10	4	5	11239.96	1.75	.00	.00	3.54	1.06
11	4	5	6959.06	1.75	.00	.00	3.16	1.06
12	4	5	2211.77	1.75	.00	.00	2.26	1.06
13	5	6	12548.24	2.41	.00	.00	3.95	1.30
14	5	6	7769.06	2.41	.00	.00	3.53	1.30
15	6	7	20317.29	2.86	.00	.00	9.22	7.73
16-PU	7	8	6772.43	.02	77.70	.00	3.07	1.01
17-PU	7	8	6772.43	.02	77.70	.00	3.07	1.01
18-PU	7	8	6772.43	.02	77.70	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20317.29	.54	.00	.00	9.22	7.73
21	9	10	10158.65	6.43	.00	.00	4.61	2.14
22	9	10	10158.65	6.43	.00	.00	4.61	2.14
23-FG	0	10	16147.20	4.45	.00	.00	3.74	.98
24	10	11	15631.50	7.63	.00	.00	3.62	.92
25-XXCV	5	12						
26	11	12	1422.79	2.65	.00	.00	2.27	1.39
27	11	13	14208.71	2.90	.00	.00	3.29	.77
28	12	14	771.98	1.28	.00	.00	1.23	.45
29	14	15	771.98	.29	.00	.00	1.23	.45

30	16	15	826.81	.66	.00	.00	1.32	.51
31	17	16	982.81	.49	.00	.00	1.57	.70
32	13	17	1045.31	.16	.00	.00	1.67	.79
33	12	18	415.31	1.36	.00	.00	1.18	.68
34	18	19	180.81	.26	.00	.00	.51	.15
35	15	19	53.69	.05	.00	.00	.15	.02
36	13	20	13007.40	1.74	.00	.00	4.10	1.39
37	20	21	12885.90	.31	.00	.00	4.06	1.37
38	21	22	12814.40	.27	.00	.00	4.04	1.36
39	22	23	12742.90	.27	.00	.00	4.02	1.34
40	23	24	12670.90	.50	.00	.00	3.99	1.33
41	15	28	1420.10	3.44	.00	.00	2.27	1.39
42	24	25	10981.56	1.12	.00	.00	3.46	1.02
43	25	26	10981.56	.45	.00	.00	4.98	2.47
44	26	27	10038.27	.09	.00	.00	3.16	.86
45	28	27	68.09	.00	.00	.00	.11	.00
46	28	35	1352.01	2.53	.00	.00	2.16	1.27
47	27	79	10106.36	2.14	.00	.00	3.19	.87
48	24	29	1689.34	.21	.00	.00	2.70	1.91
49	29	30	1589.84	5.95	.00	.00	4.51	8.15
50	30	31	1403.34	6.28	.00	.00	3.98	6.47
51	31	32	1188.84	8.09	.00	.00	3.37	4.76
52	33	32	1345.57	3.41	.00	.00	3.82	5.99
53	34	33	1444.57	3.96	.00	.00	4.10	6.83
54	35	34	1888.83	8.98	.00	.00	5.36	11.22
55	35	48	-536.82	.17	.00	.00	.86	.23
56	36	37	2018.35	8.88	.00	.00	5.73	12.69
57	38	37	191.27	.06	.00	.00	.54	.16
58	34	38	352.77	.35	.00	.00	1.00	.50
59	37	39	1351.66	7.85	.00	.00	3.83	6.04
60	32	39	516.15	.88	.00	.00	1.46	1.02
61	32	40	2018.25	14.46	.00	.00	5.72	12.69
62	40	41	1867.75	12.64	.00	.00	5.30	10.99
63	39	41	2500.25	26.22	.00	.00	7.09	18.86
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	4368.00	9.89	.00	.00	6.97	11.11
67	37	54	857.96	2.60	.00	.00	2.43	2.60
68	54	53	702.46	1.85	.00	.00	1.99	1.80
69	39	53	-1174.43	3.40	.00	.00	3.33	4.65
70	53	52	-517.47	.82	.00	.00	1.47	1.02
71	52	51	-621.47	.57	.00	.00	1.76	1.43
72	51	50	-738.97	1.14	.00	.00	2.10	1.97
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	7073.31	.07	.00	.00	2.23	.45
75	48	36	2496.22	.67	.00	.00	3.98	3.94
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	1000.97	3.51	.00	.00	2.84	3.46
80	56	55	1162.97	4.57	.00	.00	3.30	4.57
81	57	56	1225.47	2.34	.00	.00	3.48	5.04
82	36	57	477.87	.37	.00	.00	.76	.18
83	71	77	6611.26	.80	.00	.00	2.08	.40
84	77	57	872.20	.40	.00	.00	2.47	2.68
85	26	58	943.29	1.12	.00	.00	2.68	3.10
86	58	59	727.81	1.21	.00	.00	2.06	1.92
87	58	60	215.48	.94	.00	.00	1.38	1.45
88	60	61	115.98	.30	.00	.00	.74	.46
89	59	61	113.02	.03	.00	.00	.32	.06
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	614.79	.44	.00	.00	1.74	1.40
93	64	65	524.79	.44	.00	.00	1.49	1.05
94	65	66	357.79	.16	.00	.00	1.01	.52
95	66	67	92.79	.02	.00	.00	.26	.04

96	68	67	-39.79	.00	.00	.00	.11	.01
97	69	68	13.21	.00	.00	.00	.04	.00
98	70	69	66.21	.01	.00	.00	.19	.02
99	71	70	462.05	1.09	.00	.00	1.31	.83
100	79	48	3033.04	.23	.00	.00	4.84	5.66
101	70	72	395.84	.25	.00	.00	1.12	.62
102	72	73	237.34	.09	.00	.00	.67	.24
103	73	74	93.34	.03	.00	.00	.26	.04
104	75	74	142.66	.04	.00	.00	.40	.09
105	76	75	278.16	.26	.00	.00	.79	.32
106	77	76	364.16	.37	.00	.00	1.03	.53
107	77	78	5359.41	.43	.00	.00	1.69	.27
108	57	78	124.59	.02	.00	.00	.20	.02
109-XX	71	36			.00	.00		

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.38	120.00	38.38	16.63
2		.00	157.02	75.00	82.02	35.54
3		.00	156.36	77.00	79.36	34.39
4		468.50	154.87	50.00	104.87	45.44
5		93.50	153.11	85.00	68.11	29.52
6		.00	150.70	95.00	55.70	24.14
7		.00	147.84	98.00	49.84	21.60
8		.00	225.52	98.00	127.52	55.26
9		.00	224.98	102.00	122.98	53.29
10		20833.00	218.55	175.00	43.55	18.87
11		.00	210.93	55.00	155.93	67.57
12		235.50	208.28	25.00	183.28	79.42
13		156.00	208.02	45.00	163.02	70.64
14		.00	207.00	45.00	162.00	70.20
15		125.00	206.71	45.00	161.71	70.08
16		156.00	207.38	45.00	162.38	70.36
17		62.50	207.87	45.00	162.87	70.58
18		234.50	206.93	20.00	186.93	81.00
19		234.50	206.66	30.00	176.66	76.55
20		121.50	206.28	38.00	168.28	72.92
21		71.50	205.97	37.00	168.97	73.22
22		71.50	205.70	36.00	169.70	73.53
23		72.00	205.43	35.00	170.43	73.85
24		.00	204.92	34.00	170.92	74.07
25		.00	203.80	33.00	170.80	74.01
26		.00	203.36	28.00	175.36	75.99
27		.00	203.27	28.00	175.27	75.95
28		.00	203.27	27.00	176.27	76.38
29		99.50	204.71	35.00	169.71	73.54
30		186.50	198.76	36.00	162.76	70.53
31		214.50	192.48	37.00	155.48	67.38
32		.00	184.39	34.00	150.39	65.17
33		99.00	187.80	33.00	154.80	67.08
34		91.50	191.76	31.00	160.76	69.66
35		.00	200.74	34.00	166.74	72.25
36		.00	200.24	34.00	166.24	72.04
37		.00	191.36	34.00	157.36	68.19
38		161.50	191.41	33.00	158.41	68.65
39		.00	183.51	33.00	150.51	65.22
40		150.50	169.93	33.00	136.93	59.34
41		.00	157.29	34.00	123.29	53.43
42		21.00	181.86	34.00	147.86	64.07
43		4050.00	147.40	34.00	113.40	49.14

44	521.00	181.74	33.00	148.74	64.45
45	109.50	146.82	30.00	116.82	50.62
46	109.50	146.56	28.00	118.56	51.38
47	99.00	146.08	25.00	121.08	52.47
48	.00	200.91	35.00	165.91	71.89
49	193.00	189.28	25.00	164.28	71.19
50	69.00	189.44	26.00	163.44	70.82
51	117.50	188.30	27.00	161.30	69.90
52	104.00	187.73	28.00	159.73	69.21
53	45.50	186.90	29.00	157.90	68.43
54	155.50	188.75	31.00	157.75	68.36
55	162.00	192.96	27.00	165.96	71.91
56	62.50	197.53	27.00	170.53	73.89
57	.00	199.87	28.00	171.87	74.48
58	.00	202.24	32.00	170.24	73.77
59	.00	201.03	31.00	170.03	73.68
60	99.50	201.30	31.00	170.30	73.80
61	4.00	201.00	31.00	170.00	73.67
62	63.50	200.84	32.00	168.84	73.17
63	161.50	200.73	38.00	162.73	70.52
64	90.00	200.60	30.00	170.60	73.93
65	167.00	200.16	30.00	170.16	73.74
66	265.00	199.99	30.00	169.99	73.66
67	53.00	199.97	30.00	169.97	73.65
68	53.00	199.97	30.00	169.97	73.65
69	53.00	199.97	30.00	169.97	73.65
70	.00	199.97	32.00	167.97	72.79
71	.00	201.07	34.00	167.07	72.39
72	158.50	199.72	32.00	167.72	72.68
73	144.00	199.63	31.00	168.63	73.07
74	236.00	199.59	30.00	169.59	73.49
75	135.50	199.64	30.00	169.64	73.51
76	86.00	199.90	29.00	170.90	74.06
77	15.50	200.27	28.00	172.27	74.65
78	5484.00	199.84	20.00	179.84	77.93
79	.00	201.13	35.00	166.13	71.99

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8546.69
6	12332.60
23	16147.20

NET SYSTEM INFLOW = 37026.50
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 37026.50

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
55	2162.00
10	20833.00

S I M U L A T I O N   R E S U L T S

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00115

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/1000 (ft/ft)
1-7GPU	0	1	8536.80	.02	148.86	.00	2.69	.64
2	1	2	7933.55	1.36	.00	.00	3.60	1.36
3	1	2	603.25	1.36	.00	.00	1.71	1.36
4	2	3	5272.45	.65	.00	.00	1.66	.26
5	2	3	3264.36	.65	.00	.00	1.48	.26
6-FG	0	3	12285.83	66.17	.00	.00	12.55	25.45
7	3	4	11466.76	1.49	.00	.00	3.61	1.10
8	3	4	7099.48	1.49	.00	.00	3.22	1.10
9	3	4	2256.40	1.49	.00	.00	2.30	1.10
10	4	5	11208.76	1.75	.00	.00	3.53	1.06
11	4	5	6939.74	1.75	.00	.00	3.15	1.06
12	4	5	2205.63	1.75	.00	.00	2.25	1.06
13	5	6	12513.25	2.40	.00	.00	3.94	1.30
14	5	6	7747.40	2.40	.00	.00	3.52	1.30
15	6	7	20260.64	2.85	.00	.00	9.20	7.69
16-PU	7	8	6753.55	.02	78.09	.00	3.07	1.01
17-PU	7	8	6753.55	.02	78.09	.00	3.07	1.01
18-PU	7	8	6753.55	.02	78.09	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20260.64	.54	.00	.00	9.20	7.69
21	9	10	10130.32	6.39	.00	.00	4.60	2.13
22	9	10	10130.32	6.39	.00	.00	4.60	2.13
23-FG	0	10	14204.36	3.51	.00	.00	3.29	.77
24	10	11	13632.00	5.92	.00	.00	3.16	.72
25-XXCV	5	12						
26	11	12	1280.87	2.18	.00	.00	2.04	1.15
27	11	13	12351.13	2.24	.00	.00	2.86	.60
28	12	14	666.02	.97	.00	.00	1.06	.34
29	14	15	666.02	.22	.00	.00	1.06	.34
30	16	15	757.72	.56	.00	.00	1.21	.43
31	17	16	913.72	.43	.00	.00	1.46	.61
32	13	17	976.22	.14	.00	.00	1.56	.69
33	12	18	379.35	1.15	.00	.00	1.08	.57
34	18	19	144.85	.17	.00	.00	.41	.10
35	15	19	89.65	.13	.00	.00	.25	.04
36	13	20	11218.91	1.32	.00	.00	3.54	1.06
37	20	21	11097.41	.24	.00	.00	3.50	1.04
38	21	22	11025.91	.21	.00	.00	3.48	1.03
39	22	23	10954.41	.20	.00	.00	3.45	1.01
40	23	24	10882.41	.38	.00	.00	3.43	1.00
41	15	28	1209.09	2.55	.00	.00	1.93	1.03

42	24	25	9792.70	.91	.00	.00	3.09	.82
43	25	26	9792.70	.36	.00	.00	4.44	2.00
44	26	27	8885.53	.07	.00	.00	2.80	.69
45	28	27	88.71	.00	.00	.00	.14	.01
46	28	35	1120.38	1.79	.00	.00	1.79	.89
47	27	79	8974.23	1.72	.00	.00	2.83	.70
48	24	29	1089.71	.09	.00	.00	1.74	.85
49	29	30	990.21	2.48	.00	.00	2.81	3.39
50	30	31	803.71	2.24	.00	.00	2.28	2.31
51	31	32	589.21	2.21	.00	.00	1.67	1.30
52	33	32	447.17	.44	.00	.00	1.27	.78
53	34	33	546.17	.65	.00	.00	1.55	1.13
54	35	34	1005.39	2.79	.00	.00	2.85	3.49
55	35	48	114.99	.01	.00	.00	.18	.01
56	36	37	1090.91	2.84	.00	.00	3.09	4.06
57	38	37	206.23	.06	.00	.00	.58	.19
58	34	38	367.73	.38	.00	.00	1.04	.54
59	37	39	615.78	1.83	.00	.00	1.75	1.41
60	32	39	602.24	1.18	.00	.00	1.71	1.35
61	32	40	434.13	.84	.00	.00	1.23	.74
62	40	41	283.63	.39	.00	.00	.80	.33
63	39	41	84.87	.05	.00	.00	.24	.04
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	681.35	1.70	.00	.00	1.93	1.70
68	54	53	525.85	1.08	.00	.00	1.49	1.05
69	39	53	591.16	.95	.00	.00	1.68	1.31
70	53	52	1071.51	3.16	.00	.00	3.04	3.93
71	52	51	967.51	1.30	.00	.00	2.74	3.25
72	51	50	850.01	1.48	.00	.00	2.41	2.56
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	7239.08	.07	.00	.00	2.28	.47
75	48	36	1850.15	.38	.00	.00	2.95	2.26
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	-588.01	1.31	.00	.00	1.67	1.29
80	56	55	1573.99	8.00	.00	.00	4.46	8.00
81	57	56	1636.49	4.00	.00	.00	4.64	8.60
82	36	57	759.24	.87	.00	.00	1.21	.44
83	71	77	6752.43	.83	.00	.00	2.13	.41
84	77	57	912.39	.44	.00	.00	2.59	2.92
85	26	58	907.17	1.04	.00	.00	2.57	2.88
86	58	59	698.42	1.12	.00	.00	1.98	1.78
87	58	60	208.76	.89	.00	.00	1.33	1.37
88	60	61	109.26	.27	.00	.00	.70	.41
89	59	61	119.74	.04	.00	.00	.34	.07
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	578.67	.39	.00	.00	1.64	1.25
93	64	65	488.67	.39	.00	.00	1.39	.92
94	65	66	321.67	.14	.00	.00	.91	.42
95	66	67	56.67	.01	.00	.00	.16	.02
96	68	67	-3.67	.00	.00	.00	.01	.00
97	69	68	49.33	.00	.00	.00	.14	.01
98	70	69	102.33	.02	.00	.00	.29	.05
99	71	70	486.65	1.20	.00	.00	1.38	.91
100	79	48	1735.15	.08	.00	.00	2.77	2.01
101	70	72	384.32	.24	.00	.00	1.09	.59
102	72	73	225.82	.09	.00	.00	.64	.22
103	73	74	81.82	.03	.00	.00	.23	.03
104	75	74	154.18	.05	.00	.00	.44	.11
105	76	75	289.68	.28	.00	.00	.82	.35
106	77	76	375.68	.39	.00	.00	1.07	.56
107	77	78	5448.86	.44	.00	.00	1.72	.28

108	57	78	35.14	.00	.00	.00	.06	.00
109-XX	71	36						

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.84	120.00	38.84	16.83
2		.00	157.48	75.00	82.48	35.74
3		.00	156.83	77.00	79.83	34.59
4		468.50	155.34	50.00	105.34	45.65
5		93.50	153.60	85.00	68.60	29.73
6		.00	151.20	95.00	56.20	24.35
7		.00	148.35	98.00	50.35	21.82
8		.00	226.42	98.00	128.42	55.65
9		.00	225.89	102.00	123.89	53.68
10		20833.00	219.49	175.00	44.49	19.28
11		.00	213.58	55.00	158.58	68.72
12		235.50	211.40	25.00	186.40	80.77
13		156.00	211.33	45.00	166.33	72.08
14		.00	210.43	45.00	165.43	71.68
15		125.00	210.20	45.00	165.20	71.59
16		156.00	210.77	45.00	165.77	71.83
17		62.50	211.20	45.00	166.20	72.02
18		234.50	210.25	20.00	190.25	82.44
19		234.50	210.08	30.00	180.08	78.03
20		121.50	210.01	38.00	172.01	74.54
21		71.50	209.77	37.00	172.77	74.87
22		71.50	209.57	36.00	173.57	75.21
23		72.00	209.36	35.00	174.36	75.56
24		.00	208.98	34.00	174.98	75.83
25		.00	208.08	33.00	175.08	75.87
26		.00	207.72	28.00	179.72	77.88
27		.00	207.65	28.00	179.65	77.85
28		.00	207.65	27.00	180.65	78.28
29		99.50	208.89	35.00	173.89	75.35
30		186.50	206.41	36.00	170.41	73.85
31		214.50	204.18	37.00	167.18	72.44
32		.00	201.97	34.00	167.97	72.79
33		99.00	202.42	33.00	169.42	73.41
34		91.50	203.07	31.00	172.07	74.56
35		.00	205.86	34.00	171.86	74.47
36		.00	205.47	34.00	171.47	74.30
37		.00	202.62	34.00	168.62	73.07
38		161.50	202.69	33.00	169.69	73.53
39		.00	200.80	33.00	167.80	72.71
40		150.50	201.13	33.00	168.13	72.86
41		.00	200.75	34.00	166.75	72.26
42		21.00	199.15	34.00	165.15	71.57
43		50.50	200.64	34.00	166.64	72.21
44		521.00	199.03	33.00	166.03	71.94
45		109.50	200.07	30.00	170.07	73.70
46		109.50	199.81	28.00	171.81	74.45
47		99.00	199.33	25.00	174.33	75.54
48		.00	205.85	35.00	170.85	74.04
49		193.00	193.74	25.00	168.74	73.12
50		69.00	193.90	26.00	167.90	72.76
51		117.50	195.38	27.00	168.38	72.97
52		104.00	196.68	28.00	168.68	73.10
53		45.50	199.84	29.00	170.84	74.03
54		155.50	200.93	31.00	169.93	73.63
55		2162.00	192.59	27.00	165.59	71.76

56	62.50	200.60	27.00	173.60	75.22
57	.00	204.60	28.00	176.60	76.53
58	.00	206.68	32.00	174.68	75.69
59	.00	205.56	31.00	174.56	75.64
60	99.50	205.79	31.00	174.79	75.74
61	4.00	205.52	31.00	174.52	75.63
62	63.50	205.36	32.00	173.36	75.12
63	161.50	205.25	38.00	167.25	72.48
64	90.00	205.17	30.00	175.17	75.91
65	167.00	204.78	30.00	174.78	75.74
66	265.00	204.65	30.00	174.65	75.68
67	53.00	204.64	30.00	174.64	75.68
68	53.00	204.64	30.00	174.64	75.68
69	53.00	204.64	30.00	174.64	75.68
70	.00	204.66	32.00	172.66	74.82
71	.00	205.86	34.00	171.86	74.47
72	158.50	204.42	32.00	172.42	74.71
73	144.00	204.33	31.00	173.33	75.11
74	236.00	204.31	30.00	174.31	75.53
75	135.50	204.36	30.00	174.36	75.55
76	86.00	204.64	29.00	175.64	76.11
77	15.50	205.03	28.00	177.03	76.71
78	5484.00	204.59	20.00	184.59	79.99
79	.00	205.93	35.00	170.93	74.07

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8536.80
6	12285.83
23	14204.36

NET SYSTEM INFLOW = 35027.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 35027.00

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
10	20833.00
76	1586.00

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00115

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8534.49	.02	148.97	.00	2.69	.64
2	1	2	7931.41	1.35	.00	.00	3.60	1.35
3	1	2	603.09	1.35	.00	.00	1.71	1.35
4	2	3	5271.02	.65	.00	.00	1.66	.26
5	2	3	3263.48	.65	.00	.00	1.48	.26
6-FG	0	3	12274.90	66.06	.00	.00	12.53	25.41
7	3	4	11459.46	1.49	.00	.00	3.61	1.10
8	3	4	7094.96	1.49	.00	.00	3.22	1.10
9	3	4	2254.97	1.49	.00	.00	2.30	1.10
10	4	5	11201.46	1.74	.00	.00	3.53	1.06
11	4	5	6935.23	1.74	.00	.00	3.15	1.06
12	4	5	2204.20	1.74	.00	.00	2.25	1.06
13	5	6	12505.06	2.40	.00	.00	3.94	1.30
14	5	6	7742.33	2.40	.00	.00	3.51	1.30
15	6	7	20247.39	2.84	.00	.00	9.19	7.68
16-PU	7	8	6749.13	.02	78.19	.00	3.06	1.00
17-PU	7	8	6749.13	.02	78.19	.00	3.06	1.00
18-PU	7	8	6749.13	.02	78.19	.00	3.06	1.00
19-XXCV	7	8						
20	8	9	20247.39	.54	.00	.00	9.19	7.68
21	9	10	10123.70	6.39	.00	.00	4.59	2.13
22	9	10	10123.70	6.39	.00	.00	4.59	2.13
23-FG	0	10	13717.61	3.29	.00	.00	3.18	.73
24	10	11	13132.00	5.52	.00	.00	3.04	.67
25-XXCV	5	12						
26	11	12	1245.50	2.07	.00	.00	1.99	1.09
27	11	13	11886.50	2.09	.00	.00	2.75	.56
28	12	14	639.08	.90	.00	.00	1.02	.32
29	14	15	639.08	.21	.00	.00	1.02	.32
30	16	15	739.86	.54	.00	.00	1.18	.41
31	17	16	895.86	.41	.00	.00	1.43	.59
32	13	17	958.36	.13	.00	.00	1.53	.67
33	12	18	370.93	1.10	.00	.00	1.05	.55
34	18	19	136.43	.16	.00	.00	.39	.09
35	15	19	98.07	.15	.00	.00	.28	.05
36	13	20	10772.13	1.23	.00	.00	3.40	.98
37	20	21	10650.63	.22	.00	.00	3.36	.96
38	21	22	10579.13	.19	.00	.00	3.33	.95
39	22	23	10507.63	.19	.00	.00	3.31	.94
40	23	24	10435.63	.35	.00	.00	3.29	.93
41	15	28	1155.87	2.35	.00	.00	1.84	.95
42	24	25	9499.58	.86	.00	.00	2.99	.78
43	25	26	9499.58	.34	.00	.00	4.31	1.89
44	26	27	8441.18	.06	.00	.00	2.66	.63
45	28	27	124.45	.00	.00	.00	.20	.02
46	28	35	1031.42	1.53	.00	.00	1.65	.77
47	27	79	8565.63	1.57	.00	.00	2.70	.64
48	24	29	936.06	.07	.00	.00	1.49	.64
49	29	30	836.56	1.81	.00	.00	2.37	2.48
50	30	31	650.06	1.51	.00	.00	1.84	1.56
51	31	32	435.56	1.26	.00	.00	1.24	.74
52	33	32	266.63	.17	.00	.00	.76	.30
53	34	33	365.63	.31	.00	.00	1.04	.54

54	35	34	687.21	1.38	.00	.00	1.95	1.72
55	35	48	344.21	.07	.00	.00	.55	.10
56	36	37	700.32	1.25	.00	.00	1.99	1.79
57	38	37	68.57	.01	.00	.00	.19	.02
58	34	38	230.07	.16	.00	.00	.65	.23
59	37	39	390.57	.79	.00	.00	1.11	.61
60	32	39	368.78	.47	.00	.00	1.05	.54
61	32	40	333.41	.52	.00	.00	.95	.45
62	40	41	182.91	.17	.00	.00	.52	.15
63	39	41	185.59	.21	.00	.00	.53	.15
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	378.32	.57	.00	.00	1.07	.57
68	54	53	222.82	.22	.00	.00	.63	.21
69	39	53	31.76	.00	.00	.00	.09	.01
70	53	52	209.08	.15	.00	.00	.59	.19
71	52	51	105.08	.02	.00	.00	.30	.05
72	51	50	-12.42	.00	.00	.00	.04	.00
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	7529.71	.08	.00	.00	2.37	.51
75	48	36	1380.13	.22	.00	.00	2.20	1.32
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	274.42	.32	.00	.00	.78	.32
80	56	55	436.42	.74	.00	.00	1.24	.74
81	57	56	498.92	.44	.00	.00	1.42	.95
82	36	57	679.82	.71	.00	.00	1.08	.35
83	71	77	6752.82	.83	.00	.00	2.13	.41
84	77	57	319.82	.06	.00	.00	.91	.42
85	26	58	1058.40	1.38	.00	.00	3.00	3.84
86	58	59	821.41	1.51	.00	.00	2.33	2.40
87	58	60	236.99	1.12	.00	.00	1.51	1.73
88	60	61	137.49	.41	.00	.00	.88	.63
89	59	61	91.51	.02	.00	.00	.26	.04
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	729.90	.60	.00	.00	2.07	1.93
93	64	65	639.90	.63	.00	.00	1.82	1.51
94	65	66	472.90	.28	.00	.00	1.34	.86
95	66	67	207.90	.11	.00	.00	.59	.19
96	68	67	-154.90	.04	.00	.00	.44	.11
97	69	68	-101.90	.01	.00	.00	.29	.05
98	70	69	-48.90	.00	.00	.00	.14	.01
99	71	70	776.89	2.86	.00	.00	2.20	2.16
100	79	48	1035.92	.03	.00	.00	1.65	.77
101	70	72	825.79	.99	.00	.00	2.34	2.42
102	72	73	667.29	.64	.00	.00	1.89	1.63
103	73	74	523.29	.81	.00	.00	1.48	1.04
104	75	74	-287.29	.16	.00	.00	.81	.34
105	76	75	-151.79	.09	.00	.00	.43	.11
106	77	76	1434.21	4.72	.00	.00	4.07	6.74
107	77	78	4983.29	.37	.00	.00	1.57	.24
108	57	78	500.71	.32	.00	.00	.80	.20
109-XX	71	36						

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.95	120.00	38.95	16.88

2		.00	157.59	75.00	82.59	35.79
3		.00	156.94	77.00	79.94	34.64
4		468.50	155.45	50.00	105.45	45.70
5		93.50	153.71	85.00	68.71	29.77
6		.00	151.31	95.00	56.31	24.40
7		.00	148.47	98.00	50.47	21.87
8		.00	226.64	98.00	128.64	55.74
9		.00	226.10	102.00	124.10	53.78
10		20833.00	219.71	175.00	44.71	19.38
11		.00	214.19	55.00	159.19	68.98
12		235.50	212.12	25.00	187.12	81.09
13		156.00	212.10	45.00	167.10	72.41
14		.00	211.22	45.00	166.22	72.03
15		125.00	211.02	45.00	166.02	71.94
16		156.00	211.56	45.00	166.56	72.17
17		62.50	211.97	45.00	166.97	72.35
18		234.50	211.02	20.00	191.02	82.78
19		234.50	210.87	30.00	180.87	78.38
20		121.50	210.87	38.00	172.87	74.91
21		71.50	210.65	37.00	173.65	75.25
22		71.50	210.46	36.00	174.46	75.60
23		72.00	210.28	35.00	175.28	75.95
24		.00	209.92	34.00	175.92	76.23
25		.00	209.07	33.00	176.07	76.30
26		.00	208.73	28.00	180.73	78.32
27		.00	208.66	28.00	180.66	78.29
28		.00	208.67	27.00	181.67	78.72
29		99.50	209.85	35.00	174.85	75.77
30		186.50	208.04	36.00	172.04	74.55
31		214.50	206.53	37.00	169.53	73.46
32		.00	205.27	34.00	171.27	74.22
33		99.00	205.44	33.00	172.44	74.72
34		91.50	205.75	31.00	174.75	75.73
35		.00	207.13	34.00	173.13	75.02
36		.00	206.84	34.00	172.84	74.90
37		.00	205.58	34.00	171.58	74.35
38		161.50	205.59	33.00	172.59	74.79
39		.00	204.80	33.00	171.80	74.45
40		150.50	204.76	33.00	171.76	74.43
41		.00	204.58	34.00	170.58	73.92
42		21.00	203.15	34.00	169.15	73.30
43		50.50	204.48	34.00	170.48	73.88
44		521.00	203.03	33.00	170.03	73.68
45		109.50	203.91	30.00	173.91	75.36
46		109.50	203.64	28.00	175.64	76.11
47		99.00	203.17	25.00	178.17	77.21
48		.00	207.06	35.00	172.06	74.56
49		193.00	204.46	25.00	179.46	77.77
50		69.00	204.62	26.00	178.62	77.40
51		117.50	204.62	27.00	177.62	76.97
52		104.00	204.64	28.00	176.64	76.54
53		45.50	204.79	29.00	175.79	76.18
54		155.50	205.01	31.00	174.01	75.41
55		162.00	204.94	27.00	177.94	77.11
56		62.50	205.68	27.00	178.68	77.43
57		.00	206.13	28.00	178.13	77.19
58		.00	207.35	32.00	175.35	75.98
59		.00	205.83	31.00	174.83	75.76
60		99.50	206.22	31.00	175.22	75.93
61		4.00	205.81	31.00	174.81	75.75
62		63.50	205.65	32.00	173.65	75.25
63		161.50	205.54	38.00	167.54	72.60
64		90.00	205.24	30.00	175.24	75.94
65		167.00	204.60	30.00	174.60	75.66
66		265.00	204.32	30.00	174.32	75.54
67		53.00	204.22	30.00	174.22	75.49

68	53.00	204.17	30.00	174.17	75.47
69	53.00	204.16	30.00	174.16	75.47
70	.00	204.16	32.00	172.16	74.60
71	.00	207.01	34.00	173.01	74.97
72	158.50	203.16	32.00	171.16	74.17
73	144.00	202.53	31.00	171.53	74.33
74	236.00	201.71	30.00	171.71	74.41
75	135.50	201.55	30.00	171.55	74.34
76	1586.00	201.47	29.00	172.47	74.74
77	15.50	206.19	28.00	178.19	77.21
78	5484.00	205.81	20.00	185.81	80.52
79	.00	207.09	35.00	172.09	74.57

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8534.49
6	12274.90
23	13717.61

NET SYSTEM INFLOW = 34527.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 34527.00

**** KYPIPE SIMULATION COMPLETED ****

DATE: 8/ 2/2000
TIME: 8:21:34

Appendix B

Analysis of the
Fort Weaver Corridor With the
16-Inch Fort Weaver Main
Converted to Non-Potable Use

File: CONVERT

```
* * * * * * * * * *   K Y P I P E 2   * * * * * * * * * *
*   University of Kentucky Hydraulic Analysis Program   *
* Distribution of Pressure and Flows in Piping Networks *
*         1000 PIPE VERSION - 1.10    (08/25/92)        *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

DATE: 9/ 1/2000
TIME: 17:55:31

INPUT DATA FILENAME -------------- CONVERT.DAT
TABULATED OUTPUT FILENAME -------- CONVERT.OUT
POSTPROCESSOR RESULTS FILENAME --- CONVERT.RES

S U M M A R Y   O F   O R I G I N A L   D A T A

U N I T S   S P E C I F I E D

FLOWRATE .... = gallons/minute
HEAD (HGL) .... = feet
PRESSURE .... = psig

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	FGN-HGL (ft)
1-FGPU	0	1	30.0	36.0	130.00	.00	10.00
2	1	2	1000.0	30.0	130.00	.00	
3	1	2	1000.0	12.0	110.00	.00	
4	2	3	2500.0	36.0	130.00	.00	
5	2	3	2500.0	30.0	130.00	.00	
6-FG	0	3	2600.0	20.0	120.00	.00	223.00
7	3	4	1350.0	36.0	130.00	.00	
8	3	4	1350.0	30.0	130.00	.00	
9	3	4	1350.0	20.0	120.00	.00	
10	4	5	1650.0	36.0	130.00	.00	
11	4	5	1650.0	30.0	130.00	.00	
12	4	5	1650.0	20.0	120.00	.00	
13	5	6	1850.0	36.0	130.00	.00	
14	5	6	1850.0	30.0	130.00	.00	
15	6	7	370.0	30.0	130.00	.00	
16-PU	7	8	20.0	30.0	130.00	.00	
17-PU	7	8	20.0	30.0	130.00	.00	
18-PU	7	8	20.0	30.0	130.00	.00	
19-CV	7	8	20.0	30.0	130.00	.00	
20	8	9	70.0	30.0	130.00	.00	
21	9	10	3000.0	30.0	130.00	.00	
22	9	10	3000.0	30.0	130.00	.00	
23-FG	0	10	4530.0	42.0	130.00	.00	223.00
24	10	11	8250.0	42.0	130.00	.00	
25-CV	5	12	7150.0	16.0	120.00	.00	
26	11	12	1900.0	16.0	120.00	.00	

27	11	13	3750.0	42.0	130.00	.00
28	12	14	2850.0	16.0	120.00	.00
29-XX	14	15	650.0	16.0	120.00	.00
30	16	15	1300.0	16.0	120.00	.00
31	17	16	700.0	16.0	120.00	.00
32	13	17	200.0	16.0	120.00	.00
33	12	18	2000.0	12.0	110.00	.00
34	18	19	1800.0	12.0	110.00	.00
35	15	19	3200.0	12.0	110.00	.00
36	13	20	1250.0	36.0	130.00	.00
37	20	21	230.0	36.0	130.00	.00
38	21	22	200.0	36.0	130.00	.00
39	22	23	200.0	36.0	130.00	.00
40	23	24	380.0	36.0	130.00	.00
41-XX	15	28	2480.0	16.0	120.00	.00
42	24	25	1100.0	36.0	130.00	.00
43	25	26	180.0	30.0	130.00	.00
44	26	27	100.0	36.0	130.00	.00
45	28	27	150.0	16.0	120.00	.00
46-XX	28	35	2000.0	16.0	120.00	.00
47	27	79	2450.0	36.0	130.00	.00
48	24	29	110.0	16.0	120.00	.00
49	29	30	730.0	12.0	110.00	.00
50	30	31	970.0	12.0	110.00	.00
51	31	32	1700.0	12.0	110.00	.00
52	33	32	570.0	12.0	110.00	.00
53	34	33	580.0	12.0	110.00	.00
54	35	34	800.0	12.0	110.00	.00
55-XX	35	48	730.0	16.0	120.00	.00
56	36	37	700.0	12.0	110.00	.00
57	38	37	350.0	12.0	110.00	.00
58	34	38	700.0	12.0	110.00	.00
59	37	39	1300.0	12.0	110.00	.00
60	22	39	870.0	12.0	110.00	.00
61	32	40	1140.0	12.0	110.00	.00
62	40	41	1150.0	12.0	110.00	.00
63	39	41	1390.0	12.0	110.00	.00
64	39	42	1480.0	12.0	110.00	.00
65	42	44	122.0	12.0	110.00	.00
66	41	43	890.0	16.0	120.00	.00
67	37	54	1000.0	12.0	110.00	.00
68	54	53	1030.0	12.0	110.00	.00
69	39	53	730.0	12.0	110.00	.00
70	53	52	805.0	12.0	110.00	.00
71	52	51	400.0	12.0	110.00	.00
72	51	50	580.0	12.0	110.00	.00
73	50	49	965.0	12.0	110.00	.00
74	79	71	150.0	36.0	130.00	.00
75-XX	48	36	170.0	16.0	120.00	.00
76	47	46	1390.0	8.0	110.00	.00
77	45	46	1390.0	12.0	110.00	.00
78	43	45	1390.0	12.0	110.00	.00
79	55	50	1015.0	12.0	110.00	.00
80	56	55	1000.0	12.0	110.00	.00
81	57	56	465.0	12.0	110.00	.00
82-XX	36	57	2000.0	16.0	120.00	.00
83	71	77	2000.0	36.0	130.00	.00
84	77	57	150.0	12.0	110.00	.00
85	26	58	360.0	12.0	110.00	.00
86	58	59	630.0	12.0	110.00	.00
87	58	60	650.0	8.0	110.00	.00
88	60	61	650.0	8.0	110.00	.00
89	59	61	550.0	12.0	110.00	.00
90	61	62	720.0	12.0	110.00	.00
91	62	63	950.0	12.0	110.00	.00
92	59	64	310.0	12.0	110.00	.00

93	64	65	420.0	12.0	110.00	.00
94	65	66	320.0	12.0	110.00	.00
95	66	67	570.0	12.0	110.00	.00
96	68	67	400.0	12.0	110.00	.00
97	69	68	250.0	12.0	110.00	.00
98	70	69	330.0	12.0	110.00	.00
99	71	70	1320.0	12.0	110.00	.00
100	79	48	40.0	16.0	120.00	.00
101	70	72	410.0	12.0	110.00	.00
102	72	73	390.0	12.0	110.00	.00
103	73	74	780.0	12.0	110.00	.00
104	75	74	465.0	12.0	110.00	.00
105	76	75	810.0	12.0	110.00	.00
106	77	76	700.0	12.0	110.00	.00
107	77	78	1580.0	36.0	130.00	.00
108-XX	57	78	1580.0	16.0	120.00	.00
109	71	36	210.0	12.0	110.00	.00

P U M P   D A T A

THERE IS A PUMP IN LINE 1 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
415.00	.00
230.00	6700.00
105.00	9450.00

THERE IS A PUMP IN LINE 16 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 17 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 18 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

J U N C T I O N   N O D E   D A T A

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	CONNECTING PIPES					
1		.00	120.00	1	2	3			
2		.00	75.00	2	3	4	5		
3		.00	77.00	4	5	6	7	8	9

4		937.00	50.00	7	8	9	10	11	12
5		187.00	85.00	10	11	12	13	14	25
6		.00	95.00	13	14	15			
7		.00	98.00	15	16	17	18	19	
8		.00	98.00	16	17	18	19	20	
9		.00	102.00	20	21	22			
10		20830.00	175.00	21	22	23	24		
11		.00	55.00	24	26	27			
12		471.00	25.00	25	26	28	33		
13		312.00	45.00	27	32	36			
14		.00	45.00	28	29				
15		250.00	45.00	29	30	35	41		
16		312.00	45.00	30	31				
17		125.00	45.00	31	32				
18		469.00	20.00	33	34				
19		469.00	30.00	34	35				
20		243.00	38.00	36	37				
21		143.00	37.00	37	38				
22		143.00	36.00	38	39				
23		144.00	35.00	39	40				
24		.00	34.00	40	42	48			
25		.00	33.00	42	43				
26		.00	28.00	43	44	85			
27		.00	28.00	44	45	47			
28		.00	27.00	41	45	46			
29		199.00	35.00	48	49				
30		373.00	36.00	49	50				
31		429.00	37.00	50	51				
32		.00	34.00	51	52	60	61		
33		198.00	33.00	52	53				
34		183.00	31.00	53	54	58			
35		.00	34.00	46	54	55			
36		.00	34.00	56	75	82	109		
37		.00	34.00	56	57	59	67		
38		323.00	33.00	57	58				
39		.00	33.00	59	60	63	64	69	
40		301.00	33.00	61	62				
41		.00	34.00	62	63	66			
42		42.00	34.00	64	65				
43		101.00	34.00	66	78				
44		1042.00	33.00	65					
45		219.00	30.00	77	78				
46		219.00	28.00	76	77				
47		198.00	25.00	76					
48		.00	35.00	55	75	100			
49		386.00	25.00	73					
50		138.00	26.00	72	73	79			
51		235.00	27.00	71	72				
52		208.00	28.00	70	71				
53		91.00	29.00	68	69	70			
54		311.00	31.00	67	68				
55		324.00	27.00	79	80				
56		125.00	27.00	80	81				
57		.00	28.00	81	82	84	108		
58		.00	32.00	85	86	87			
59		.00	31.00	86	89	92			
60		199.00	31.00	87	88				
61		8.00	31.00	88	89	90			
62		127.00	32.00	90	91				
63		323.00	38.00	91					
64		180.00	30.00	92	93				
65		334.00	30.00	93	94				
66		530.00	30.00	94	95				

67	106.00	30.00	95	96		
68	106.00	30.00	96	97		
69	106.00	30.00	97	98		
70	.00	32.00	98	99	101	
71	.00	34.00	74	83	99	109
72	317.00	32.00	101	102		
73	288.00	31.00	102	103		
74	472.00	30.00	103	104		
75	271.00	30.00	104	105		
76	172.00	29.00	105	106		
77	31.00	28.00	83	84	106	107
78	10968.00	20.00	107	108		
79	.00	35.00	47	74	100	

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

NUMBER OF PIPES ....(p) = 109
NUMBER OF JUNCTION NODES ....(j) = 79
NUMBER OF PRIMARY LOOPS ....(l) = 28
NUMBER OF FIXED GRADE NODES ....(f) = 3
NUMBER OF SUPPLY ZONES ....(z) = 1

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 4 TRIALS WITH AN ACCURACY = .00275

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8644.55	.02	143.80	.00	2.72	.65
2	1	2	8033.68	1.39	.00	.00	3.65	1.39
3	1	2	610.86	1.39	.00	.00	1.73	1.39
4	2	3	5338.99	.67	.00	.00	1.68	.27
5	2	3	3305.56	.67	.00	.00	1.50	.27
6-FG	0	3	12789.09	71.28	.00	.00	13.06	27.41
7	3	4	11803.25	1.57	.00	.00	3.72	1.16
8	3	4	7307.78	1.57	.00	.00	3.32	1.16
9	3	4	2322.61	1.57	.00	.00	2.37	1.16
10	4	5	11287.26	1.77	.00	.00	3.56	1.07
11	4	5	6988.30	1.77	.00	.00	3.17	1.07
12	4	5	2221.08	1.77	.00	.00	2.27	1.07
13	5	6	12543.58	2.41	.00	.00	3.95	1.30
14	5	6	7766.06	2.41	.00	.00	3.52	1.30
15	6	7	20309.63	2.86	.00	.00	9.22	7.73
16-PU	7	8	6769.88	.02	77.75	.00	3.07	1.01
17-PU	7	8	6769.88	.02	77.75	.00	3.07	1.01

18-PU	7	8	6769.88	.02	77.75	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20309.63	.54	.00	.00	9.22	7.73
21	9	10	10154.82	6.42	.00	.00	4.61	2.14
22	9	10	10154.82	6.42	.00	.00	4.61	2.14
23-FG	0	10	23784.37	9.11	.00	.00	5.51	2.01
24	10	11	23264.00	15.92	.00	.00	5.39	1.93
25-XXCV	5	12						
26	11	12	1262.83	2.12	.00	.00	2.01	1.12
27	11	13	22001.17	6.53	.00	.00	5.09	1.74
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	396.17	.17	.00	.00	.63	.13
31	17	16	708.17	.27	.00	.00	1.13	.38
32	13	17	833.17	.10	.00	.00	1.33	.52
33	12	18	791.83	4.49	.00	.00	2.25	2.24
34	18	19	322.83	.77	.00	.00	.92	.43
35	15	19	146.17	.31	.00	.00	.41	.10
36	13	20	20856.00	4.18	.00	.00	6.57	3.34
37	20	21	20613.00	.75	.00	.00	6.50	3.27
38	21	22	20470.00	.65	.00	.00	6.45	3.23
39	22	23	20327.00	.64	.00	.00	6.41	3.18
40	23	24	20183.00	1.19	.00	.00	6.36	3.14
41-XX	15	28						
42	24	25	18049.86	2.81	.00	.00	5.69	2.56
43	25	26	18049.86	1.12	.00	.00	8.19	6.21
44	26	27	16286.64	.21	.00	.00	5.13	2.11
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	16286.64	5.18	.00	.00	5.13	2.11
48	24	29	2133.15	.32	.00	.00	3.40	2.95
49	29	30	1934.15	8.56	.00	.00	5.49	11.72
50	30	31	1561.15	7.65	.00	.00	4.43	7.88
51	31	32	1132.15	7.39	.00	.00	3.21	4.35
52	33	32	46.19	.01	.00	.00	.13	.01
53	34	33	244.19	.15	.00	.00	.69	.25
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	2145.12	9.94	.00	.00	6.08	14.20
57	38	37	-750.19	.71	.00	.00	2.13	2.03
58	34	38	-427.19	.50	.00	.00	1.21	.72
59	37	39	715.24	2.41	.00	.00	2.03	1.86
60	32	39	566.71	1.05	.00	.00	1.61	1.21
61	32	40	611.63	1.58	.00	.00	1.73	1.39
62	40	41	310.63	.46	.00	.00	.88	.40
63	39	41	426.37	.99	.00	.00	1.21	.71
64	39	42	1084.00	5.94	.00	.00	3.07	4.01
65	42	44	1042.00	.45	.00	.00	2.96	3.73
66	41	43	737.00	.37	.00	.00	1.18	.41
67	37	54	679.70	1.69	.00	.00	1.93	1.69
68	54	53	368.70	.56	.00	.00	1.05	.54
69	39	53	-228.43	.16	.00	.00	.65	.22
70	53	52	49.27	.01	.00	.00	.14	.01
71	52	51	-158.73	.05	.00	.00	.45	.11
72	51	50	-393.73	.36	.00	.00	1.12	.61
73	50	49	386.00	.57	.00	.00	1.09	.59
74	79	71	16286.64	.32	.00	.00	5.13	2.11
75-XX	48	36						
76	47	46	-198.00	1.72	.00	.00	1.26	1.24
77	45	46	417.00	.95	.00	.00	1.18	.68
78	43	45	636.00	2.08	.00	.00	1.80	1.49
79	55	50	917.73	2.99	.00	.00	2.60	2.95
80	56	55	1241.73	5.16	.00	.00	3.52	5.16
81	57	56	1366.73	2.87	.00	.00	3.88	6.16
82-XX	36	57						
83	71	77	13144.80	2.84	.00	.00	4.14	1.42

84	77	57	1366.73	.92	.00	.00	3.88	6.16
85	26	58	1763.22	3.56	.00	.00	5.00	9.88
86	58	59	1355.20	3.82	.00	.00	3.84	6.07
87	58	60	408.02	3.08	.00	.00	2.60	4.73
88	60	61	209.02	.89	.00	.00	1.33	1.37
89	59	61	248.98	.14	.00	.00	.71	.26
90	61	62	450.00	.57	.00	.00	1.28	.79
91	62	63	323.00	.40	.00	.00	.92	.43
92	59	64	1106.22	1.29	.00	.00	3.14	4.17
93	64	65	926.22	1.26	.00	.00	2.63	3.00
94	65	66	592.22	.42	.00	.00	1.68	1.31
95	66	67	62.22	.01	.00	.00	.18	.02
96	68	67	43.78	.00	.00	.00	.12	.01
97	69	68	149.78	.03	.00	.00	.42	.10
98	70	69	255.78	.09	.00	.00	.73	.28
99	71	70	996.72	4.53	.00	.00	2.83	3.43
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	740.93	.81	.00	.00	2.10	1.98
102	72	73	423.93	.27	.00	.00	1.20	.71
103	73	74	135.93	.07	.00	.00	.39	.09
104	75	74	336.07	.21	.00	.00	.95	.46
105	76	75	607.07	1.11	.00	.00	1.72	1.37
106	77	76	779.07	1.52	.00	.00	2.21	2.18
107	77	78	10968.00	1.61	.00	.00	3.46	1.02
108-XX	57	78						
109	71	36	2145.12	2.98	.00	.00	6.08	14.20

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	153.78	120.00	33.78	14.64
2		.00	152.39	75.00	77.39	33.54
3		.00	151.72	77.00	74.72	32.38
4		937.00	150.15	50.00	100.15	43.40
5		187.00	148.38	85.00	63.38	27.47
6		.00	145.97	95.00	50.97	22.09
7		.00	143.12	98.00	45.12	19.55
8		.00	220.85	98.00	122.85	53.24
9		.00	220.31	102.00	118.31	51.27
10		20830.00	213.89	175.00	38.89	16.85
11		.00	197.97	55.00	142.97	61.95
12		471.00	195.84	25.00	170.84	74.03
13		312.00	191.44	45.00	146.44	63.46
14		.00	195.84	45.00	150.84	65.37
15		250.00	190.90	45.00	145.90	63.22
16		312.00	191.07	45.00	146.07	63.30
17		125.00	191.33	45.00	146.33	63.41
18		469.00	191.36	20.00	171.36	74.26
19		469.00	190.59	30.00	160.59	69.59
20		243.00	187.26	38.00	149.26	64.68
21		143.00	186.51	37.00	149.51	64.79
22		143.00	185.87	36.00	149.87	64.94
23		144.00	185.23	35.00	150.23	65.10
24		.00	184.03	34.00	150.03	65.01
25		.00	181.22	33.00	148.22	64.23
26		.00	180.10	28.00	152.10	65.91
27		.00	179.89	28.00	151.89	65.82
28		.00	179.89	27.00	152.89	66.25
29		199.00	183.71	35.00	148.71	64.44
30		373.00	175.15	36.00	139.15	60.30
31		429.00	167.50	37.00	130.50	56.55

32		.00	160.11	34.00	126.11	54.65
33		198.00	160.11	33.00	127.11	55.08
34		183.00	160.26	31.00	129.26	56.01
35		.00	160.26	34.00	126.26	54.71
36		.00	171.41	34.00	137.41	59.54
37		.00	161.47	34.00	127.47	55.24
38		323.00	160.76	33.00	127.76	55.36
39		.00	159.06	33.00	126.06	54.62
40		301.00	158.52	33.00	125.52	54.39
41		.00	158.06	34.00	124.06	53.76
42		42.00	153.12	34.00	119.12	51.62
43		101.00	157.70	34.00	123.70	53.60
44		1042.00	152.66	33.00	119.66	51.85
45		219.00	155.62	30.00	125.62	54.44
46		219.00	154.67	28.00	126.67	54.89
47		198.00	152.95	25.00	127.95	55.44
48		.00	174.71	35.00	139.71	60.54
49		386.00	159.04	25.00	134.04	58.08
50		138.00	159.61	26.00	133.61	57.90
51		235.00	159.25	27.00	132.25	57.31
52		208.00	159.21	28.00	131.21	56.86
53		91.00	159.22	29.00	130.22	56.43
54		311.00	159.78	31.00	128.78	55.80
55		324.00	162.60	27.00	135.60	58.76
56		125.00	167.76	27.00	140.76	61.00
57		.00	170.63	28.00	142.63	61.81
58		.00	176.54	32.00	144.54	62.64
59		.00	172.72	31.00	141.72	61.41
60		199.00	173.47	31.00	142.47	61.74
61		8.00	172.58	31.00	141.58	61.35
62		127.00	172.01	32.00	140.01	60.67
63		323.00	171.60	38.00	133.60	57.89
64		180.00	171.43	30.00	141.43	61.29
65		334.00	170.17	30.00	140.17	60.74
66		530.00	169.75	30.00	139.75	60.56
67		106.00	169.74	30.00	139.74	60.55
68		106.00	169.74	30.00	139.74	60.56
69		106.00	169.77	30.00	139.77	60.57
70		.00	169.86	32.00	137.86	59.74
71		.00	174.39	34.00	140.39	60.84
72		317.00	169.05	32.00	137.05	59.39
73		288.00	168.77	31.00	137.77	59.70
74		472.00	168.71	30.00	138.71	60.11
75		271.00	168.92	30.00	138.92	60.20
76		172.00	170.03	29.00	141.03	61.11
77		31.00	171.55	28.00	143.55	62.21
78		10968.00	169.95	20.00	149.95	64.98
79		.00	174.71	35.00	139.71	60.54

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8644.55
6	12789.09
23	23784.37

NET SYSTEM INFLOW = 45218.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 45218.00

DATA CHANGES FOR NEXT SIMULATION

DEMAND CHANGES

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
10	20833.00
43	4050.00

SIMULATION RESULTS

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00022

PIPELINE RESULTS

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8546.69	.02	148.40	.00	2.69	.64
2	1	2	7942.74	1.36	.00	.00	3.60	1.36
3	1	2	603.95	1.36	.00	.00	1.71	1.36
4	2	3	5278.55	.66	.00	.00	1.66	.26
5	2	3	3268.14	.66	.00	.00	1.48	.26
6-FG	0	3	12332.59	66.64	.00	.00	12.59	25.63
7	3	4	11497.95	1.50	.00	.00	3.62	1.11
8	3	4	7118.79	1.50	.00	.00	3.23	1.11
9	3	4	2262.54	1.50	.00	.00	2.31	1.11
10	4	5	11239.95	1.75	.00	.00	3.54	1.06
11	4	5	6959.06	1.75	.00	.00	3.16	1.06
12	4	5	2211.77	1.75	.00	.00	2.26	1.06
13	5	6	12548.23	2.41	.00	.00	3.95	1.30
14	5	6	7769.06	2.41	.00	.00	3.53	1.30
15	6	7	20317.29	2.86	.00	.00	9.22	7.73
16-PU	7	8	6772.43	.02	77.70	.00	3.07	1.01
17-PU	7	8	6772.43	.02	77.70	.00	3.07	1.01
18-PU	7	8	6772.43	.02	77.70	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20317.29	.54	.00	.00	9.22	7.73
21	9	10	10158.64	6.43	.00	.00	4.61	2.14
22	9	10	10158.64	6.43	.00	.00	4.61	2.14
23-FG	0	10	16147.21	4.45	.00	.00	3.74	.98
24	10	11	15631.50	7.63	.00	.00	3.62	.92
25-XXCV	5	12						
26	11	12	735.01	.78	.00	.00	1.17	.41
27	11	13	14896.49	3.17	.00	.00	3.45	.85
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						

30	16	15	94.49	.01	.00	.00	.15	.01
31	17	16	250.49	.04	.00	.00	.40	.06
32	13	17	312.99	.02	.00	.00	.50	.08
33	12	18	499.51	1.91	.00	.00	1.42	.96
34	18	19	265.01	.53	.00	.00	.75	.30
35	15	19	-30.51	.02	.00	.00	.09	.01
36	13	20	14427.50	2.11	.00	.00	4.55	1.69
37	20	21	14306.00	.38	.00	.00	4.51	1.66
38	21	22	14234.50	.33	.00	.00	4.49	1.65
39	22	23	14163.00	.33	.00	.00	4.46	1.63
40	23	24	14091.00	.61	.00	.00	4.44	1.62
41-XX	15	28						
42	24	25	11933.60	1.31	.00	.00	3.76	1.19
43	25	26	11933.60	.52	.00	.00	5.42	2.89
44	26	27	10948.05	.10	.00	.00	3.45	1.01
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	10948.05	2.48	.00	.00	3.45	1.01
48	24	29	2157.40	.33	.00	.00	3.44	3.01
49	29	30	2057.90	9.60	.00	.00	5.84	13.15
50	30	31	1871.40	10.70	.00	.00	5.31	11.03
51	31	32	1656.90	14.97	.00	.00	4.70	8.80
52	33	32	764.80	1.20	.00	.00	2.17	2.10
53	34	33	863.80	1.53	.00	.00	2.45	2.63
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	3036.81	18.92	.00	.00	8.61	27.04
57	38	37	-1116.80	1.48	.00	.00	3.17	4.24
58	34	38	-955.30	2.22	.00	.00	2.71	3.17
59	37	39	1271.65	7.01	.00	.00	3.61	5.39
60	32	39	410.22	.58	.00	.00	1.16	.66
61	32	40	2011.49	14.37	.00	.00	5.71	12.61
62	40	41	1860.99	12.55	.00	.00	5.28	10.92
63	39	41	2507.01	26.35	.00	.00	7.11	18.96
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	4368.00	9.89	.00	.00	6.97	11.11
67	37	54	648.36	1.55	.00	.00	1.84	1.55
68	54	53	492.86	.96	.00	.00	1.40	.93
69	39	53	-1367.15	4.50	.00	.00	3.88	6.17
70	53	52	-919.79	2.38	.00	.00	2.61	2.96
71	52	51	-1023.79	1.44	.00	.00	2.90	3.61
72	51	50	-1141.29	2.56	.00	.00	3.24	4.41
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	10948.05	.15	.00	.00	3.45	1.01
75-XX	48	36						
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	1403.29	6.57	.00	.00	3.98	6.47
80	56	55	1565.29	7.92	.00	.00	4.44	7.92
81	57	56	1627.79	3.96	.00	.00	4.62	8.52
82-XX	36	57						
83	71	77	7457.00	.99	.00	.00	2.35	.50
84	77	57	1627.79	1.28	.00	.00	4.62	8.52
85	26	58	985.55	1.21	.00	.00	2.80	3.36
86	58	59	762.19	1.32	.00	.00	2.16	2.09
87	58	60	223.36	1.01	.00	.00	1.43	1.55
88	60	61	123.86	.34	.00	.00	.79	.52
89	59	61	105.14	.03	.00	.00	.30	.05
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	657.05	.49	.00	.00	1.86	1.59
93	64	65	567.05	.51	.00	.00	1.61	1.21
94	65	66	400.05	.20	.00	.00	1.13	.63
95	66	67	135.05	.05	.00	.00	.38	.08

100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	430.29	.30	.00	.00	1.22	.72
102	72	73	271.79	.12	.00	.00	.77	.31
103	73	74	127.79	.06	.00	.00	.36	.08
104	75	74	108.21	.03	.00	.00	.31	.06
105	76	75	243.71	.20	.00	.00	.69	.25
106	77	76	329.71	.31	.00	.00	.94	.44
107	77	78	5484.00	.44	.00	.00	1.73	.28
108-XX	57	78						
109	71	36	3036.81	5.68	.00	.00	8.61	27.04

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.38	120.00	38.38	16.63
2		.00	157.02	75.00	82.02	35.54
3		.00	156.36	77.00	79.36	34.39
4		468.50	154.87	50.00	104.87	45.44
5		93.50	153.11	85.00	68.11	29.52
6		.00	150.70	95.00	55.70	24.14
7		.00	147.84	98.00	49.84	21.60
8		.00	225.52	98.00	127.52	55.26
9		.00	224.98	102.00	122.98	53.29
10		20833.00	218.55	175.00	43.55	18.87
11		.00	210.93	55.00	155.93	67.57
12		235.50	210.15	25.00	185.15	80.23
13		156.00	207.76	45.00	162.76	70.53
14		.00	210.15	45.00	165.15	71.56
15		125.00	207.69	45.00	162.69	70.50
16		156.00	207.70	45.00	162.70	70.50
17		62.50	207.74	45.00	162.74	70.52
18		234.50	208.24	20.00	188.24	81.57
19		234.50	207.71	30.00	177.71	77.01
20		121.50	205.65	38.00	167.65	72.65
21		71.50	205.27	37.00	168.27	72.92
22		71.50	204.94	36.00	168.94	73.21
23		72.00	204.61	35.00	169.61	73.50
24		.00	204.00	34.00	170.00	73.67
25		.00	202.69	33.00	169.69	73.53
26		.00	202.17	28.00	174.17	75.47
27		.00	202.07	28.00	174.07	75.43
28		.00	202.07	27.00	175.07	75.86
29		99.50	203.67	35.00	168.67	73.09
30		186.50	194.06	36.00	158.06	68.49
31		214.50	183.37	37.00	146.37	63.43
32		.00	168.40	34.00	134.40	58.24
33		99.00	169.60	33.00	136.60	59.19
34		91.50	171.13	31.00	140.13	60.72
35		.00	171.13	34.00	137.13	59.42
36		.00	193.76	34.00	159.76	69.23
37		.00	174.83	34.00	140.83	61.03
38		161.50	173.35	33.00	140.35	60.82
39		.00	167.82	33.00	134.82	58.42
40		150.50	154.03	33.00	121.03	52.45
41		.00	141.48	34.00	107.48	46.57
42		21.00	166.18	34.00	132.18	57.28
43		4050.00	131.59	34.00	97.59	42.29
44		521.00	166.05	33.00	133.05	57.66
45		109.50	131.01	30.00	101.01	43.77
46		109.50	130.75	28.00	102.75	44.52

47	99.00	130.27	25.00	105.27	45.62
48	.00	199.59	35.00	164.59	71.32
49	193.00	178.55	25.00	153.55	66.54
50	69.00	178.71	26.00	152.71	66.17
51	117.50	176.15	27.00	149.15	64.63
52	104.00	174.71	28.00	146.71	63.57
53	45.50	172.33	29.00	143.33	62.11
54	155.50	173.29	31.00	142.29	61.66
55	162.00	185.28	27.00	158.28	68.59
56	62.50	193.20	27.00	166.20	72.02
57	.00	197.16	28.00	169.16	73.30
58	.00	200.96	32.00	168.96	73.22
59	.00	199.64	31.00	168.64	73.08
60	99.50	199.95	31.00	168.95	73.21
61	4.00	199.61	31.00	168.61	73.07
62	63.50	199.46	32.00	167.46	72.56
63	161.50	199.34	38.00	161.34	69.92
64	90.00	199.15	30.00	169.15	73.30
65	167.00	198.64	30.00	168.64	73.08
66	265.00	198.44	30.00	168.44	72.99
67	53.00	198.39	30.00	168.39	72.97
68	53.00	198.38	30.00	168.38	72.96
69	53.00	198.38	30.00	168.38	72.96
70	.00	198.38	32.00	166.38	72.10
71	.00	199.44	34.00	165.44	71.69
72	158.50	198.08	32.00	166.08	71.97
73	144.00	197.96	31.00	166.96	72.35
74	236.00	197.90	30.00	167.90	72.76
75	135.50	197.93	30.00	167.93	72.77
76	86.00	198.13	29.00	169.13	73.29
77	15.50	198.44	28.00	170.44	73.86
78	5484.00	198.00	20.00	178.00	77.13
79	.00	199.59	35.00	164.59	71.32

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8546.69
6	12332.59
23	16147.21

NET SYSTEM INFLOW = 37026.50
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 37026.50

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)

55	2162.00
10	20833.00

****

S I M U L A T I O N   R E S U L T S

****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00168

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8536.80	.02	148.86	.00	2.69	.64
2	1	2	7933.55	1.36	.00	.00	3.60	1.36
3	1	2	603.25	1.36	.00	.00	1.71	1.36
4	2	3	5272.45	.65	.00	.00	1.66	.26
5	2	3	3264.36	.65	.00	.00	1.48	.26
6-FG	0	3	12285.84	66.17	.00	.00	12.55	25.45
7	3	4	11466.76	1.49	.00	.00	3.61	1.10
8	3	4	7099.48	1.49	.00	.00	3.22	1.10
9	3	4	2256.40	1.49	.00	.00	2.30	1.10
10	4	5	11208.76	1.75	.00	.00	3.53	1.06
11	4	5	6939.74	1.75	.00	.00	3.15	1.06
12	4	5	2205.63	1.75	.00	.00	2.25	1.06
13	5	6	12513.25	2.40	.00	.00	3.94	1.30
14	5	6	7747.40	2.40	.00	.00	3.52	1.30
15	6	7	20260.64	2.85	.00	.00	9.20	7.69
16-PU	7	8	6753.55	.02	78.09	.00	3.07	1.01
17-PU	7	8	6753.55	.02	78.09	.00	3.07	1.01
18-PU	7	8	6753.55	.02	78.09	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20260.64	.54	.00	.00	9.20	7.69
21	9	10	10130.32	6.39	.00	.00	4.60	2.13
22	9	10	10130.32	6.39	.00	.00	4.60	2.13
23-FG	0	10	14204.35	3.51	.00	.00	3.29	.77
24	10	11	13632.00	5.92	.00	.00	3.16	.72
25-XXCV	5	12						
26	11	12	680.48	.67	.00	.00	1.09	.36
27	11	13	12951.52	2.45	.00	.00	3.00	.65
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	149.02	.03	.00	.00	.24	.02
31	17	16	305.02	.06	.00	.00	.49	.08
32	13	17	367.52	.02	.00	.00	.59	.11
33	12	18	444.98	1.54	.00	.00	1.26	.77
34	18	19	210.48	.35	.00	.00	.60	.19
35	15	19	24.02	.01	.00	.00	.07	.00
36	13	20	12428.00	1.60	.00	.00	3.92	1.28
37	20	21	12306.50	.29	.00	.00	3.88	1.26
38	21	22	12235.00	.25	.00	.00	3.86	1.24
39	22	23	12163.50	.25	.00	.00	3.83	1.23
40	23	24	12091.50	.46	.00	.00	3.81	1.22
41-XX	15	28						
42	24	25	10714.04	1.07	.00	.00	3.38	.97
43	25	26	10714.04	.43	.00	.00	4.86	2.36
44	26	27	9769.58	.08	.00	.00	3.08	.82

45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	9769.58	2.01	.00	.00	3.08	.82
48	24	29	1377.46	.14	.00	.00	2.20	1.31
49	29	30	1277.96	3.97	.00	.00	3.63	5.44
50	30	31	1091.46	3.94	.00	.00	3.10	4.06
51	31	32	876.96	4.61	.00	.00	2.49	2.71
52	33	32	102.82	.03	.00	.00	.29	.05
53	34	33	201.82	.10	.00	.00	.57	.18
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	1688.04	6.38	.00	.00	4.79	9.11
57	38	37	-454.82	.28	.00	.00	1.29	.80
58	34	38	-293.32	.25	.00	.00	.83	.36
59	37	39	594.10	1.71	.00	.00	1.69	1.32
60	32	39	564.32	1.04	.00	.00	1.60	1.20
61	32	40	415.46	.77	.00	.00	1.18	.68
62	40	41	264.96	.34	.00	.00	.75	.30
63	39	41	103.54	.07	.00	.00	.29	.05
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	639.12	1.51	.00	.00	1.81	1.51
68	54	53	483.62	.93	.00	.00	1.37	.90
69	39	53	512.88	.73	.00	.00	1.45	1.00
70	53	52	951.00	2.53	.00	.00	2.70	3.15
71	52	51	847.00	1.02	.00	.00	2.40	2.54
72	51	50	729.50	1.12	.00	.00	2.07	1.93
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	9769.58	.12	.00	.00	3.08	.82
75-XX	48	36						
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	-467.50	.86	.00	.00	1.33	.85
80	56	55	1694.50	9.18	.00	.00	4.81	9.18
81	57	56	1757.00	4.56	.00	.00	4.98	9.81
82-XX	36	57						
83	71	77	7599.34	1.03	.00	.00	2.40	.51
84	77	57	1757.00	1.47	.00	.00	4.98	9.81
85	26	58	944.45	1.12	.00	.00	2.68	3.11
86	58	59	728.76	1.21	.00	.00	2.07	1.92
87	58	60	215.69	.94	.00	.00	1.38	1.45
88	60	61	116.19	.30	.00	.00	.74	.46
89	59	61	112.81	.03	.00	.00	.32	.06
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	615.95	.44	.00	.00	1.75	1.41
93	64	65	525.95	.44	.00	.00	1.49	1.05
94	65	66	358.95	.17	.00	.00	1.02	.52
95	66	67	93.95	.02	.00	.00	.27	.04
96	68	67	-40.95	.00	.00	.00	.12	.01
97	69	68	12.05	.00	.00	.00	.03	.00
98	70	69	65.05	.01	.00	.00	.18	.02
99	71	70	482.21	1.18	.00	.00	1.37	.90
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	417.16	.28	.00	.00	1.18	.68
102	72	73	258.66	.11	.00	.00	.73	.28
103	73	74	114.66	.05	.00	.00	.33	.06
104	75	74	121.34	.03	.00	.00	.34	.07
105	76	75	256.84	.23	.00	.00	.73	.28
106	77	76	342.84	.33	.00	.00	.97	.48
107	77	78	5484.00	.44	.00	.00	1.73	.28
108-XX	57	78						
109	71	36	1688.04	1.91	.00	.00	4.79	9.11

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.84	120.00	38.84	16.83
2		.00	157.48	75.00	82.48	35.74
3		.00	156.83	77.00	79.83	34.59
4		468.50	155.34	50.00	105.34	45.65
5		93.50	153.60	85.00	68.60	29.73
6		.00	151.20	95.00	56.20	24.35
7		.00	148.35	98.00	50.35	21.82
8		.00	226.42	98.00	128.42	55.65
9		.00	225.89	102.00	123.89	53.68
10		20833.00	219.49	175.00	44.49	19.28
11		.00	213.58	55.00	158.58	68.72
12		235.50	212.90	25.00	187.90	81.42
13		156.00	211.13	45.00	166.13	71.99
14		.00	212.90	45.00	167.90	72.76
15		125.00	211.02	45.00	166.02	71.94
16		156.00	211.05	45.00	166.05	71.95
17		62.50	211.11	45.00	166.11	71.98
18		234.50	211.36	20.00	191.36	82.92
19		234.50	211.01	30.00	181.01	78.44
20		121.50	209.53	38.00	171.53	74.33
21		71.50	209.24	37.00	172.24	74.64
22		71.50	208.99	36.00	172.99	74.96
23		72.00	208.74	35.00	173.74	75.29
24		.00	208.28	34.00	174.28	75.52
25		.00	207.21	33.00	174.21	75.49
26		.00	206.79	28.00	178.79	77.47
27		.00	206.70	28.00	178.70	77.44
28		.00	206.70	27.00	179.70	77.87
29		99.50	208.14	35.00	173.14	75.03
30		186.50	204.16	36.00	168.16	72.87
31		214.50	200.22	37.00	163.22	70.73
32		.00	195.62	34.00	161.62	70.03
33		99.00	195.65	33.00	162.65	70.48
34		91.50	195.75	31.00	164.75	71.39
35		.00	195.75	34.00	161.75	70.09
36		.00	202.66	34.00	168.66	73.09
37		.00	196.28	34.00	162.28	70.32
38		161.50	196.00	33.00	163.00	70.63
39		.00	194.58	33.00	161.58	70.02
40		150.50	194.84	33.00	161.84	70.13
41		.00	194.50	34.00	160.50	69.55
42		21.00	192.93	34.00	158.93	68.87
43		50.50	194.40	34.00	160.40	69.51
44		521.00	192.81	33.00	159.81	69.25
45		109.50	193.83	30.00	163.83	70.99
46		109.50	193.56	28.00	165.56	71.74
47		99.00	193.09	25.00	168.09	72.84
48		.00	204.69	35.00	169.69	73.53
49		193.00	189.03	25.00	164.03	71.08
50		69.00	189.19	26.00	163.19	70.72
51		117.50	190.29	27.00	163.29	70.76
52		104.00	191.31	28.00	163.31	70.77
53		45.50	193.84	29.00	164.84	71.43
54		155.50	194.77	31.00	163.77	70.97
55		2162.00	188.33	27.00	161.33	69.91
56		62.50	197.51	27.00	170.51	73.89
57		.00	202,07	28.00	174.07	75.43
58		.00	205.67	32.00	173.67	75.26

59		.00	204.46	31.00	173.46	75.16
60		99.50	204.72	31.00	173.72	75.28
61		4.00	204.42	31.00	173.42	75.15
62		63.50	204.26	32.00	172.26	74.65
63		161.50	204.15	38.00	166.15	72.00
64		90.00	204.02	30.00	174.02	75.41
65		167.00	203.58	30.00	173.58	75.22
66		265.00	203.41	30.00	173.41	75.14
67		53.00	203.39	30.00	173.39	75.13
68		53.00	203.38	30.00	173.38	75.13
69		53.00	203.38	30.00	173.38	75.13
70		.00	203.39	32.00	171.39	74.27
71		.00	204.57	34.00	170.57	73.91
72		158.50	203.11	32.00	171.11	74.15
73		144.00	203.00	31.00	172.00	74.53
74		236.00	202.95	30.00	172.95	74.95
75		135.50	202.98	30.00	172.98	74.96
76		86.00	203.21	29.00	174.21	75.49
77		15.50	203.54	28.00	175.54	76.07
78		5484.00	203.10	20.00	183.10	79.34
79		.00	204.69	35.00	169.69	73.53

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8536.80
6	12285.84
23	14204.35

NET SYSTEM INFLOW = 35027.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 35027.00

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
10	20833.00
76	1586.00

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00052

PIPELINE RESULTS

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/1000 (ft/ft)
1-FGPU	0	1	8534.50	.02	148.97	.00	2.69	.64
2	1	2	7931.41	1.35	.00	.00	3.60	1.35
3	1	2	603.09	1.35	.00	.00	1.71	1.35
4	2	3	5271.02	.65	.00	.00	1.66	.26
5	2	3	3263.48	.65	.00	.00	1.48	.26
6-FG	0	3	12274.90	66.06	.00	.00	12.53	25.41
7	3	4	11459.46	1.49	.00	.00	3.61	1.10
8	3	4	7094.96	1.49	.00	.00	3.22	1.10
9	3	4	2254.97	1.49	.00	.00	2.30	1.10
10	4	5	11201.47	1.74	.00	.00	3.53	1.06
11	4	5	6935.23	1.74	.00	.00	3.15	1.06
12	4	5	2204.20	1.74	.00	.00	2.25	1.06
13	5	6	12505.06	2.40	.00	.00	3.94	1.30
14	5	6	7742.33	2.40	.00	.00	3.51	1.30
15	6	7	20247.39	2.84	.00	.00	9.19	7.68
16-PU	7	8	6749.13	.02	78.19	.00	3.06	1.00
17-PU	7	8	6749.13	.02	78.19	.00	3.06	1.00
18-PU	7	8	6749.13	.02	78.19	.00	3.06	1.00
19-XXCV	7	8						
20	8	9	20247.39	.54	.00	.00	9.19	7.68
21	9	10	10123.70	6.39	.00	.00	4.59	2.13
22	9	10	10123.70	6.39	.00	.00	4.59	2.13
23-FG	0	10	13717.61	3.29	.00	.00	3.18	.73
24	10	11	13132.00	5.52	.00	.00	3.04	.67
25-XXCV	5	12						
26	11	12	667.58	.65	.00	.00	1.07	.34
27	11	13	12464.42	2.28	.00	.00	2.89	.61
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	161.92	.03	.00	.00	.26	.02
31	17	16	317.92	.06	.00	.00	.51	.09
32	13	17	380.42	.02	.00	.00	.61	.12
33	12	18	432.08	1.46	.00	.00	1.23	.73
34	18	19	197.58	.31	.00	.00	.56	.17
35	15	19	36.92	.02	.00	.00	.10	.01
36	13	20	11928.00	1.48	.00	.00	3.76	1.19
37	20	21	11806.50	.27	.00	.00	3.72	1.16
38	21	22	11735.00	.23	.00	.00	3.70	1.15
39	22	23	11663.50	.23	.00	.00	3.68	1.14
40	23	24	11591.50	.43	.00	.00	3.65	1.13
41-XX	15	28						
42	24	25	10483.55	1.03	.00	.00	3.30	.93
43	25	26	10483.55	.41	.00	.00	4.76	2.27
44	26	27	9400.29	.08	.00	.00	2.96	.76
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	9400.29	1.87	.00	.00	2.96	.76
48	24	29	1107.95	.10	.00	.00	1.77	.88
49	29	30	1008.45	2.56	.00	.00	2.86	3.51
50	30	31	821.95	2.33	.00	.00	2.33	2.40
51	31	32	607.45	2.33	.00	.00	1.72	1.37
52	33	32	7.43	.00	.00	.00	.02	.00
53	34	33	106.43	.03	.00	.00	.30	.05
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	1058.08	2.69	.00	.00	3.00	3.84

57	38	37	-359.43	.18	.00	.00	1.02	.52
58	34	38	-197.93	.12	.00	.00	.56	.17
59	37	39	356.12	.66	.00	.00	1.01	.51
60	32	39	303.16	.33	.00	.00	.86	.38
61	32	40	311.72	.45	.00	.00	.88	.40
62	40	41	161.22	.14	.00	.00	.46	.12
63	39	41	207.28	.26	.00	.00	.59	.19
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	342.52	.48	.00	.00	.97	.48
68	54	53	187.02	.16	.00	.00	.53	.15
69	39	53	-90.00	.03	.00	.00	.26	.04
70	53	52	51.53	.01	.00	.00	.15	.01
71	52	51	-52.47	.01	.00	.00	.15	.01
72	51	50	-169.97	.08	.00	.00	.48	.13
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	9400.29	.11	.00	.00	2.96	.76
75-XX	48	36						
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	431.97	.74	.00	.00	1.23	.73
80	56	55	593.97	1.32	.00	.00	1.68	1.32
81	57	56	656.47	.74	.00	.00	1.86	1.58
82-XX	36	57						
83	71	77	7573.57	1.02	.00	.00	2.39	.51
84	77	57	656.47	.24	.00	.00	1.86	1.58
85	26	58	1083.25	1.44	.00	.00	3.07	4.01
86	58	59	841.60	1.58	.00	.00	2.39	2.51
87	58	60	241.66	1.17	.00	.00	1.54	1.79
88	60	61	142.16	.44	.00	.00	.91	.67
89	59	61	86.84	.02	.00	.00	.25	.04
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	754.75	.64	.00	.00	2.14	2.05
93	64	65	664.75	.68	.00	.00	1.89	1.62
94	65	66	497.75	.30	.00	.00	1.41	.95
95	66	67	232.75	.13	.00	.00	.66	.23
96	68	67	-179.75	.06	.00	.00	.51	.14
97	69	68	-126.75	.02	.00	.00	.36	.08
98	70	69	-73.75	.01	.00	.00	.21	.03
99	71	70	768.65	2.80	.00	.00	2.18	2.12
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	842.41	1.03	.00	.00	2.39	2.52
102	72	73	683.91	.67	.00	.00	1.94	1.71
103	73	74	539.91	.86	.00	.00	1.53	1.10
104	75	74	-303.91	.18	.00	.00	.86	.38
105	76	75	-168.41	.10	.00	.00	.48	.13
106	77	76	1417.59	4.62	.00	.00	4.02	6.59
107	77	78	5484.00	.44	.00	.00	1.73	.28
108-XX	57	78						
109	71	36	1058.08	.81	.00	.00	3.00	3.84

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.95	120.00	38.95	16.88
2		.00	157.59	75.00	82.59	35.79
3		.00	156.94	77.00	79.94	34.64
4		468.50	155.45	50.00	105.45	45.70

5	93.50	153.71	85.00	68.71	29.77
6	.00	151.31	95.00	56.31	24.40
7	.00	148.47	98.00	50.47	21.87
8	.00	226.64	98.00	128.64	55.74
9	.00	226.10	102.00	124.10	53.78
10	20833.00	219.71	175.00	44.71	19.38
11	.00	214.19	55.00	159.19	68.98
12	235.50	213.54	25.00	188.54	81.70
13	156.00	211.91	45.00	166.91	72.33
14	.00	213.54	45.00	168.54	73.03
15	125.00	211.79	45.00	166.79	72.28
16	156.00	211.83	45.00	166.83	72.29
17	62.50	211.89	45.00	166.89	72.32
18	234.50	212.08	20.00	192.08	83.23
19	234.50	211.77	30.00	181.77	78.77
20	121.50	210.43	38.00	172.43	74.72
21	71.50	210.16	37.00	173.16	75.04
22	71.50	209.93	36.00	173.93	75.37
23	72.00	209.70	35.00	174.70	75.70
24	.00	209.27	34.00	175.27	75.95
25	.00	208.25	33.00	175.25	75.94
26	.00	207.84	28.00	179.84	77.93
27	.00	207.76	28.00	179.76	77.90
28	.00	207.76	27.00	180.76	78.33
29	99.50	209.18	35.00	174.18	75.48
30	186.50	206.62	36.00	170.62	73.93
31	214.50	204.28	37.00	167.28	72.49
32	.00	201.95	34.00	167.95	72.78
33	99.00	201.95	33.00	168.95	73.21
34	91.50	201.98	31.00	170.98	74.09
35	.00	201.98	34.00	167.98	72.79
36	.00	204.97	34.00	170.97	74.09
37	.00	202.29	34.00	168.29	72.92
38	161.50	202.10	33.00	169.10	73.28
39	.00	201.62	33.00	168.62	73.07
40	150.50	201.50	33.00	168.50	73.02
41	.00	201.36	34.00	167.36	72.52
42	21.00	199.98	34.00	165.98	71.92
43	50.50	201.26	34.00	167.26	72.48
44	521.00	199.85	33.00	166.85	72.30
45	109.50	200.68	30.00	170.68	73.96
46	109.50	200.42	28.00	172.42	74.72
47	99.00	199.94	25.00	174.94	75.81
48	.00	205.89	35.00	170.89	74.05
49	193.00	201.56	25.00	176.56	76.51
50	69.00	201.72	26.00	175.72	76.15
51	117.50	201.65	27.00	174.65	75.68
52	104.00	201.64	28.00	173.64	75.24
53	45.50	201.65	29.00	172.65	74.82
54	155.50	201.81	31.00	170.81	74.02
55	162.00	202.46	27.00	175.46	76.03
56	62.50	203.78	27.00	176.78	76.60
57	.00	204.52	28.00	176.52	76.49
58	.00	206.40	32.00	174.40	75.57
59	.00	204.81	31.00	173.81	75.32
60	99.50	205.23	31.00	174.23	75.50
61	4.00	204.79	31.00	173.79	75.31
62	63.50	204.64	32.00	172.64	74.81
63	161.50	204.52	38.00	166.52	72.16
64	90.00	204.18	30.00	174.18	75.48
65	167.00	203.50	30.00	173.50	75.18
66	265.00	203.19	30.00	173.19	75.05
67	53.00	203.06	30.00	173.06	74.99
68	53.00	203.00	30.00	173.00	74.97
69	53.00	202.98	30.00	172.98	74.96
70	.00	202.97	32.00	170.97	74.09

71	.00	205.78	34.00	171.78	74.44
72	158.50	201.94	32.00	169.94	73.64
73	144.00	201.28	31.00	170.28	73.79
74	236.00	200.42	30.00	170.42	73.85
75	135.50	200.24	30.00	170.24	73.77
76	1586.00	200.14	29.00	171.14	74.16
77	15.50	204.75	28.00	176.75	76.59
78	5484.00	204.31	20.00	184.31	79.87
79	.00	205.89	35.00	170.89	74.05

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8534.50
6	12274.90
23	13717.61

NET SYSTEM INFLOW = 34527.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 34527.00

**** KYPIPE SIMULATION COMPLETED ****

DATE: 9/ 1/2000
TIME: 17:55:31

Appendix C

Analysis of the
Fort Weaver Corridor With the
16-Inch Fort Weaver Main
Converted to Non-Potable Use
and the Ohana Zoning Allocation in
Ewa Beach Removed

File: OHANA

```
* * * * * * * * * *   K Y P I P E 2   * * * * * * * * * *
*  University of Kentucky Hydraulic Analysis Program    *
* Distribution of Pressure and Flows in Piping Networks *
*         1000 PIPE VERSION - 1.10    (08/25/92)        *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

DATE: 8/ 2/2000
TIME: 8:59:52

INPUT DATA FILENAME -------------- ohana.DAT
TABULATED OUTPUT FILENAME -------- ohana.OUT
POSTPROCESSOR RESULTS FILENAME --- ohana.RES

S U M M A R Y O F O R I G I N A L D A T A

U N I T S S P E C I F I E D

FLOWRATE .... = gallons/minute
HEAD (HGL) .... = feet
PRESSURE .... = psig

P I P E L I N E D A T A

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	FGN-HGL (ft)
1-FGPU	0	1	30.0	36.0	130.00	.00	10.00
2	1	2	1000.0	30.0	130.00	.00	
3	1	2	1000.0	12.0	110.00	.00	
4	2	3	2500.0	36.0	130.00	.00	
5	2	3	2500.0	30.0	130.00	.00	
6-FG	0	3	2600.0	20.0	120.00	.00	223.00
7	3	4	1350.0	36.0	130.00	.00	
8	3	4	1350.0	30.0	130.00	.00	
9	3	4	1350.0	20.0	120.00	.00	
10	4	5	1650.0	36.0	130.00	.00	
11	4	5	1650.0	30.0	130.00	.00	
12	4	5	1650.0	20.0	120.00	.00	
13	5	6	1850.0	36.0	130.00	.00	
14	5	6	1850.0	30.0	130.00	.00	
15	6	7	370.0	30.0	130.00	.00	
16-PU	7	8	20.0	30.0	130.00	.00	
17-PU	7	8	20.0	30.0	130.00	.00	
18-PU	7	8	20.0	30.0	130.00	.00	
19-CV	7	8	20.0	30.0	130.00	.00	
20	8	9	70.0	30.0	130.00	.00	
21	9	10	3000.0	30.0	130.00	.00	
22	9	10	3000.0	30.0	130.00	.00	
23-FG	0	10	4530.0	42.0	130.00	.00	223.00
24	10	11	8250.0	42.0	130.00	.00	
25-CV	5	12	7150.0	16.0	120.00	.00	
26	11	12	1900.0	16.0	120.00	.00	

27	11	13	3750.0	42.0	130.00	.00
28	12	14	2850.0	16.0	120.00	.00
29-XX	14	15	650.0	16.0	120.00	.00
30	16	15	1300.0	16.0	120.00	.00
31	17	16	700.0	16.0	120.00	.00
32	13	17	200.0	16.0	120.00	.00
33	12	18	2000.0	12.0	110.00	.00
34	18	19	1800.0	12.0	110.00	.00
35	15	19	3200.0	12.0	110.00	.00
36	13	20	1250.0	36.0	130.00	.00
37	20	21	230.0	36.0	130.00	.00
38	21	22	200.0	36.0	130.00	.00
39	22	23	200.0	36.0	130.00	.00
40	23	24	380.0	36.0	130.00	.00
41-XX	15	28	2480.0	16.0	120.00	.00
42	24	25	1100.0	36.0	130.00	.00
43	25	26	180.0	30.0	130.00	.00
44	26	27	100.0	36.0	130.00	.00
45	28	27	150.0	16.0	120.00	.00
46-XX	28	35	2000.0	16.0	120.00	.00
47	27	79	2450.0	36.0	130.00	.00
48	24	29	110.0	16.0	120.00	.00
49	29	30	730.0	12.0	110.00	.00
50	30	31	970.0	12.0	110.00	.00
51	31	32	1700.0	12.0	110.00	.00
52	33	32	570.0	12.0	110.00	.00
53	34	33	580.0	12.0	110.00	.00
54	35	34	800.0	12.0	110.00	.00
55-XX	35	48	730.0	16.0	120.00	.00
56	36	37	700.0	12.0	110.00	.00
57	38	37	350.0	12.0	110.00	.00
58	34	38	700.0	12.0	110.00	.00
59	37	39	1300.0	12.0	110.00	.00
60	32	39	870.0	12.0	110.00	.00
61	32	40	1140.0	12.0	110.00	.00
62	40	41	1150.0	12.0	110.00	.00
63	39	41	1390.0	12.0	110.00	.00
64	39	42	1480.0	12.0	110.00	.00
65	42	44	122.0	12.0	110.00	.00
66	41	43	890.0	16.0	120.00	.00
67	37	54	1000.0	12.0	110.00	.00
68	54	53	1030.0	12.0	110.00	.00
69	39	53	730.0	12.0	110.00	.00
70	53	52	805.0	12.0	110.00	.00
71	52	51	400.0	12.0	110.00	.00
72	51	50	580.0	12.0	110.00	.00
73	50	49	965.0	12.0	110.00	.00
74	79	71	150.0	36.0	130.00	.00
75-XX	48	36	170.0	16.0	120.00	.00
76	47	46	1390.0	8.0	110:00	.00
77	45	46	1390.0	12.0	110.00	.00
78	43	45	1390.0	12.0	110.00	.00
79	55	50	1015.0	12.0	110.00	.00
80	56	55	1000.0	12.0	110.00	.00
81	57	56	465.0	12.0	110.00	.00
82-XX	36	57	2000.0	16.0	120.00	.00
83	71	77	2000.0	36.0	130.00	.00
84	77	57	150.0	12.0	110.00	.00
85	26	58	360.0	12.0	110.00	.00
86	58	59	630.0	12.0	110.00	.00
87	58	60	650.0	8.0	110.00	.00
88	60	61	650.0	8.0	110.00	.00
89	59	61	550.0	12.0	110.00	.00
90	61	62	720.0	12.0	110.00	.00
91	62	63	950.0	12.0	110.00	.00
92	59	64	310.0	12.0	110.00	.00

93	64	65	420.0	12.0	110.00	.00
94	65	66	320.0	12.0	110.00	.00
95	66	67	570.0	12.0	110.00	.00
96	68	67	400.0	12.0	110.00	.00
97	69	68	250.0	12.0	110.00	.00
98	70	69	330.0	12.0	110.00	.00
99	71	70	1320.0	12.0	110.00	.00
100	79	48	40.0	16.0	120.00	.00
101	70	72	410.0	12.0	110.00	.00
102	72	73	390.0	12.0	110.00	.00
103	73	74	780.0	12.0	110.00	.00
104	75	74	465.0	12.0	110.00	.00
105	76	75	810.0	12.0	110.00	.00
106	77	76	700.0	12.0	110.00	.00
107	77	78	1580.0	36.0	130.00	.00
108-XX	57	78	1580.0	16.0	120.00	.00
109	71	36	210.0	12.0	110.00	.00

P U M P   D A T A

THERE IS A PUMP IN LINE 1 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
415.00	.00
230.00	6700.00
105.00	9450.00

THERE IS A PUMP IN LINE 16 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 17 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 18 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

J U N C T I O N   N O D E   D A T A

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	CONNECTING PIPES					
1		.00	120.00	1	2	3			
2		.00	75.00	2	3	4	5		
3		.00	77.00	4	5	6	7	8	9

4	937.00	50.00	7	8	9	10	11	12
5	187.00	85.00	10	11	12	13	14	25
6	.00	95.00	13	14	15			
7	.00	98.00	15	16	17	18	19	
8	.00	98.00	16	17	18	19	20	
9	.00	102.00	20	21	22			
10	20830.00	175.00	21	22	23	24		
11	.00	55.00	24	26	27			
12	471.00	25.00	25	26	28	33		
13	312.00	45.00	27	32	36			
14	.00	45.00	28	29				
15	250.00	45.00	29	30	35	41		
16	312.00	45.00	30	31				
17	125.00	45.00	31	32				
18	469.00	20.00	33	34				
19	469.00	30.00	34	35				
20	243.00	38.00	36	37				
21	143.00	37.00	37	38				
22	143.00	36.00	38	39				
23	144.00	35.00	39	40				
24	.00	34.00	40	42	48			
25	.00	33.00	42	43				
26	.00	28.00	43	44	85			
27	.00	28.00	44	45	47			
28	.00	27.00	41	45	46			
29	199.00	35.00	48	49				
30	373.00	36.00	49	50				
31	429.00	37.00	50	51				
32	.00	34.00	51	52	60	61		
33	198.00	33.00	52	53				
34	183.00	31.00	53	54	58			
35	.00	34.00	46	54	55			
36	.00	34.00	56	75	82	109		
37	.00	34.00	56	57	59	67		
38	323.00	33.00	57	58				
39	.00	33.00	59	60	63	64	69	
40	301.00	33.00	61	62				
41	.00	34.00	62	63	66			
42	42.00	34.00	64	65				
43	101.00	34.00	66	78				
44	1042.00	33.00	65					
45	219.00	30.00	77	78				
46	219.00	28.00	76	77				
47	198.00	25.00	76					
48	.00	35.00	55	75	100			
49	386.00	25.00	73					
50	138.00	26.00	72	73	79			
51	235.00	27.00	71	72				
52	208.00	28.00	70	71				
53	91.00	29.00	68	69	70			
54	311.00	31.00	67	68				
55	324.00	27.00	79	80				
56	125.00	27.00	80	81				
57	.00	28.00	81	82	84	108		
58	.00	32.00	85	86	87			
59	.00	31.00	86	89	92			
60	199.00	31.00	87	88				
61	8.00	31.00	88	89	90			
62	127.00	32.00	90	91				
63	323.00	38.00	91					
64	180.00	30.00	92	93				
65	334.00	30.00	93	94				
66	530.00	30.00	94	95				

67	106.00	30.00	95	96		
68	106.00	30.00	96	97		
69	106.00	30.00	97	98		
70	.00	32.00	98	99	101	
71	.00	34.00	74	83	99	109
72	317.00	32.00	101	102		
73	288.00	31.00	102	103		
74	472.00	30.00	103	104		
75	271.00	30.00	104	105		
76	172.00	29.00	105	106		
77	31.00	28.00	83	84	106	107
78	8885.00	20.00	107	108		
79	.00	35.00	47	74	100	

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

NUMBER OF PIPES ....(p) = 109
NUMBER OF JUNCTION NODES ....(j) = 79
NUMBER OF PRIMARY LOOPS ....(l) = 28
NUMBER OF FIXED GRADE NODES ....(f) = 3
NUMBER OF SUPPLY ZONES ....(z) = 1

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 4 TRIALS WITH AN ACCURACY = .00364

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS.. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8630.03	.02	144.48	.00	2.72	.65
2	1	2	8020.20	1.38	.00	.00	3.64	1.38
3	1	2	609.84	1.38	.00	.00	1.73	1.38
4	2	3	5330.02	.67	.00	.00	1.68	.27
5	2	3	3300.01	.67	.00	.00	1.50	.27
6-FG	0	3	12722.15	70.59	.00	.00	12.99	27.15
7	3	4	11758.40	1.56	.00	.00	3.71	1.16
8	3	4	7280.01	1.56	.00	.00	3.30	1.16
9	3	4	2313.79	1.56	.00	.00	2.36	1.16
10	4	5	11242.41	1.75	.00	.00	3.54	1.06
11	4	5	6960.53	1.75	.00	.00	3.16	1.06
12	4	5	2212.26	1.75	.00	.00	2.26	1.06
13	5	6	12493.29	2.39	.00	.00	3.94	1.29
14	5	6	7734.90	2.39	.00	.00	3.51	1.29
15	6	7	20228.19	2.84	.00	.00	9.18	7.67
16-PU	7	8	6742.73	.02	78.32	.00	3.06	1.00
17-PU	7	8	6742.73	.02	78.32	.00	3.06	1.00

18-PU	7	8	6742.73	.02	78.32	.00	3.06	1.00
19-XXCV	7	8						
20	8	9	20228.19	.54	.00	.00	9.18	7.67
21	9	10	10114.10	6.37	.00	.00	4.59	2.12
22	9	10	10114.10	6.37	.00	.00	4.59	2.12
23-PG	0	10	21782.81	7.74	.00	.00	5.04	1.71
24	10	11	21181.00	13.39	.00	.00	4.90	1.62
25-XXCV	5	12						
26	11	12	1217.35	1.98	.00	.00	1.94	1.04
27	11	13	19963.65	5.45	.00	.00	4.62	1.45
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	441.65	.21	.00	.00	.70	.16
31	17	16	753.65	.30	.00	.00	1.20	.43
32	13	17	878.65	.11	.00	.00	1.40	.57
33	12	18	746.35	4.02	.00	.00	2.12	2.01
34	18	19	277.35	.58	.00	.00	.79	.32
35	15	19	191.65	.52	.00	.00	.54	.16
36	13	20	18773.00	3.44	.00	.00	5.92	2.75
37	20	21	18530.00	.62	.00	.00	5.84	2.68
38	21	22	18387.00	.53	.00	.00	5.80	2.64
39	22	23	18244.00	.52	.00	.00	5.75	2.61
40	23	24	18100.00	.98	.00	.00	5.70	2.57
41-XX	15	28						
42	24	25	16024.54	2.26	.00	.00	5.05	2.05
43	25	26	16024.54	.90	.00	.00	7.27	4.98
44	26	27	14335.57	.17	.00	.00	4.52	1.67
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	14335.57	4.09	.00	.00	4.52	1.67
48	24	29	2075.46	.31	.00	.00	3.31	2.80
49	29	30	1876.46	8.09	.00	.00	5.32	11.08
50	30	31	1503.46	7.13	.00	.00	4.26	7.35
51	31	32	1074.46	6.71	.00	.00	3.05	3.95
52	33	32	66.33	.01	.00	.00	.19	.02
53	34	33	264.33	.17	.00	.00	.75	.29
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	2161.91	10.09	.00	.00	6.13	14.41
57	38	37	-770.33	.75	.00	.00	2.19	2.13
58	34	38	-447.33	.55	.00	.00	1.27	.78
59	37	39	717.12	2.43	.00	.00	2.03	1.87
60	32	39	537.48	.95	.00	.00	1.52	1.09
61	32	40	603.31	1.55	.00	.00	1.71	1.36
62	40	41	302.31	.43	.00	.00	.86	.38
63	39	41	434.69	1.03	.00	.00	1.23	.74
64	39	42	1084.00	5.94	.00	.00	3.07	4.01
65	42	44	1042.00	.45	.00	.00	2.96	3.73
66	41	43	737.00	.37	.00	.00	1.18	.41
67	37	54	674.46	1.67	.00	.00	1.91	1.67
68	54	53	363.46	.55	.00	.00	1.03	.53
69	39	53	-264.09	.21	.00	.00	.75	.29
70	53	52	8.37	.00	.00	.00	.02	.00
71	52	51	-199.63	.07	.00	.00	.57	.17
72	51	50	-434.63	.43	.00	.00	1.23	.74
73	50	49	386.00	.57	.00	.00	1.09	.59
74	79	71	14335.57	.25	.00	.00	4.52	1.67
75-XX	48	36						
76	47	46	-198.00	1.72	.00	.00	1.26	1.24
77	45	46	417.00	.95	.00	.00	1.18	.68
78	43	45	636.00	2.08	.00	.00	1.80	1.49
79	55	50	958.63	3.24	.00	.00	2.72	3.20
80	56	55	1282.63	5.48	.00	.00	3.64	5.48
81	57	56	1407.63	3.03	.00	.00	3.99	6.51
82-XX	36	57						
83	71	77	11168.40	2.10	.00	.00	3.52	1.05

84	77	57	1407.63	.98	.00	.00	3.99	6.51
85	26	58	1688.97	3.28	.00	.00	4.79	9.12
86	58	59	1294.71	3.51	.00	.00	3.67	5.57
87	58	60	394.26	2.89	.00	.00	2.52	4.44
88	60	61	195.26	.79	.00	.00	1.25	1.21
89	59	61	262.74	.16	.00	.00	.75	.29
90	61	62	450.00	.57	.00	.00	1.28	.79
91	62	63	323.00	.40	.00	.00	.92	.43
92	59	64	1031.97	1.14	.00	.00	2.93	3.66
93	64	65	851.97	1.08	.00	.00	2.42	2.57
94	65	66	517.97	.33	.00	.00	1.47	1.02
95	66	67	-12.03	.00	.00	.00	.03	.00
96	68	67	118.03	.03	.00	.00	.33	.07
97	69	68	224.03	.05	.00	.00	.64	.22
98	70	69	330.03	.15	.00	.00	.94	.44
99	71	70	1005.25	4.61	.00	.00	2.85	3.49
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	675.23	.68	.00	.00	1.92	1.67
102	72	73	358.23	.20	.00	.00	1.02	.52
103	73	74	70.23	.02	.00	.00	.20	.03
104	75	74	401.77	.30	.00	.00	1.14	.64
105	76	75	672.77	1.34	.00	.00	1.91	1.66
106	77	76	844.77	1.77	.00	.00	2.40	2.53
107	77	78	8885.00	1.09	.00	.00	2.80	.69
108-XX	57	78						
109	71	36	2161.91	3.03	.00	.00	6.13	14.41

J U N C T I O N N O D E R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	154.47	120.00	34.47	14.93
2		.00	153.08	75.00	78.08	33.84
3		.00	152.41	77.00	75.41	32.68
4		937.00	150.85	50.00	100.85	43.70
5		187.00	149.10	85.00	64.10	27.78
6		.00	146.71	95.00	51.71	22.41
7		.00	143.87	98.00	45.87	19.88
8		.00	222.17	98.00	124.17	53.81
9		.00	221.63	102.00	119.63	51.84
10		20830.00	215.26	175.00	40.26	17.45
11		.00	201.87	55.00	146.87	63.65
12		471.00	199.89	25.00	174.89	75.79
13		312.00	196.42	45.00	151.42	65.62
14		.00	199.89	45.00	154.89	67.12
15		250.00	195.80	45.00	150.80	65.35
16		312.00	196.01	45.00	151.01	65.44
17		125.00	196.31	45.00	151.31	65.57
18		469.00	195.87	20.00	175.87	76.21
19		469.00	195.29	30.00	165.29	71.63
20		243.00	192.99	38.00	154.99	67.16
21		143.00	192.37	37.00	155.37	67.33
22		143.00	191.84	36.00	155.84	67.53
23		144.00	191.32	35.00	156.32	67.74
24		.00	190.34	34.00	156.34	67.75
25		.00	188.07	33.00	155.07	67.20
26		.00	187.18	28.00	159.18	68.98
27		.00	187.01	28.00	159.01	68.90
28		.00	187.01	27.00	160.01	69.34
29		199.00	190.03	35.00	155.03	67.18
30		373.00	181,94	36.00	145.94	63.24
31		429.00	174.80	37.00	137.80	59.71

32	.00	168.09	34.00	134.09	58.10
33	198.00	168.10	33.00	135.10	58.54
34	183.00	168.27	31.00	137.27	59.48
35	.00	168.27	34.00	134.27	58.18
36	.00	179.65	34.00	145.65	63.11
37	.00	169.56	34.00	135.56	58.74
38	323.00	168.82	33.00	135.82	58.85
39	.00	167.13	33.00	134.13	58.13
40	301.00	166.54	33.00	133.54	57.87
41	.00	166.11	34.00	132.11	57.25
42	42.00	161.20	34.00	127.20	55.12
43	101.00	165.74	34.00	131.74	57.09
44	1042.00	160.74	33.00	127.74	55.35
45	219.00	163.66	30.00	133.66	57.92
46	219.00	162.71	28.00	134.71	58.38
47	198.00	160.99	25.00	135.99	58.93
48	.00	182.92	35.00	147.92	64.10
49	386.00	167.27	25.00	142.27	61.65
50	138.00	167.85	26.00	141.85	61.47
51	235.00	167.42	27.00	140.42	60.85
52	208.00	167.35	28.00	139.35	60.38
53	91.00	167.35	29.00	138.35	59.95
54	311.00	167.90	31.00	136.90	59.32
55	324.00	171.09	27.00	144.09	62.44
56	125.00	176.57	27.00	149.57	64.81
57	.00	179.60	28.00	151.60	65.69
58	.00	183.89	32.00	151.89	65.82
59	.00	180.38	31.00	149.38	64.73
60	199.00	181.01	31.00	150.01	65.00
61	8.00	180.22	31.00	149.22	64.66
62	127.00	179.65	32.00	147.65	63.98
63	323.00	179.25	38.00	141.25	61.21
64	180.00	179.25	30.00	149.25	64.67
65	334.00	178.17	30.00	148.17	64.21
66	530.00	177.84	30.00	147.84	64.06
67	106.00	177.84	30.00	147.84	64.06
68	106.00	177.87	30.00	147.87	64.08
69	106.00	177.92	30.00	147.92	64.10
70	.00	178.07	32.00	146.07	63.30
71	.00	182.67	34.00	148.67	64.42
72	317.00	177.38	32.00	145.38	63.00
73	288.00	177.18	31.00	146.18	63.35
74	472.00	177.16	30.00	147.16	63.77
75	271.00	177.46	30.00	147.46	63.90
76	172.00	178.80	29.00	149.80	64.91
77	31.00	180.57	28.00	152.57	66.11
78	8885.00	179.48	20.00	159.48	69.11
79	.00	182.92	35.00	147.92	64.10

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8630.03
6	12722.15
23	21782.81

NET SYSTEM INFLOW = 43135.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 43135.00

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
10	20833.00
43	4050.00

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00019

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	NODE NOS. #2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8541.41	.02	148.64	.00	2.69	.64
2	1	2	7937.83	1.36	.00	.00	3.60	1.36
3	1	2	603.58	1.36	.00	.00	1.71	1.36
4	2	3	5275.29	.65	.00	.00	1.66	.26
5	2	3	3266.12	.65	.00	.00	1.48	.26
6-FG	0	3	12307.64	66.39	.00	.00	12.57	25.53
7	3	4	11481.30	1.49	.00	.00	3.62	1.11
8	3	4	7108.48	1.49	.00	.00	3.23	1.11
9	3	4	2259.26	1.49	.00	.00	2.31	1.11
10	4	5	11223.31	1.75	.00	.00	3.54	1.06
11	4	5	6948.75	1.75	.00	.00	3.15	1.06
12	4	5	2208.50	1.75	.00	.00	2.26	1.06
13	5	6	12529.56	2.40	.00	.00	3.95	1.30
14	5	6	7757.49	2.40	.00	.00	3.52	1.30
15	6	7	20287.05	2.85	.00	.00	9.21	7.71
16-PU	7	8	6762.35	.02	77.91	.00	3.07	1.01
17-PU	7	8	6762.35	.02	77.91	.00	3.07	1.01
18-PU	7	8	6762.35	.02	77.91	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20287.05	.54	.00	.00	9.21	7.71
21	9	10	10143.53	6.41	.00	.00	4.60	2.14
22	9	10	10143.53	6.41	.00	.00	4.60	2.14
23-FG	0	10	15135.95	3.94	.00	.00	3.50	.87
24	10	11	14590.00	6.71	.00	.00	3.38	.81
25-XXCV	5	12						
26	11	12	706.63	.72	.00	.00	1.13	.38
27	11	13	13883.37	2.78	.00	.00	3.21	.74
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						

30	16	15	122.87	.02	.00	.00	.20	.01
31	17	16	278.87	.05	.00	.00	.44	.07
32	13	17	341.37	.02	.00	.00	.54	.10
33	12	18	471.13	1.71	.00	.00	1.34	.86
34	18	19	236.63	.43	.00	.00	.67	.24
35	15	19	-2.13	.00	.00	.00	.01	.00
36	13	20	13386.00	1.84	.00	.00	4.22	1.47
37	20	21	13264.50	.33	.00	.00	4.18	1.44
38	21	22	13193.00	.29	.00	.00	4.16	1.43
39	22	23	13121.50	.28	.00	.00	4.14	1.42
40	23	24	13049.50	.53	.00	.00	4.11	1.40
41-XX	15	28						
42	24	25	10907.56	1.11	.00	.00	3.44	1.01
43	25	26	10907.56	.44	.00	.00	4.95	2.44
44	26	27	9965.04	.09	.00	.00	3.14	.85
45	28	27	.00	..00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	9965.04	2.08	.00	.00	3.14	.85
48	24	29	2141.94	.33	.00	.00	3.42	2.97
49	29	30	2042.44	9.47	.00	.00	5.79	12.97
50	30	31	1855.94	10.54	.00	.00	5.26	10.86
51	31	32	1641.44	14.71	.00	.00	4.66	8.65
52	33	32	769.45	1.21	.00	.00	2.18	2.13
53	34	33	868.45	1.54	.00	.00	2.46	2.66
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	3043.35	19.00	.00	.00	8.63	27.14
57	38	37	-1121.45	1.50	.00	.00	3.18	4.27
58	34	38	-959.95	2.24	.00	.00	2.72	3.20
59	37	39	1274.98	7.04	.00	.00	3.62	5.42
60	32	39	399.99	.55	.00	.00	1.13	.63
61	32	40	2010.90	14.36	.00	.00	5.70	12.60
62	40	41	1860.40	12.55	.00	.00	5.28	10.91
63	39	41	2507.60	26.36	.00	.00	7.11	18.96
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	4368.00	9.89	.00	.00	6.97	11.11
67	37	54	646.92	1.54	.00	.00	1.84	1.54
68	54	53	491.42	.95	.00	.00	1.39	.93
69	39	53	-1374.63	4.55	.00	.00	3.90	6.23
70	53	52	-928.71	2.43	.00	.00	2.63	3.01
71	52	51	-1032.71	1.47	.00	.00	2.93	3.67
72	51	50	-1150.21	2.60	.00	.00	3.26	4.48
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	9965.04	.13	.00	.00	3.14	.85
75-XX	48	36						
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	1412.21	6.65	.00	.00	4.01	6.55
80	56	55	1574.21	8.01	.00	.00	4.47	8.01
81	57	56	1636.71	4.00	.00	.00	4.64	8.61
82-XX	36	57						
83	71	77	6462.12	.76	.00	.00	2.04	.38
84	77	57	1636.71	1.29	.00	.00	4.64	8.61
85	26	58	942.52	1.11	.00	.00	2.67	3.10
86	58	59	727.19	1.21	.00	.00	2.06	1.92
87	58	60	215.33	.94	.00	.00	1.37	1.45
88	60	61	115.83	.30	.00	.00	.74	.46
89	59	61	113.17	.03	.00	.00	.32	.06
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	614.02	.43	.00	.00	1.74	1.40
93	64	65	524.02	.44	.00	.00	1.49	1.04
94	65	66	357.02	.16	.00	.00	1.01	.51
95	66	67	92.02	.02	.00	.00	.26	.04

96	68	67	-39.02	.00	.00	.00	.11	.01
97	69	68	13.98	.00	.00	.00	.04	.00
98	70	69	66.98	.01	.00	.00	.19	.02
99	71	70	459.57	1.08	.00	.00	1.30	.82
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	392.59	.25	.00	.00	1.11	.61
102	72	73	234.09	.09	.00	.00	.66	.23
103	73	74	90.09	.03	.00	.00	.26	.04
104	75	74	145.91	.05	.00	.00	.41	.10
105	76	75	281.41	.27	.00	.00	.80	.33
106	77	76	367.41	.38	.00	.00	1.04	.54
107	77	78	4442.50	.30	.00	.00	1.40	.19
108-XX	57	78						
109	71	36	3043.35	5.70	.00	.00	8.63	27.14

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.62	120.00	38.62	16.74
2		.00	157.27	75.00	82.27	35.65
3		.00	156.61	77.00	79.61	34.50
4		468.50	155.12	50.00	105.12	45.55
5		93.50	153.37	85.00	68.37	29.63
6		.00	150.97	95.00	55.97	24.25
7		.00	148.11	98.00	50.11	21.72
8		.00	226.00	98.00	128.00	55.47
9		.00	225.46	102.00	123.46	53.50
10		20833.00	219.06	175.00	44.06	19.09
11		.00	212.34	55.00	157.34	68.18
12		235.50	211.62	25.00	186.62	80.87
13		156.00	209.56	45.00	164.56	71.31
14		.00	211.62	45.00	166.62	72.20
15		125.00	209.47	45.00	164.47	71.27
16		156.00	209.49	45.00	164.49	71.28
17		62.50	209.54	45.00	164.54	71.30
18		234.50	209.91	20.00	189.91	82.29
19		234.50	209.47	30.00	179.47	77.77
20		121.50	207.73	38.00	169.73	73.55
21		71.50	207.39	37.00	170.39	73.84
22		71.50	207.11	36.00	171.11	74.15
23		72.00	206.82	35.00	171.82	74.46
24		.00	206.29	34.00	172.29	74.66
25		.00	205.18	33.00	172.18	74.61
26		.00	204.74	28.00	176.74	76.59
27		.00	204.66	28.00	176.66	76.55
28		.00	204.66	27.00	177.66	76.99
29		99.50	205.96	35.00	170.96	74.08
30		186.50	196.50	36.00	160.50	69.55
31		214.50	185.96	37.00	148.96	64.55
32		.00	171.25	34.00	137.25	59.48
33		99.00	172.47	33.00	139.47	60.44
34		91.50	174.01	31.00	143.01	61.97
35		.00	174.01	34.00	140.01	60.67
36		.00	196.75	34.00	162.75	70.52
37		.00	177.75	34.00	143.75	62.29
38		161.50	176.25	33.00	143.25	62.08
39		.00	170.70	33.00	137.70	59.67
40		150.50	156.89	33.00	123.89	53.69
41		.00	144.34	34.00	110.34	47.82
42		21.00	169.06	34.00	135.06	58.53
43		4050.00	134.45	34.00	100.45	43.53

44	521.00	168.93	33.00	135.93	58.90
45	109.50	133.88	30.00	103.88	45.01
46	109.50	133.61	28.00	105.61	45.77
47	99.00	133.14	25.00	108.14	46.86
48	.00	202.58	35.00	167.58	72.62
49	193.00	181.58	25.00	156.58	67.85
50	69.00	181.74	26.00	155.74	67.49
51	117.50	179.14	27.00	152.14	65.93
52	104.00	177.68	28.00	149.68	64.86
53	45.50	175.25	29.00	146.25	63.38
54	155.50	176.21	31.00	145.21	62.92
55	162.00	188.39	27.00	161.39	69.93
56	62.50	196.39	27.00	169.39	73.40
57	.00	200.39	28.00	172.39	74.70
58	.00	203.63	32.00	171.63	74.37
59	.00	202.42	31.00	171.42	74.28
60	99.50	202.69	31.00	171.69	74.40
61	4.00	202.39	31.00	171.39	74.27
62	63.50	202.23	32.00	170.23	73.77
63	161.50	202.12	38.00	164.12	71.12
64	90.00	201.99	30.00	171.99	74.53
65	167.00	201.55	30.00	171.55	74.34
66	265.00	201.39	30.00	171.39	74.27
67	53.00	201.36	30.00	171.36	74.26
68	53.00	201.36	30.00	171.36	74.26
69	53.00	201.36	30.00	171.36	74.26
70	.00	201.37	32.00	169.37	73.39
71	.00	202.45	34.00	168.45	72.99
72	158.50	201.12	32.00	169.12	73.28
73	144.00	201.03	31.00	170.03	73.68
74	236.00	200.99	30.00	170.99	74.10
75	135.50	201.04	30.00	171.04	74.12
76	86.00	201.31	29.00	172.31	74.67
77	15.50	201.69	28.00	173.69	75.26
78	4442.50	201.38	20.00	181.38	78.60
79	.00	202.58	35.00	167.58	72.62

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8541.41
6	12307.64
23	15135.95

NET SYSTEM INFLOW = 35985.00
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 35985.00

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
55	2162.00
10	20833.00

S I M U L A T I O N   R E S U L T S

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00180

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	NODE NOS. #2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8532.07	.02	149.08	.00	2.69	.64
2	1	2	7929.16	1.35	.00	.00	3.60	1.35
3	1	2	602.92	1.35	.00	.00	1.71	1.35
4	2	3	5269.52	.65	.00	.00	1.66	.26
5	2	3	3262.55	.65	.00	.00	1.48	.26
6-FG	0	3	12263.41	65.95	.00	.00	12.52	25.36
7	3	4	11451.80	1.49	.00	.00	3.61	1.10
8	3	4	7090.22	1.49	.00	.00	3.22	1.10
9	3	4	2253.46	1.49	.00	.00	2.30	1.10
10	4	5	11193.80	1.74	.00	.00	3.53	1.06
11	4	5	6930.48	1.74	.00	.00	3.15	1.06
12	4	5	2202.69	1.74	.00	.00	2.25	1.06
13	5	6	12496.47	2.39	.00	.00	3.94	1.29
14	5	6	7737.01	2.39	.00	.00	3.51	1.29
15	6	7	20233.48	2.84	.00	.00	9.18	7.67
16-PU	7	8	6744.49	.02	78.28	.00	3.06	1.00
17-PU	7	8	6744.49	.02	78.28	.00	3.06	1.00
18-PU	7	8	6744.49	.02	78.28	.00	3.06	1.00
19-XXCV	7	8						
20	8	9	20233.48	.54	.00	.00	9.18	7.67
21	9	10	10116.74	6.38	.00	.00	4.59	2.13
22	9	10	10116.74	6.38	.00	.00	4.59	2.13
23-FG	0	10	13190.02	3.06	.00	.00	3.05	.67
24	10	11	12590.50	5.11	.00	.00	2.92	.62
25-XXCV	5	12						
26	11	12	654.14	.63	.00	.00	1.04	.33
27	11	13	11936.36	2.10	.00	.00	2.76	.56
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	175.36	.04	.00	.00	.28	.03
31	17	16	331.36	.07	.00	.00	.53	.09
32	13	17	393.86	.03	.00	.00	.63	.13
33	12	18	418.64	1.38	.00	.00	1.19	.69
34	18	19	184.14	.27	.00	.00	.52	.15
35	15	19	50.36	.04	.00	.00	.14	.01
36	13	20	11386.50	1.36	.00	.00	3.59	1.09
37	20	21	11265.00	.25	.00	.00	3.55	1.07
38	21	22	11193.50	.21	.00	.00	3.53	1.05
39	22	23	11122.00	.21	.00	.00	3.51	1.04
40	23	24	11050.00	.39	.00	.00	3.48	1.03
41-XX	15	28						

42	24	25	9695.01	.89	.00	.00	3.06	.81
43	25	26	9695.01	.35	.00	.00	4.40	1.96
44	26	27	8792.01	.07	.00	.00	2.77	.67
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	8792.01	1.65	.00	.00	2.77	.67
48	24	29	1354.99	.14	.00	.00	2.16	1.27
49	29	30	1255.49	3.84	.00	.00	3.56	5.27
50	30	31	1068.99	3.79	.00	.00	3.03	3.91
51	31	32	854.49	4.39	.00	.00	2.42	2.58
52	33	32	112.91	.03	.00	.00	.32	.06
53	34	33	211.91	.11	.00	.00	.60	.20
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	1699.48	6.46	.00	.00	4.82	9.23
57	38	37	-464.91	.29	.00	.00	1.32	.84
58	34	38	-303.41	.27	.00	.00	.86	.38
59	37	39	596.83	1.73	.00	.00	1.69	1.33
60	32	39	555.95	1.01	.00	.00	1.58	1.16
61	32	40	411.45	.76	.00	.00	1.17	.67
62	40	41	260.95	.33	.00	.00	.74	.29
63	39	41	107.55	.08	.00	.00	.31	.06
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	637.74	1.50	.00	.00	1.81	1.50
68	54	53	482.24	.92	.00	.00	1.37	.90
69	39	53	503.23	.71	.00	.00	1.43	.97
70	53	52	939.97	2.48	.00	.00	2.67	3.08
71	52	51	835.97	.99	.00	.00	2.37	2.48
72	51	50	718.47	1.09	.00	.00	2.04	1.87
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	8792.01	.10	.00	.00	2.77	.67
75-XX	48	36						
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	-456.47	.82	.00	.00	1.29	.81
80	56	55	1705.53	9.29	.00	.00	4.84	9.29
81	57	56	1768.03	4.62	.00	.00	5.02	9.93
82-XX	36	57						
83	71	77	6606.27	.79	.00	.00	2.08	.40
84	77	57	1768.03	1.49	.00	.00	5.02	9.93
85	26	58	903.00	1.03	.00	.00	2.56	2.86
86	58	59	695.02	1.11	.00	.00	1.97	1.76
87	58	60	207.98	.88	.00	.00	1.33	1.36
88	60	61	108.48	.26	.00	.00	.69	.41
89	59	61	120.52	.04	.00	.00	.34	.07
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	574.50	.38	.00	.00	1.63	1.24
93	64	65	484.50	.38	.00	.00	1.37	.90
94	65	66	317.50	.13	.00	.00	.90	.41
95	66	67	52.50	.01	.00	.00	.15	.01
96	68	67	.50	.00	.00	.00	.00	.00
97	69	68	53.50	.00	.00	.00	.15	.02
98	70	69	106.50	.02	.00	.00	.30	.05
99	71	70	486.26	1.20	.00	.00	1.38	.91
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	379.76	.24	.00	.00	1.08	.58
102	72	73	221.26	.08	.00	.00	.63	.21
103	73	74	77.26	.02	.00	.00	.22	.03
104	75	74	158.74	.05	.00	.00	.45	.11
105	76	75	294.24	.29	.00	.00	.83	.36
106	77	76	380.24	.40	.00	.00	1.08	.58
107	77	78	4442.50	.30	.00	.00	1.40	.19

108-XX	57	78						
109	71	36	1699.48	1.94	.00	.00	4.82	9.23

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	159.06	120.00	39.06	16.93
2		.00	157.71	75.00	82.71	35.84
3		.00	157.05	77.00	80.05	34.69
4		468.50	155.57	50.00	105.57	45.75
5		93.50	153.83	85.00	68.83	29.83
6		.00	151.43	95.00	56.43	24.46
7		.00	148.60	98.00	50.60	21.92
8		.00	226.86	98.00	128.86	55.84
9		.00	226.32	102:00	124.32	53.87
10		20833.00	219.94	175.00	44.94	19.48
11		.00	214.83	55.00	159.83	69.26
12		235.50	214.21	25.00	189.21	81.99
13		156.00	212.73	45.00	167.73	72.68
14		.00	214.21	45.00	169.21	73.32
15		125.00	212.60	45.00	167.60	72.63
16		156.00	212.64	45.00	167.64	72.64
17		62.50	212.71	45.00	167.71	72.67
18		234.50	212.83	20.00	192.83	83.56
19		234.50	212.56	30.00	182.56	79.11
20		121.50	211.37	38.00	173.37	75.13
21		71.50	211.12	37.00	174.12	75.45
22		71.50	210.91	36.00	174.91	75.80
23		72.00	210.71	35.00	175.71	76.14
24		.00	210.31	34.00	176.31	76.40
25		.00	209.42	33.00	176.42	76.45
26		.00	209.07	28.00	181.07	78.46
27		.00	209.00	28.00	181.00	78.43
28		.00	209.00	27.00	182.00	78.87
29		99.50	210.17	35.00	175.17	75.91
30		186.50	206.33	36.00	170.33	73.81
31		214.50	202.54	37.00	165.54	71.73
32		.00	198.15	34.00	164.15	71.13
33		99.00	198.18	33.00	165.18	71.58
34		91.50	198.30	31.00	167.30	72.50
35		.00	198.30	34.00	164.30	71.20
36		.00	205.31	34.00	171.31	74.24
37		.00	198.85	34.00	164.85	71.44
38		161.50	198.56	33.00	165.56	71.74
39		.00	197.14	33.00	164.14	71.13
40		150.50	197.39	33.00	164.39	71.23
41		.00	197.06	34.00	163.06	70.66
42		21.00	195.49	34.00	161.49	69.98
43		50.50	196.96	34.00	162.96	70.61
44		521.00	195.36	33.00	162.36	70.36
45		109.50	196.38	30.00	166.38	72.10
46		109.50	196.12	28.00	168.12	72.85
47		99.00	195.64	25.00	170.64	73.94
48		.00	207.35	35.00	172.35	74.69
49		193.00	191.72	25.00	166.72	72.25
50		69.00	191.88	26.00	165.88	71.88
51		117.50	192.96	27.00	165.96	71.91
52		104.00	193.95	28.00	165.95	71.91
53		45.50	196.43	29.00	167.43	72.55
54		155.50	197.35	31.00	166.35	72.09
55		2162.00	191.06	27.00	164.06	71.09

56	62.50	200.35	27.00	173.35	75.12
57	.00	204.97	28.00	176.97	76.69
58	.00	208.04	32.00	176.04	76.28
59	.00	206.93	31.00	175.93	76.24
60	99.50	207.16	31.00	176.16	76.34
61	4.00	206.89	31.00	175.89	76.22
62	63.50	206.74	32.00	174.74	75.72
63	161.50	206.62	38.00	168.62	73.07
64	90.00	206.55	30.00	176.55	76.50
65	167.00	206.17	30.00	176.17	76.34
66	265.00	206.04	30.00	176.04	76.28
67	53.00	206.03	30.00	176.03	76.28
68	53.00	206.03	30.00	176.03	76.28
69	53.00	206.03	30.00	176.03	76.28
70	.00	206.05	32.00	174.05	75.42
71	.00	207.25	34.00	173.25	75.07
72	158.50	205.81	32.00	173.81	75.32
73	144.00	205.73	31.00	174.73	75.72
74	236.00	205.71	30.00	175.71	76.14
75	135.50	205.76	30.00	175.76	76.16
76	86.00	206.05	29.00	177.05	76.72
77	15.50	206.46	28.00	178.46	77.33
78	4442.50	206.15	20.00	186.15	80.67
79	.00	207.35	35.00	172.35	74.69

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8532.07
6	12263.41
23	13190.02

NET SYSTEM INFLOW = 33985.50
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 33985.50

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
10	20833.00
76	1586.00

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00055

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8529.90	.02	149.18	.00	2.69	.64
2	1	2	7927.14	1.35	.00	.00	3.60	1.35
3	1	2	602.76	1.35	.00	.00	1.71	1.35
4	2	3	5268.18	.65	.00	.00	1.66	.26
5	2	3	3261.72	.65	.00	.00	1.48	.26
6-FG	0	3	12253.12	65.84	.00	.00	12.51	25.32
7	3	4	11444.94	1.48	.00	.00	3.61	1.10
8	3	4	7085.97	1.48	.00	.00	3.22	1.10
9	3	4	2252.11	1.48	.00	.00	2.30	1.10
10	4	5	11186.95	1.74	.00	.00	3.53	1.05
11	4	5	6926.24	1.74	.00	.00	3.14	1.05
12	4	5	2201.34	1.74	.00	.00	2.25	1.05
13	5	6	12488.78	2.39	.00	.00	3.94	1.29
14	5	6	7732.25	2.39	.00	.00	3.51	1.29
15	6	7	20221.03	2.84	.00	.00	9.18	7.66
16-PU	7	8	6740.34	.02	78.37	.00	3.06	1.00
17-PU	7	8	6740.34	.02	78.37	.00	3.06	1.00
18-PU	7	8	6740.34	.02	78.37	.00	3.06	1.00
19-XXCV	7	8						
20	8	9	20221.03	.54	.00	.00	9.18	7.66
21	9	10	10110.51	6.37	.00	.00	4.59	2.12
22	9	10	10110.51	6.37	.00	.00	4.59	2.12
23-FG	0	10	12702.47	2.85	.00	.00	2.94	.63
24	10	11	12090.50	4.74	.00	.00	2.80	.57
25-XXCV	5	12						
26	11	12	642.19	.61	.00	.00	1.02	.32
27	11	13	11448.31	1.95	.00	.00	2.65	.52
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	187.31	.04	.00	.00	.30	.03
31	17	16	343.31	.07	.00	.00	.55	.10
32	13	17	405.81	.03	.00	.00	.65	.14
33	12	18	406.69	1.31	.00	.00	1.15	.65
34	18	19	172.19	.24	.00	.00	.49	.13
35	15	19	62.31	.06	.00	.00	.18	.02
36	13	20	10886.50	1.25	.00	.00	3.43	1.00
37	20	21	10765.00	.23	.00	.00	3.39	.98
38	21	22	10693.50	.19	.00	.00	3.37	.97
39	22	23	10622.00	.19	.00	.00	3.35	.96
40	23	24	10550.00	.36	.00	.00	3.33	.95
41-XX	15	28						
42	24	25	9474.12	.85	.00	.00	2.99	.77
43	25	26	9474.12	.34	.00	.00	4.30	1.88
44	26	27	8418.51	.06	.00	.00	2.65	.62
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	8418.51	1.52	.00	.00	2.65	.62
48	24	29	1075.88	.09	.00	.00	1.72	.83
49	29	30	976.38	2.41	.00	.00	2.77	3.31
50	30	31	789.88	2.17	.00	.00	2.24	2.23
51	31	32	575.38	2.11	.00	.00	1.63	1.24
52	33	32	18.90	.00	.00	.00	.05	.00
53	34	33	117.90	.04	.00	.00	.33	.07

54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	1066.57	2.73	.00	.00	3.03	3.89
57	38	37	-370.90	.19	.00	.00	1.05	.55
58	34	38	-209.40	.13	.00	.00	.59	.19
59	37	39	356.28	.66	.00	.00	1.01	.51
60	32	39	287.31	.30	.00	.00	.81	.34
61	32	40	306.97	.44	.00	.00	.87	.39
62	40	41	156.47	.13	.00	.00	.44	.11
63	39	41	212.03	.27	.00	.00	.60	.20
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	339.40	.47	.00	.00	.96	.47
68	54	53	183.90	.15	.00	.00	.52	.15
69	39	53	-110.45	.04	.00	.00	.31	.06
70	53	52	27.95	.00	.00	.00	.08	.00
71	52	51	-76.05	.01	.00	.00	.22	.03
72	51	50	-193.55	.10	.00	.00	.55	.17
73	50	49	193.00	.16	.00	.00	.55	.16
74	79	71	8418.51	.09	.00	.00	2.65	.62
75-XX	48	36						
76	47	46	-99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	455.55	.82	.00	.00	1.29	.81
80	56	55	617.55	1.42	.00	.00	1.75	1.42
81	57	56	680.05	.79	.00	.00	1.93	1.69
82-XX	36	57						
83	71	77	6574.97	.79	.00	.00	2.07	.39
84	77	57	680.05	.25	.00	.00	1.93	1.69
85	26	58	1055.61	1.38	.00	.00	2.99	3.82
86	58	59	819.14	1.50	.00	.00	2.32	2.39
87	58	60	236.47	1.12	.00	.00	1.51	1.72
88	60	61	136.97	.41	.00	.00	.87	.63
89	59	61	92.03	.02	.00	.00	.26	.04
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	727.11	.59	.00	.00	2.06	1.92
93	64	65	637.11	.63	.00	.00	1.81	1.50
94	65	66	470.11	.27	.00	.00	1.33	.85
95	66	67	205.11	.10	.00	.00	.58	.18
96	68	67	-152.11	.04	.00	.00	.43	.11
97	69	68	-99.11	.01	.00	.00	.28	.05
98	70	69	-46.11	.00	.00	.00	.13	.01
99	71	70	776.98	2.86	.00	.00	2.20	2.17
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	823.09	.99	.00	.00	2.33	2.41
102	72	73	664.59	.63	.00	.00	1.89	1.62
103	73	74	520.59	.80	.00	.00	1.48	1.03
104	75	74	-284.59	.16	.00	.00	.81	.34
105	76	75	-149.09	.08	.00	.00	.42	.10
106	77	76	1436.91	4.73	.00	.00	4.08	6.76
107	77	78	4442.50	.30	.00	.00	1.40	.19
108-XX	57	78						
109	71	36	1066.57	.82	.00	.00	3.03	3.89

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	159.16	120.00	39.16	16.97

2		.00	157.81	75.00	82.81	35.88
3		.00	157.16	77.00	80.16	34.73
4		468.50	155.67	50.00	105.67	45.79
5		93.50	153.93	85.00	68.93	29.87
6		.00	151.54	95.00	56.54	24.50
7		.00	148.71	98.00	50.71	21.97
8		.00	227.06	98.00	129.06	55.92
9		.00	226.52	102.00	124.52	53.96
10		20833.00	220.15	175.00	45.15	19.56
11		.00	215.41	55.00	160.41	69.51
12		235.50	214.80	25.00	189.80	82.25
13		156.00	213.46	45.00	168.46	73.00
14		.00	214.80	45.00	169.80	73.58
15		125.00	213.32	45.00	168.32	72.94
16		156.00	213.37	45.00	168.37	72.96
17		62.50	213.44	45.00	168.44	72.99
18		234.50	213.50	20.00	193.50	83.85
19		234.50	213.26	30.00	183.26	79.41
20		121.50	212.21	38.00	174.21	75.49
21		71.50	211.99	37.00	174.99	75.83
22		71.50	211.79	36.00	175.79	76.18
23		72.00	211.60	35.00	176.60	76.53
24		.00	211.24	34.00	177.24	76.80
25		.00	210.39	33.00	177.39	76.87
26		.00	210.05	28.00	182.05	78.89
27		.00	209.99	28.00	181.99	78.86
28		.00	209.99	27.00	182.99	79.29
29		99.50	211.15	35.00	176.15	76.33
30		186.50	208.74	36.00	172.74	74.85
31		214.50	206.57	37.00	169.57	73.48
32		.00	204.46	34.00	170.46	73.87
33		99.00	204.46	33.00	171.46	74.30
34		91.50	204.50	31.00	173.50	75.18
35		.00	204.50	34.00	170.50	73.88
36		.00	207.55	34.00	173.55	75.21
37		.00	204.83	34.00	170.83	74.02
38		161.50	204.63	33.00	171.63	74.37
39		.00	204.16	33.00	171.16	74.17
40		150.50	204.02	33.00	171.02	74.11
41		.00	203.89	34.00	169.89	73.62
42		21.00	202.52	34.00	168.52	73.02
43		50.50	203.79	34.00	169.79	73.58
44		521.00	202.39	33.00	169.39	73.40
45		109.50	203.21	30.00	173.21	75.06
46		109.50	202.95	28.00	174.95	75.81
47		99.00	202.47	25.00	177.47	76.90
48		.00	208.46	35.00	173.46	75.17
49		193.00	204.15	25.00	179.15	77.63
50		69.00	204.31	26.00	178.31	77.27
51		117.50	204.21	27.00	177.21	76.79
52		104.00	204.20	28.00	176.20	76.35
53		45.50	204.20	29.00	175.20	75.92
54		155.50	204.36	31.00	173.36	75.12
55		162.00	205.13	27.00	178.13	77.19
56		62.50	206.54	27.00	179.54	77.80
57		.00	207.33	28.00	179.33	77.71
58		.00	208.67	32.00	176.67	76.56
59		.00	207.17	31.00	176.17	76.34
60		99.50	207.55	31.00	176.55	76.51
61		4.00	207.15	31.00	176.15	76.33
62		63.50	206.99	32.00	174.99	75.83
63		161.50	206.88	38.00	168.88	73.18
64		90.00	206.58	30.00	176.58	76.52
65		167.00	205.95	30.00	175.95	76.24
66		265.00	205.67	30.00	175.67	76.13
67		53.00	205.57	30.00	175.57	76.08

68	53.00	205.53	30.00	175.53	76.06
69	53.00	205.51	30.00	175.51	76.06
70	.00	205.51	32.00	173.51	75.19
71	.00	208.37	34.00	174.37	75.56
72	158.50	204.52	32.00	172.52	74.76
73	144.00	203.89	31.00	172.89	74.92
74	236.00	203.09	30.00	173.09	75.00
75	135.50	202.93	30.00	172.93	74.94
76	1586.00	202.85	29.00	173.85	75.33
77	15.50	207.58	28.00	179.58	77.82
78	4442.50	207.28	20.00	187.28	81.15
79	.00	208.46	35.00	173.46	75.17

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8529.90
6	12253.12
23	12702.47

NET SYSTEM INFLOW = 33485.49
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 33485.50

**** KYPIPE SIMULATION COMPLETED ****

DATE: 8/ 2/2000
TIME: 8:59:53

TNWRE
Tom Nance Water
Resource Engineering

January 31, 2003
03/041 (03-09)

Mr. Tosh Hosoda
Senior Vice President
Gentry Homes, Ltd.
P. O. Box 295
Honolulu, Hawaii 96809

Dear Mr. Hosoda:

Inclusion of Ewa Makai in the
Potable Water Master Plan for Ewa by Gentry

The latest approved potable water master plan for the Ewa by Gentry project was prepared by our firm in September 2000 and approved by the Board of Water Supply on November 3, 2000. It included all of the Ewa Makai project areas on both sides of Fort Weaver Road (the areas formerly known as Laulani and Fairways).

I have compared Gentry's current (January 30, 2003) land use plan for all of its Ewa project areas with the land use plan which was the basis of the September 2000 potable water master plan our firm prepared. There are only nominal changes to the areas of the School, Park, and Commercial parcels. The number of residential units is 47 higher than in the approved water master plan. However, because there is a shift from less single family to more multi-family units in the current land use plan, the project's water requirements have actually been reduced (refer to the tally below). As a result, size requirements for well supply, reservoir storage, and pipeline hydraulic capacity for the Gentry Ewa project have actually been reduced.

Changes from the September 2002 BWS-Approved Potable Water Master Plan for Ewa by Gentry

Residential Unit Type	Unit Use Rate (GPD)	Change in Required Supply (GPD)
Addition of 309 Multi-Family Units Reduction of 262 Single Family Units	276 500	+85,284 -131,000
Net Change for 47 More Units	- -	-45,716

680 Ala Moana Boulevard, Suite 406 • Honolulu, Hawaii 96813-5411 • Phone: (808) 537-1141 • Fax: (808) 538-7757 • E-mail: office@tnwre.com

The only other change of significance since the September 2000 water master plan was prepared is BWS' conversion of its 16-inch potable main in Fort Weaver Road for use by its non-potable system. That conversion was completed in late 2001. However, the BWS-approved Gentry water master plan anticipated that this conversion would take place and incorporated hydraulic analyses with the 16-inch Fort Weaver main no longer available for potable use.

Based on the foregoing, it is my opinion that the water master plan approved by BWS in November 2000 is still valid for Gentry's current land use plan.

Sincerely,

Tom Nance

Tom Nance

APPENDIX E

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

January 24, 2003

Ms. Debra M. A. Luning
The Gentry Companies
Gentry Homes, Ltd.
P. O. Box 295
Honolulu, Hawaii 96809

Dear Ms. Luning:

Subject: Your Letter Dated January 9, 2003 Regarding the Availability of Potable Water for Ewa Makai Development, Ewa Oahu

Thank you for your letter regarding water service to the proposed Ewa Makai Development.

The Board of Water Supply (BWS) does not provide advance water allocations or water reservations. Water commitments are made at the building permit or construction drawing stage on a first come, first serve basis. When water is made available, the developer will be required to pay our Water System Facilities Charges.

We expect to have sufficient water for the Ewa Region. The BWS currently has water system improvement projects in the construction and design stages, which will provide adequate source capacity to accommodate your proposed development. The Ewa Shaft's estimated yield is 15 million gallons per day (mgd). In addition, the proposed Desalination Facility in Kalaeloa is being designed for 5 mgd with a potential to expand to 35 mgd in the future. The installation of wells at the Waipahu Wells II Station and completion of the Waipahu Wells IV will add 4.21 mgd to our capacity to deliver water. These two well projects should be completed this year.

If you have any questions, please contact Joseph Kaakua at 527-6123.

Very truly yours,

K. Sinda

for CLIFFORD S. JAMILE
Manager and Chief Engineer

APPENDIX F

BOTANICAL SURVEY
'EWA GENTRY MAKAI
'EWA DISTRICT, O'AHU

by

Winona P. Char

CHAR & ASSOCIATES
Botanical Consultants
Honolulu, Hawai'i

Prepared for: ENVIRONMENTAL COMMUNICATIONS, INC.

June 2001

BOTANICAL SURVEY
'EWA GENTRY MAKAI
'EWA DISTRICT, O'AHU

INTRODUCTION

The project site consists of approximately 283 acres bounded by the former Barbers Point Naval Air Station to the west, the Coral Creek Golf Course and residential lots to the north, overgrown sugar cane fields to the east, and the Hawaii Prince Golf Course and residential lots to the south. The site is divided into two parcels by Fort Weaver Road. The 'Ewa Makai-East parcel consists of ±115 acres, while the 'Ewa Makai-West parcel is approximately 168 acres.

The project site as well as the adjacent lands were used for sugar cane cultivation until 1995 when Oahu Sugar Company, Ltd. ceased operations. Currently the site is used for limited grazing activities; a few horses were observed on the west parcel during this survey.

Field studies to assess the botanical resources on the project site were conducted on 07 and 14 June 2001 by a team of two botanists. The primary objectives of the field studies were to:

1) provide a general description of the vegetation on the site;
2) inventory the flora;
3) search for threatened and endangered species as well as species of concern; and
4) identify areas of potential environmental problems or concerns and propose appropriate mitigation measures.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Topographic maps were examined to determine terrain characteristics, access, boundaries, and reference points.

A walk-through survey method was used. Notes were made on plant associations and distribution, disturbances, substrate types, drainage, topography, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium, and for comparison with the recent taxonomic literature.

The species are indicative of the season ("rainy" vs. "dry") and the environmental conditions at the time of the survey. A survey taken at a different time of the year and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the weedy, annual plants.

DESCRIPTION OF THE VEGETATION

Prior to 1995, the project site was under active sugar cane cultivation. A botanical survey of the site by Char in 1991 described dense fields of sugar cane on the cultivated portions of the site, and weedy vegetation on the uncultivated areas such as along cane haul roads, irrigation ditches, and the Kaloi drainage channel. A ±20-acre parcel surrounded by the 'Ewa Makai-West property and Fort Weaver Road was surveyed in 1998 by Char for the proposed Laulani Commercial Center. Weedy scrub vegetation had replaced the former sugar cane fields.

Today, the 283-acre project site is covered by scattered weedy patches and large areas with barren soil. Both the 'Ewa Makai-East and 'Ewa Makai-West parcels have been used for grazing horses; as a result the vegetation on both parcels is sparse with about 50 to 60% plant cover.

An inventory of all the plants found during the field studies is presented in the species checklist at the end of this report.

Scrub Vegetation

Due to prolonged drought conditions and grazing pressure, the vegetation on the site consists of live and dried up patches of weedy plants with scattered young trees of kiawe (Prosopis pallida), 10 to 15 ft. tall. Locally abundant are golden crown-beard (Verbesina encelioides), running pop (Passiflora foetida), and 'uhaloa (Waltheria indica). Where the substrate consists of soil and broken up coralline material, Indian pluchea (Pluchea indica) and sourbush (Pluchea carolinensis) become abundant, forming 20 to 30% of the plant cover. A few shrubs of koa haole (Leucaena leucocephala), klu (Acacia farnesiana), and Christmas berry (Schinus terebinthifolius) are found scattered here and there; these tend to be 1 to 3 ft. tall. Other plants which occur here in smaller numbers include buffelgrass (Cenchrus ciliaris), Australian saltbush (Atriplex semibaccata), virgate mimosa (Desmathus pernambucanus), Sida ciliaris, and pa'uohi'iaka (Jacquemontia ovalifolia ssp. sandwicensis). 'Ilima (Sida fallax) occurs as scattered shrubs, but may be locally abundant during the wetter months.

On the 'Ewa Makai-West parcel, the former Kaloi drainage channel supports dried clumps of Guinea grass (Panicum maximum) and koa haole shrubs. A few live castor bean plants (Ricinus communis) are found here. Where the parcel abuts the Barbers Point Naval Air Station Golf Course, there is a strip of greener vegetation with more or less dense buffelgrass and weeds such as false mallow (Malvastrum coromandelianum), hairy spurge (Chamaesyce hirta), Boerhavia coccinea, and Calyptocarpus vialis.

On the 'Ewa Makai-East parcel, low lying swale areas which receive runoff from the adjacent mauka projects support dense, green patches of golden crown-beard, large Pluchea shrubs (7 to 8 ft. tall), 'ilima, ivy gourd (Coccinia grandis), 'uhaloa, hoary abutilon (Abutilon incanum), coat buttons (Tridax procumbens), etc. A small drainageway with standing water supports a number of weedy species including spiny amaranth (Amaranthus spinosus), slender amaranth (Amaranthus viridis), wiregrass (Eleusine indica), false daisy (Eclipta alba), castor bean, Leptochloa fusca ssp. uninervia, common purslane (Portulaca oleracea), nutgrass (Cyperus rotundus), and Bermuda grass (Cynodon dactylon).

DISCUSSION AND RECOMMENDATIONS

The project site has been disturbed for a long period of time, first by extensive sugar cane cultivation and recently by grazing activity. As a result, the vegetation on the site consists largely of introduced or alien plant species such as sourbush, Indian pluchea, golden crown-beard, buffelgrass, kiawe, etc. Of a total of 62 species inventoried on the site, 56 (90%) are introduced. A few native species occur on the site, some of them in fairly large numbers. These are: 'uhaloa, 'ilima, pa'uohi'iaka, kipukai (Heliotropium curassavicum), hoary abutilon, and popolo (Solaum americanum). Only the pa'uohi'iaka is endemic, that is, it is native only to the Hawaiian Islands. The other species are indigenous, that is, they are native to the Hawaiian Islands and elsewhere.

An intensive search was made for Abutilon menziesii, a listed endangered species belonging to the mallow family. The Abutilon is known from the abandoned sugar cane fields on the Varona Village/ 'Ewa mill area (Nagata 1996; PBR Hawaii 1998). No Abutilon menziesii plants were found nor did we encounter any other threatened and endangered species or species of concern (U.S. Fish and Wildlife Service 1999; Wagner et al. 1999) on the project site.

Given these findings, the proposed development of the site is not expected to have a significant negative impact on the botanical resources. It is recommended, however, that landscaping be installed as soon as possible to prevent dust problems and soil loss.

LITERATURE CITED

Char, W.P. (Char & Associates). 1991. Botanical Survey, Laulani/ Fairways Subdivision, 'Ewa District, Island of O'ahu. Prepared for William E. Wanket, Inc. August 1991.

Char, W.P. (Char & Associates). 1998. Botanical Resources, ±20-Acre Laulani Commercial Center. Letter report prepared for William E. Wanket, Inc. August 1998.

Evenhuis, N.L. and S.E. Miller, editors. 1995-1998. Records of the Hawaii Biological Survey. Bishop Museum Occasional Papers Nos. 41-56.

Evenhuis, N.L. and L.E. Eldredge, editors. 1999-2000. Records of the Hawaii Biological Survey. Bishop Museum Occasional Papers Nos. 58-64.

Nagata, K.M. 1996. East Kapolei Master Plan, Biological Survey. Prepared for PBR Hawaii. September 1996.

PBR Hawaii. 1998. East Kapolei Master Plan, Habitat Conservation Plan for Abutilon menziesii. Prepared for State of Hawai'i, Housing Finance Development Corporation. June 1998.

U.S. Fish and Wildlife Service. 1999. U.S. Fish and Wildlife Service species list, plants. March 23, 1999. Pacific Islands Ecoregion Office, Honolulu, HI.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. 2 vols. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI. Bishop Museum Special Publication 83.

Wagner, W.L., M.M. Bruegmann, D.R. Herbst, and J.Q.C. Lau. 1999. Hawaiian vascular plants at risk: 1999. Bishop Museum Occasional Papers No. 60.

PLANT SPECIES LIST -- 'Ewa Gentry Makai

The following checklist is an inventory of all the plants observed on the project site during the field studies. The plant names are arranged alphabetically by families within each of two groups: Dicots and Monocots. The taxonomy and nomenclature of the flowering plants follow Wagner et al. (1990). The few recent name changes for the flowering plants follow those reported in the Hawaii Biological Survey series (Evenhuis and Miller 1995-1998; Evenhuis and Eldredge 1999-2000).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands.
   - I = indigenous = native to the Hawaiian Islands and also elsewhere.
   - I? = questionably indigenous = data not clear if dispersal to the islands by natural or human-related mechanisms, but weight of evidence suggests probably indigenous.
   - X = introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact, that is, Cook's arrival in the islands in 1778.
   - X? = questionably introduced = date of introduction unclear or very soon after Western contact; may possibly be indigenous or of Polynesian introduction.

Scientific name	Common name	Status
FLOWERING PLANTS		
DICOTS		
AMARANTHACEAE (Amaranth family)		
Alternanthera pungens Kunth	khaki weed	X
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X
Amaranthus viridis L.	slender amaranth, pakai	X
ANACARDIACEAE (Mango family)		
Schinus terebinthifolius Raddi	Christmas berry	X
ASCLEPIADACEAE (Milkweed family)		
Calotropis gigantea (L.) W.T. Aiton	crown flower	X
ASTERACEAE (Daisy family)		
Calyptocarpus vialis Less.		X
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X
Eclipta prostrata (L.) L.	false daisy	X
Flaveria trinervia (Spreng.) C. Mohr.	flaveria	X
Pluchea carolinensis (Jacq.) G. Don	sourbush, pluchea	X
Pluchea X fosbergii Cooperr. & Galang	pluchea hybrid	X
Pluchea indica (L.) Less.	Indian fleabane	X
Sonchus oleraceus L.	sowthistle, pualele	X
Spagneticola trilobata (L.) Pruski	wedelia	X
Tridax procumbens L.	coat buttons	X
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	X
BORAGINACEAE (Heliotrope family)		
Heliotropium curassavicum L.	kipukai, nena	I
Heliotropium procumbens var. depressum (Cham.) Fosb.		X
CHENOPODIACEAE (Goosefoot family)		
Atriplex semibaccata R. Br.	Australian saltbush	X
Atriplex suberecta Verd.	saltbush	X
Chenopodium murale L.	'aheahea	X
CONVOLVULACEAE (Morning glory family)		
Ipomoea obscura (L.) Ker-Gawl.	field bindweed	X
Ipomoea triloba L.	little bell, pink bindweed	X
Jacquemontia ovalifolia ssp. sandwicensis (A. Gray) K. Robertson	pa'uohi'iaka	E
Merremia aegyptia (L.) Urban	hairy merremia, koali kua hulu	X?

Scientific name	Common name	Status
CUCURBITACEAE (Gourd family)		
Coccinia grandis (L.) Voigt	coccinia, ivy gourd	X
Cucumis dipsaceus Ehrenb. & Spach	wild cucumber, hedgehog gourd, teasel gourd	X
EUPHORBIACEAE (Spurge family)		
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge	X
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X
Ricinus communis L.	castor bean, koli	X
FABACEAE (Pea family)		
Acacia farnesiana (L.) Willd.	klu	X
Crotalaria incana L.	fuzzy rattlepod, kukaehoki	X
Desmanthus pernambucanus (L.) Thellung	slender mimosa	X
Indigofera hendecaphylla Jacq.	creeping indigo	X
Indigofera suffruticosa Mill.	indigo, 'iniko	X
Leucaena leucocephala (Lam.) de Wit	koa haole	X
Pithecellobium dulce (Roxb.) Benth.	'opiuma	X
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X
Senna surattensis (N.L. Burm.) H. Irwin & Barneby	kolomona, kalamona	X
LAMIACEAE (Mint family)		
Leonotis nepetifolia (L.) R. Br.	lion's ear	X
MALVACEAE (Mallow family)		
Abutilon incanum (Link) Sweet	ma'o, hoary abutilon	I?
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X
Sida ciliaris L.		X
Sida fallax Walp.	'ilima	I
Sida rhombifolia L.	Cuba jute	X
PASSIFLORACEAE (Passion flower family)		
Passiflora foetida L.	running pop, pohapoha	X
PORTULACACEAE (Purslane family)		
Portulaca oleracea L.	common purslane, pigweed, 'ihi	X
SOLANACEAE (Nightshade family)		
Nicotiana glauca R.C. Graham	tree tobacco	X
Solanum americanum Mill.	popolo, glossy nightshade	I?
Solanum lycopersicum var. cerasiforme (Dunal) Spooner, Anderson & Jansen	currant tomato, wild tomato	X
STERCULIACEAE (Cacao family)		
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?

Scientific name	Common name	Status
ZYGOPHYLLACEAE (Creosote bush family)		
Tribulus terrestris L.	puncture vine, goat head	X
MONOCOTS		
CYPERACEAE (Sedge family)		
Cyperus rotundus L.	nutgrass, nut sedge	X
POACEAE (Grass family)		
Cenchrus ciliaris L.	buffelgrass	X
Chloris barbata (L.) Sw.	swollen fingergrass, mau'ulei	X
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X
Eleusine indica (L.) Gaertn.	wiregrass, manienie ali'i	X
Eragrostis amabilis (L.) Wight & Arnott	lovegrass	X
Leptochloa fusca ssp. uninervia (J. Presl) N. Snow		X
Melinis repens (Willd.) Zizka	Natal redtop, Natal grass	X
Panicum maximum Jacq.	Guinea grass	X
Sporobolus pyramidatus (Lam.) Hitchc.		X

APPENDIX G

AVIFAUNAL AND FERAL MAMMAL SURVEY OF THE EWA BY GENTRY MAKAI DEVELOPMENT PROJECT, OAHU

Prepared for:

Environmental Communications, Inc.

Prepared by:

Phil Bruner
Environmental Consultant
Faunal (Bird & Mammal) Surveys
Box 1775
BYU-H
Laie, Hawaii 96762

9 May 2001

INTRODUCTION

The purpose of this report is to present the findings of a field survey of a 283 acre site (Ewa by Gentry Makai) located at Ewa, Oahu (Fig. 1). Published and unpublished resources were also used to supplement the results of the field survey. The purposes of the survey were:

1- Document the species of birds and mammals currently on or near the site.
2- Investigate all habitats on the property.
3- Record any natural resources important to native and migratory birds.

GENERAL SITE DESCRIPTION

Figure One shows the location of the property. The entire area is relatively flat and is surrounded by existing residential and golf course developments. The vegetation is comprised of grasses, weeds and scattered brush. No wetland habitat was found on the property.

SURVEY METHODS

The field survey was conducted on 17, 26 April 2001. The area was surveyed on foot and from a vehicle traveling along roads at the edge of the property. Sections not visible from the roads were walked in order to search for birds and mammals. Tallies of all birds and mammals observed were kept and were used to estimate relative abundance data given in Table One. Weather during the survey days was partly cloudy with light easterly winds. These conditions did not limit the collection of data. Scientific and common names used in this report follow Pyle (1997) and Honaki et al. (1982).

RESULTS AND DISCUSSION

Native Birds:

No native birds were recorded on the field survey. The only native species that might occur in this area is the endangered Short-eared Owl (*Asio flammeus sandwichensis*). The Hawaiian name for this bird is Pueo. They are found on all the main Hawaiian Islands but are only listed as endangered on Oahu. Pueo nest on the ground and forage over open fields and forests. They are known to occur in Ewa and have been seen on the nearby HASEKO property (Bruner 1994). The available habitats and location of this site are not appropriate for other native birds. The absence of wetlands

also makes this property unattractive to native waterbirds. Earlier studies in this region have found similar results (Bruner 1991, 1993, 1994).

Migratory Birds:

Two species of migrants were seen on the survey. An average of 18 Pacific Golden-Plover (*Pluvialis fulva*) were tallied over the two survey days. Five Ruddy Turnstone (*Arenaria interpres*) were seen on 26 April. These species are not endangered or threatened. They are the two most common migrants to Hawaii (Pratt et al. 1987, Hawaii Audubon Society 1993).

Introduced Birds:

Sixteen species of introduced birds were recorded over the two survey days. Table One lists these birds and gives their relative abundance. None of these species is endangered or threatened. The array of birds recorded at this location is typical of this region of the island (Hawaiian Audubon Society 1993).

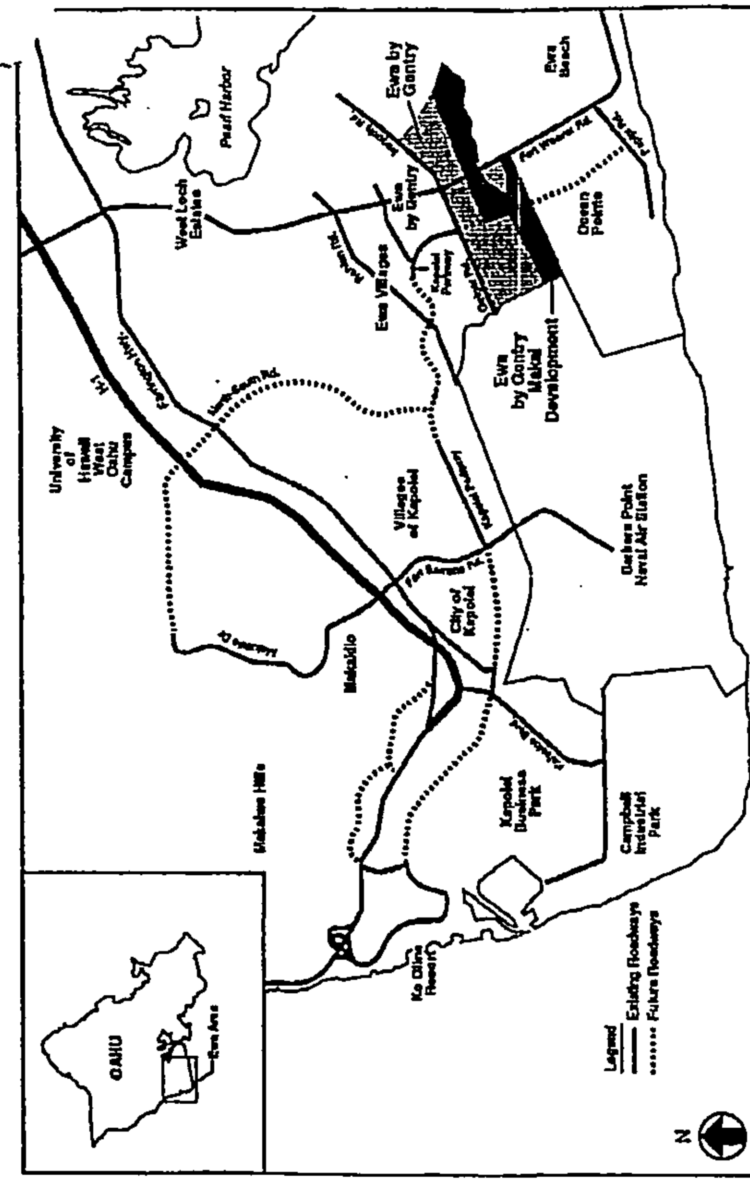
Mammals:

The only species of mammal observed on the survey was the Small Indian Mongoose (*Herpestes auropunctatus*). A total of three mongoose were tallied. Feral cats (*Felis catus*) and rats (*Rattus spp.*) were not recorded but likely occur on and near the property. The endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) was not found. This species is rarely recorded on Oahu but is fairly common on Kauai and the Big Island (Tomich 1986, Kepler and Scott 1990). The Hawaiian Hoary Bat forages in a wide variety of native and non-native habitats including urban areas. They generally roost solitarily in trees.

CONCLUSIONS

The survey of this site found the typical array of introduced birds that normally occur in the lowlands in this region of the island. The presence of the two migratory species was likewise expected. These birds utilize open habitats such as fields and lawns to forage for insects. The Small Indian Mongoose is common in dry lowland habitats.

No unique resources important to native birds were discovered on this property. Weed covered fields are not uncommon in west Oahu. The development of this property will likely result in the decrease of some species and an increase in the populations of other introduced birds.



VICINITY MAP

Fig. 1. Location of the faunal (bird and mammal) field survey. Area shown in black.

Introduced birds recorded at the Ewa by Gentry Makai Development Project site. Relative Abundance estimates are based on the following scale: Abundant = 25+; Common = 15-24; Uncommon = 5-14; Rare = less than 5 tallied for the entire time of the survey. Data from both days of the survey were averaged to obtain the relative abundance estimate number.

Common Name	Scientific Name	Relative Abundance
Cattle egret	*Bubulcus ibis*	R
Ring-necked Pheasant	*Phasianus colchicus*	R
Spotted Dove	*Streptopelia chinensis*	C
Zebra Dove	*Geopelia striata*	A
Sky Lark	*Alauda arvensis*	A
Red-vented Bulbul	*Pycnonotus cafer*	C
Northern Mockingbird	*Mimus polyglottos*	U
Common Myna	*Acridotheres tristis*	A
Japanese White-eye	*Zosterops japonicus*	U
Northern Cardinal	*Cardinalis cardinalis*	C
Red-crested Cardinal	*Paroaria coronata*	U
House Finch	*Carpodacus mexicanus*	A
House Sparrow	*Passer domesticus*	R
Common Waxbill	*Estrilda astrild*	A
Nutmeg Mannikin	*Lonchura punctulata*	A
Java Sparrow	*Padda oryzivora*	C

SOURCES CITED

Bruner, P.L. 1991. Survey of the avifauna and feral mammals at the proposed Saint Francis Medical Center-West Expansion, Ewa, Oahu. Unpubl. ms. Prep. for William E. Wanket.

______ 1993. Survey of the avifauna and feral mammals along the proposed alignment of the Ewa by Gentry East Offsite Drainage Ditch. Oahu, Hawaii. Unpubl. ms. Prep. for Parametrix, Inc.

______ 1994. Letter report summarizing the findings of faunal studies on Ewa Marina Project Property, Ewa, Oahu. Unpubl. ms. Prep. for HASEKO (Ewa) Inc.

Hawaii Audubon Society. 1993. Hawaii's Birds. Fourth edition. Hawaii Audubon Society. Honolulu.

Honacki, J.H., K.E. Kinman and J.W. Koeppl eds. 1982. Mammal species of the world: a taxonomic and geographic reference. Allen Press Inc., and the Association of Systematic Collections. Lawrence, Kansas.

Kepler, C.B. and J.M. Scott. 1990. Notes on the distribution and behavior of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). 'Elepaio 50(7): 59-64.

Pratt, H.D., P.L. Bruner and D.G. Berrett. 1987. A field guide to the birds of Hawaii and the tropical Pacific. Princeton University Press. Princeton, New Jersey.

Pyle, R.L. 1997. Checklist of the birds of Hawaii – 1997. 'Elepaio 57(9): 153-157.

Tomich, P.Q. 1986. Mammals in Hawaii. Bishop Museum Press. Honolulu.

APPENDIX H

FINAL REPORT

ARCHAEOLOGICAL SURVEY FOR THE PROPOSED 'EWA GENTRY MAKAI DEVELOPMENT 'EWA DISTRICT, AHUPUA'A OF HONOULIULI, ISLAND OF O'AHU

(TMK 9-1-10:7 AND 9-1-69:5)

Prepared for:

Environmental Communications
1188 Bishop Street, Suite 2210
Honolulu, HI 96813

Prepared by:

James McIntosh, B.A.
and
Paul L. Cleghorn, Ph. D.

Pacific Legacy, Inc.
332 Uluniu, St.
Kailua, HI 96734
(808) 263-4800 phone
(808) 263-4300 fax

January 2002

ABSTRACT

Pacific Legacy, Inc., at the request Environmental Communications, conducted an archaeological survey for the proposed 'Ewa Gentry Makai residential housing, commercial and industrial mixed uses, community facilities and open spaces development at a 283-acre parcel in 'Ewa (TMK 9-1-10:7 and 9-1-69:5), *ahupua'a* of Honouliuli, island of O'ahu. The proposed project area is currently zoned for agriculture and presently consists of fallow agricultural land formerly used for sugar cane production and limited grazing activities.

Archival research and a review of previous archaeological studies in the area indicates that the #Ewa Plain has undergone dramatic and extensive alterations over its long land use history. The review of the previous archaeology for the area determined the current project area has been previously surveyed by Davis (1988), Goodman and Cleghorn (1991), Jayatilaka et al. (1992), and Goodman et al. (1993). None of these surveys identified any cultural resources within the project area. Based on this information, it seemed extremely unlikely that any surface archaeological sites would be present within the project area. Further, given that the project area was under sugar cane cultivation for approximately 100 years, it seems unlikely that any subsurface cultural material is present in the area.

Indeed, the current survey failed to identify any surface cultural remains. The proposed project area is completely devoid of any natural features and contours. No cultural resources are present in the proposed project area.

While there are no surface archaeological sites in the project area, there is the possibility of encountering subsurface resources in the form of sinkholes containing cultural materials and possibly human burials. These features could be as deep as 3 feet below ground surface. It is recommended that an archaeologist be retained on an on-call basis to assist the contractor in the event that subsurface archaeological resources are encountered.

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

Pacific Legacy, Inc., at the request Environmental Communications, conducted an archaeological survey for the proposed 'Ewa Gentry Makai residential housing, commercial and industrial mixed uses, community facilities and open spaces development at a 283-acre parcel in 'Ewa (TMK 9-1-10:7 and 9-1-69:5), *ahupua'a* of Honouliuli, island of O'ahu (Figure 1). The proposed project area is currently zoned for agriculture and presently consists of fallow agricultural land formerly used for sugar cane production and limited grazing activities.

1.1 SCOPE OF WORK

Tasks for the current project were performed as follows:

(1) a review of the relevant previous archaeological research conducted in the immediate area;

(2) review of historic documents and literature pertaining to the area;

(3) a survey of the proposed project area; and

(4) the preparation of a final report summarizing results of the survey and recommendations for future work.

1.2 PROJECT LOCATION AND ENVIRONMENTAL SETTING

The district of 'Ewa (or The 'Ewa Plain, as it is often referred) located on the southwest side of O'ahu, was formed by "a broad elevated coral reef partly covered by alluvium carried out from the mountains" (Macdonald et al. 1983: 420). The district of 'Ewa has undergone numerous changes in modern times.

The project area is located along both the east and west sides of Fort Weaver Road. The project area is bounded by residential housing and the Coral Creek Golf Course to the north, the Hawaii Prince Golf Course and residential housing to the south, undeveloped land to the east and the former Barbers Point Naval Air Station to the west. Fort Weaver Road bisects the project area.

Elevation of the 'Ewa Plain ranges from sea level to over 200 feet (60.96 m) above mean sea level (AMSL). Approximately 20 inches (50.80 cm) of rain falls annually (with the majority occurring between November and February) with temperatures ranging between 60E and 90EF with the highest temperatures occurring in August and September (Armstrong 1983).

The only permanent running water at Honouliuli is located in Honouliuli Gulch, located on the northeast side of the *ahupua'a*, adjacent to the *ahupua'a* of Ho'ae'ae.

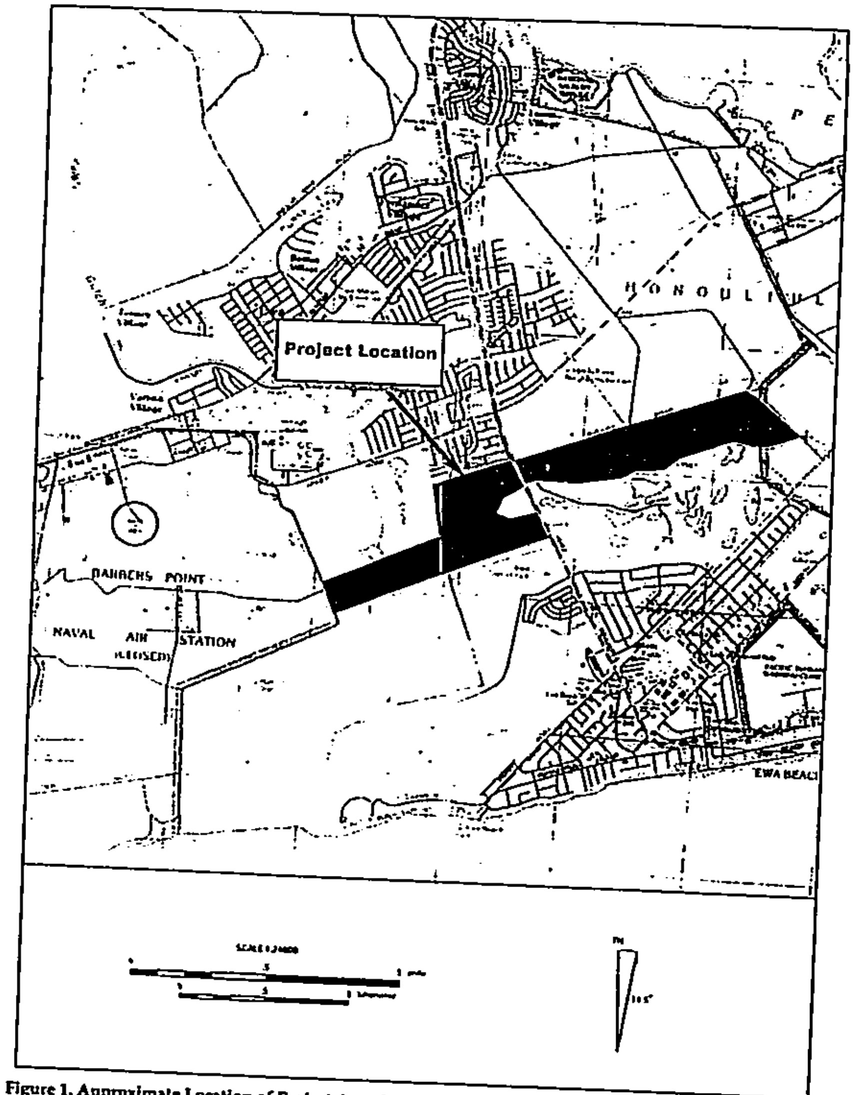


Figure 1. Approximate Location of Project Area depicted on USGS Ewa and Pearl Harbor Quadrangular Map, 1998 and 1999.

1.2.1 Vegetation
Vegetation throughout the 'Ewa Plain consists of a variety of alien plants including: lantana (*Lantana camara*), *koa haole* (*Leucaena glauca*), *klu* (*Acacia farnesiana*), *kiawe* (*Prosopis pallida*), finger grass (*Chloris* sp.), natal grass (*Tricholaena rosea*), and various ornamental trees and bushes.

1.2.2 Soils
Soils in the region of 'Ewa include: the Waipahu Series, Honouliuli Series, Pearl Harbor Series, Kaloko series, Ewa Series, Mamala series, Filled Land, and Coral Outcrop (Foote et al. 1972). Each of these soils is briefly discussed below.

Coral Outcrop consists of coral or cemented calcareous sand on the island of Oahu. The coral reefs formed in shallow ocean water during the time the ocean stand was at a higher level. Small areas of coral outcrop are exposed on the ocean shore, on the coastal plains, and at the foot of the uplands. Elevations range from sea level to approximately 100 feet. . .This land type is used for military installations, quarries, and urban development. Vegetation is sparse. It consists of *kiawe*, *koa haole*, and fingergrass (Foote et al. 1972:29).

Fill Land consists mostly of areas filled with bagasse and slurry from sugar mills. A few areas are filled with material from dredging and from soil excavation. Generally, these materials are dumped and spread over marshes, low-lying areas along the coastal flats, coral sand, coral limestone, or areas shallow to bedrock. . .This land type is used mostly for the production of sugarcane (Foote et al. 1972:31).

Honouliuli Series consists of well-drained soils on coastal plains on the island of Oahu in the Ewa area. These soils developed in alluvium derived from basic igneous material. They are nearly level and gently sloping. Elevation ranges from 15 to 125 feet. . .These soils are used for sugarcane, truck crops, orchards and pasture. The natural vegetation consists of *kiawe*, *koa haole*, fingergrass, bristly foxtail, and bermudagrass (Foote et al. 1972:43).

Kaloko Series consists of poorly drained soils on coastal plains on the islands of Kauai and Oahu. These soils developed in alluvium derived from basic igneous rock; the alluvium has been deposited over marly lagoon deposits. The soils are nearly level. Elevations range from sea level to 20 feet. . .These soils are used for irrigated sugarcane and pasture. The natural vegetation consists of *kiawe*, klu, bermuda grass, and annuals (Foote et al. 1972:58).

Mamala Series consists of shallow, well-drained soils along the coastal plains on the islands of Oahu and Kauai. These soils formed in alluvium deposited over coral limestone and consolidated calcareous sand. They are nearly level to moderately sloping. Elevations range from nearly sea level to 100 feet on Oahu but extend to 850 feet on Kauai. . .These soils are used for sugarcane, truck crops, orchards, and pasture. The natural vegetation consists of *kiawe*, *koa haole*, bristly foxtail, and swollen fingergrass (Foote et al. 1972:93).

Waipahu Series consists of well-drained soils on the marine terraces on the island of Oahu. These soils developed in old alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from nearly sea level to 125 feet. . .These soils are used for sugarcane and homesites. The natural vegetation is fingergrass, bermuda grass, bristly foxtail and *kiawe* (Foote et al. 1972:134).

Pearl Harbor Series consists of very poorly drained soils on nearly level coastal plains on the island of Oahu. These soils developed in alluvium overlying organic material. Elevations range from nearly sea level to 5 feet. . .These soils are used for taro, sugarcane, and pasture. The natural vegetation consists of cattails, mangrove trees, California grass, and sedges (Foote et al. 1972:112).

2.0 ARCHIVAL RESEARCH

The information discussed below was obtained from a document and literature search conducted at the State Historic Preservation Division, Department of Land and Natural Resources Library at Kapolei, The State of Hawai'i Library and The State Bureau of Conveyances. Materials obtained from this search are used in the current document to assess possible impact to cultural resources. Based on these results, recommendations will be presented for further archaeological work.

2.1 TRADITIONAL HISTORY

Several works have summarized the traditions of 'Ewa. Among these are Sterling and Summers (1978), Kelly (1991), and Charvet-Pond and Davis (1992). The reader is referred to these for more detailed information. Presented below is a brief discussion, highlighting the themes of the 'Ewa Plain.

Sterling and Summers (1978) relates an interesting legend regarding the creation and name of the 'Ewa Plain:

> When Kane and Kanaloa were surveying the islands they came to Oahu and when they reached Red Hill saw below them the broad plains of what is now Ēwa. To mark the boundaries of land they would throw a stone and where the stone fell would be the boundary line. When they saw the beautiful land lying below them, it was their thought to include as much of the flat level land as possible. They hurled the stone as far as the Waianae range and it landed somewhere in the Waimanalo section. When they went to find it, they could not locate the spot where it fell. So Ewa (strayed) became known by that name. The stone that strayed (Sterling and Summers 1978:1).

The stone was eventually found at Pili o Kahe. The spot marks the boundary between Honouliuli and Waianae. It is said that the hill on the 'Ewa side is the male and the hill on the Waianae side is the female (Sterling and Summer 1978: 1).

Traditionally, Pu'u o Kapolei may have been the most important cultural place on 'Ewa. Pu'u o Kapolei is a volcanic cone that in ancient times had several uses (the residence of *kamapua'a*, a landmark, and a point for solar observation). The *pu'u* was said to have a *heiau* (possibly dedicated to the sun) which was destroyed prior to McAllister's O'ahu survey (1933). Tuggle and Tuggle (1997:28) claim that Pu'u o Kapolei may have been the term for the whole region of 'Ewa and not just the hill. This is based on the fact that Pu'u o Kapolei was the primary landmark for travelers between Pearl Harbor and west O'ahu with the trail passing inland of it. The *ahupua'a* of 'Ewa was known for its taro (*kalo*). In fact, 'Ewa was said to have its own taro that was favored by the inhabitants of the region. This particular type of taro was known as *Kaikoi* and was the famous type of taro grown in 'Ewa (Handy and Handy 1972). Sterling and Summers (1978) also discuss this type of taro. In a newspaper article taken from *Na Wahi Pana o Ewa*, by Ka Loea Kalaiaina, dated June 3, 1899, the merits of the 'Ewa taro are discussed:

> The native of Ewa, whether man or woman, will know just how to do it (pound

> *poi*) until your palate is pleased. This is one thing on the ka-i koi taro of Ewa. That is the taro that visitors gnaw on and find it so good that they want to live until they die in Ewa. The poi of ka-i koi is so delicious (Sterling and Summers 1978: 8).

Of the lands used to cultivate taro, Handy (1940) writes:

> Large terrace areas are shown on the U.S. Geological Survey map of Oahu (1917) bordering West Loch of Pearl Harbor, the indication being that these are still under cultivation. I am told taro is still grown here. This is evidently what is referred to as "Ewa taro lands" (Handy 1940: 82).

Traditionally, the 'Ewa district was an alii stronghold. This is attributed to the fact that Pearl Harbor was abundant with marine resources.

> The primary reason for 'Ewa's prominence in history and as an ali'i stronghold was undoubtedly the existence of the great number of fishponds at different points around Pearl Harbor, which was 'Ewa territory. . .The Pearl Harbor ponds were stocked with various kinds of fish, but especially mullet, because these inland waters were the summer home of the mullet of Oahu (Handy and Handy 1972:470).

2.2 HISTORIC LAND USE

Kamehameha gave the entire *ahupua'a* of Honouliuli to Kalanimoku, after he conquered O'ahu, with the right that he could pass it on to his heirs. Later, Kalanimoku passed on the land to his sister Wahinepi'o.

The entire *ahupua'a* of Honouliuli (Land Commission Award 11216, Apana 8; approximately 43,250 acres) was awarded to a granddaughter of Kamehameha I, Mikahela Kekau'Ґnohi, one of the wives of Kamehameha II and daughter of Wahinepi'o (who she likely claimed the land through). Kekau'Ґnohi was awarded land on all of the Hawaiian Islands including the *ahupua'a* of Honouliuli and Waimalu on O'ahu (LCA records on file at the State of Hawai'i, Bureau of Conveyances; Vol. 9, pg. 659). "About 150 acres of the *ahupua'a* (Honouliuli) were excluded as part of *kuleana* awards to commoners" (Tuggle and Tuggle 1997:34). A total of 72 awards were made all of which appear to be in or adjacent to Honouliuli Gulch (Tuggle and Tuggle 1997:34), which is not within or near the project area.

By the 1850's cattle ranching was firmly established at 'Ewa with an estimated 12,000 head of cattle. By 1877, James Campbell was said to have some 32,000 head of wild cattle (Briggs 1926, quoted in Kelly 1991: 162). The sugar industry in Hawaii began to rapidly expand in the 1890's and severely altered the appearance of the 'Ewa Plain and the rest of the islands. Construction for the Oahu Railway & Land (OR&L) railroad began in 1889 and eventually went around the island. This opened up 'Ewa and the rest of O'ahu for sugar, pineapple, and eventually military use.

In 1888, Benjamin F. Dillingham's company Oahu Railway and Land Company began construction of the OR&L railroad that was to extend westward from Honolulu. By 1890 it

extended to Pearl City, by 1895 it extended to Waianae, and by 1899 it extended to Kahuku, the farthest point form Honolulu (National Register of Historic Places Nomination Form; see Appendix A). The railroad carried both passengers and freight. The railroad was instrumental in the development of several sugar plantations (Ewa Plantation Company, Kahuku Plantation Company, Oahu Sugar Company, and the Wailua Agricultural Company) as well as James Dole's pineapple efforts in central Oahu. During World War II, the Oahu Railway, as it became to be known, transported supplies, munitions, troops, and defense workers. At its height, the Oahu Railway consisted of 175 miles of track. After World War II, railroad business declined dramatically – in 1947 all operations outside of Honolulu were abandoned, a pineapple shuttle from Pier 34 to the cannery ceased operation in 1972. A portion of the railroad right-of-way between Nanakuli and Honouliuli was placed on the National Register of Historic Places.

In 1893 the first sisal or *malina* (*Agave sisalana*) plants were imported from Florida (approximately 20,000 plants) and experimentally planted in an area southeast of Pu'u o Kapolei. The Hawaiian name, *malina*, means marine, indicating that the plant was used in the manufacturing of marine ropes (Neal 1965: 225). The Hawaiian Fibre Company was established in 1898 to utilize the sisal grown on the 300 acre plantation in 'Ewa (Tuggle and Tuggle 1997: 37). The production of sisal in 'Ewa continued into the 1920's.

By the 1920s, Honouliuli was used almost exclusively for sugar cultivation and ranching. The 'Ewa Plantation Company controlled approximately 12,000 acres which included sugar cane, a sisal plantation, residential areas for several thousand people, and a limestone quarry. The O'ahu Sugar Company controlled 3,000 acres although not all of it was planted in sugar. Honouliuli Ranch, the largest landholder, controlled approximately 20,000 acres with much of it considered waste because it contained gullies and rocks. Six thousand acres were reportedly planted in pineapple, or forest and wetland.

Frierson (1973) indicates that the Ewa Plantation Company drastically altered the landscape in an attempt to increase the amount of fertile agricultural land. Prior to the rainy season, the plantation excavated drainage ditches from the lower slopes of the Wai'anae range down to the lowlands. Vertical channels were cut into the adjacent slopes to encourage erosion. Frierson writes that "enough soil was washed down the ditches and deposited on the plain to reclaim 373 acres in a few years" (Frierson 1973:17). "By 1931, 'Ewa Plantation had seventy artesian and four surface wells with eighteen pumps (Wilcox 1996: 107).

The 'Ewa Plantation was acquired by Oanu Sugar Company in 1970. The Oahu Sugar Company operated two mills in 'Ewa and Waipahu. Sugar cultivation along the 'Ewa Plain began a slow and steady decline in the 1970's. The Oahu Sugar Company with the demise of sugar ceased operations at 'Ewa in 1994. Real estate development has flourished including the creation of Kapolei, touted as O'ahu's "second city."

2.3 ARCHAEOLOGICAL BACKGROUND

The first archaeological sites identified on 'Ewa were recorded by J. Gilbert McAllister (1933) in the 1930's. McAllister identified several sites on the 'Ewa Plain. Among these were Site 138, Site 139, Site 141, Site 145 and Site 146.

Site 138. Puu Kapolei Heiau, on Puu Kapolei hill, Honouliuli.

> The stones from the heiau supplied the rock crusher which was located on the side of this elevation, which is about 100 feet away on the sea side. There was formerly a large rock shelter on the sea side where Kamapuaa is said to have lived with grandmother (McAllister 1933:108).

Site 139. Kalanamaihiki fishing shrine at Kapapapuhi, Honouliuli.

> Near the end of the small tongue of land that juts out opposite Laulaunui Island in the west loch of Pearl Harbor, are two large rough stones about 2.5 feet in size, with six or seven smooth stones averaging 1 foot in size in a small pile adjoining the larger stones. The entire site is covered with akulikuli and would not be noticed or considered if the Hawaiians did not know of its former sacredness (McAllister 1933:108).

Site 141. Kaihuopalaai.

> The site is named for Kaihuopalaai, said to be the daughter of Konikonia and his wife Hinaaimalama. Fornander (37, vol5, p. 270) writes "...on Oahu, Kaihuopalaai saw a goodly man by the name of Kapapaapuhi (site 139) who was living at Honouliuli, Ewa; she fell in love with him and they were united, so Kaihuopalaai has remained in Ewa to this day. She was changed into that fishponds in which mullet are kept and fattened, and this fish is used for that purpose to this day" (McAllister 1933:108).

Site 145. Puuloa.

> Puuloa, site where the first breadfruit in Hawaii is said to have been planted. As noted by Thrum:
>
> > Tradition credits the introduction of the breadfruit trees in these islands to Kahai, a son of Moikeha, who brought a species from Upolu, in the Samoan Group, on his return voyage from Kahiki, and planted same at Puuloa, Oahu (McAllister 1933:109).

Site 146. The Ewa Coral Plains.

> Site 146, Ewa coral plains, throughout which are remains of many sites. The great extent of old stone walls, particularly near the Puuloa Salt Works, belongs to the ranching period about 75 years ago. It is probable that the holes and pits in the coral were formerly used by the Hawaiians. Frequently the soil on the floor of the larger pits was used for cultivation, and even today one comes upon bananas and Hawaiian sugar cane still growing in them. They afford shelter and

> protection, but I doubt if previous to the time of Cook there was ever a large population there (McAllister 1933:109).

2.4 PREVIOUS ARCHAEOLOGY

A vast number of archaeological studies have been conducted on the 'Ewa Plain in recent years. These investigations are related to the expansive development that has taken place on the 'Ewa Plain in the last 20 years. Only a limited number of investigations will be presented here. For a complete synthesis of the cultural resources recorded on the 'Ewa Plain prior to 1995, the reader is directed to Tuggle and Tuggle (1997). Additional information can be obtained from Haun (1991) and Tuggle (1995).

In 1975, Clark and Connolly (1975) conducted an archaeological reconnaissance survey for the Honouliuli Sewage Treatment plant and ocean outfall. They surveyed the entire parcel proposed for the facility. No sites were identified. Clark and Connolly did not survey the corridor that extended makai from the plant to the ocean since it passed through sugarcane fields. However, they did survey the beach portion where the outfall would be located. No cultural features were identified. They concluded that if any significant cultural resources would be impacted, it would be located on the beach and not on the plain itself.

In 1978 A. Sinoto (1978) of the Bishop Museum conducted archaeological test excavations at Barbers Point. While excavating limestone sinkholes, Sinoto recovered the remains of numerous fossil bird bones "including the skeletal remains of many extinct species, such as large flightless geese, eagles, ibises, finches" (Kirch 1985:117). Later studies have indicated that human alteration of the environment (i.e. land clearing of the native vegetation) and direct predation may have led to the extinction of these species.

In 1979, Bert Davis (1979) conducted archaeological investigations in an area totaling approximately 1,099 acres. This area was previously surveyed by Jourdane (1979) for the proposed 'Ewa Marina Community Development. The survey resulted in the identification of 18 previously unrecorded archaeological sites (State Site Numbers 3201-3218) composed of 107 features including sinkholes, mounds, platforms, and enclosures. A second survey, performed in an area previously utilized for sugar cane cultivation, did not identify any archaeological sites.

In 1983, Hommon and Ahlo (1983) conducted archaeological subsurface testing at the proposed 'Ewa Marina Community Development Area (TMK 9-1-12:2-3, 5-17, 23, 28). The project area is located south of the area previously surveyed by Davis (1979) and Jourdane (1979). A total of five trenches were excavated. No cultural remains were identified.

In 1987, Paul H. Rosendahl, Inc, (Dicks et al. 1987) conducted an archaeological reconnaissance survey with subsurface testing on a 216 acre parcel for the proposed West Loch Estates Golf Course and parks. A total of seven archaeological sites were identified (State Sites 3318 to 3324). These sites consisted of prehistoric and historic burials and habitation sites located on H∩'ae'ae Point and on the slopes and uplands surrounding the Honouliuli Stream floodplain. Other sites recorded were remnants of an agricultural system including: irrigated pondfield cropping of the floodplain, and dryland cultivation in the surrounding slopes and uplands.

Also in 1987, Rosendahl (1987), conducted an archaeological surface survey with subsurface testing immediately adjacent to area mentioned above (Dicks et al. 1987) as part of the Environmental Impact Statement. The survey resulted in the identification of four archaeological sites including a small cemetery related to the sugarcane industry, a historic surface artifact collection area that pre-dates the sugarcane industry and a probable exposed midden pit.

In 1988, The Bishop Museum (Davis 1988) conducted archaeological testing for the Ewa Gentry project at Honouliuli (the current project area). The project area was situated in an area previously utilized for sugar cane cultivation. A surface survey previously conducted by Kennedy (1988) for the same area failed to identify any archaeological sites. No archaeological sites were identified during testing.

Cultural Surveys Hawaii (Hammatt et al. 1990) conducted archaeological investigations for the proposed 'Ewa Villages project site, immediately north of the Honouliuli Sewage Treatment Plant. A total of 616 acres were surveyed and a total of nine sites were identified, all associated with the sugar cane industry and the supporting plantation. Site types identified were: a historic cemetery, reservoir, a communal bathhouse, OR&L tracks, village store and saimin stand, and a roundhouse.

In 1990, Archaeological Consultants of Hawaii, Inc (Kennedy et al. 1991) conducted an archaeological inventory survey for the then proposed Puuloa Golf Course (now the New Ewa Beach Golf Club)(TMK: 9-1-01:27&6). The project area was bounded is at the south end of Fort Weaver Road and to the north of The Pacific Tsunami Warning Center. The survey resulted in the recording of 72 prehistoric, historic and modern sites. Most of the sites were sinkholes containing cultural material, C-shapes, enclosures and mounds. Kennedy and Denham (1992) conducted data recovery at sites slated to be impacted during construction of the golf course. It was concluded that initial occupation of the area occurred between A.D. 1020-1480. Three of the sites (3910, 3921 and 3770) were judged no longer significant following data recovery. All other sites slated for data recovery were considered significant and recommended for preservation.

In 1991, The Bishop Museum (Goodman and Cleghorn 1991) conducted an archaeological surface survey in conjunction with a historical documents and literature search for the Laulani Fairways Housing project at Pu'uloa (TMK 9-1-10: por. 7; 9-1-12:por.5). The project area is located to the south Honouliuli Sewage Treatment Plant and to the east of Barbers Point Naval Air Station and is approximately 300 acres in size (this is the current project area). No surface cultural remains were identified during the survey.

In 1991, the Applied Research Group (Jayatilaka et al. 1992) conducted an archaeological survey with subsurface testing on a 270-acre parcel for the then proposed Hawaii Prince Golf Course (also the current project area)(TMK 9-1-10). No surface archaeological remains were identified during the survey. Eleven backhoe trenches and four backhoe scrapes were excavated. No cultural remains were identified and no further work was recommended.

In 1993, Pantaleo and Sinoto (1993) conducted an archaeological inventory survey for a proposed offsite drainage system at the 'Ewa Gentry in Honouliuli. Only one historic site was identified, a concrete drainage ditch that measured 4,600 feet long, 150 feet wide and between

20 and 25 feet deep. No other significant cultural remains were recorded.

Also in 1993, the Bishop Museum (Goodman et al. 1993) conducted an archaeological reconnaissance survey of a proposed commercial project. The project area is located south and east of the Honouliuli Sewage Treatment Plant, and to the west of Fort Weaver Road, surrounded to the north, south and west by former sugarcane fields (the current project area) (TMK 9-1-69:por. 5). No cultural remains were identified.

In 1996, Scientific Consultant Services (Spear 1996) conducted an archaeological survey for an area north of the Honouliuli Treatment Plant, and west of the Tenney and Varona plantation villages. The survey concentrated on two short, shallow gulches present in an area formerly used for sugarcane cultivation. No archaeological sites were identified during the survey.

Tuggle and Tuggle (1997) authored a synthesis of cultural resource studies conducted on the 'Ewa Plain. Although the manuscript was prepared for the Barbers Point Naval Air Station, it examines the prehistory and history, the previous archaeology, and the natural resources found on the 'Ewa Plain. Their manuscript was used in the preparation of this document and proved to be invaluable. It is highly recommended for anyone planning to work in the region.

Paul H. Rosendahl conducted three archaeological data recovery projects (1988, 1989, and 1990) at West Loch Estates Residential Increment I, Golf course and Shoreline Park located in Honouliuli, 'Ewa District, Island of O'ahu (Wolforth et al. 1998). This "work included excavations at Sites 3319, 3320, and 3321; backhoe trenching at Sites 3322 (buried fishpond) and 3324 (extensive pondfield system); and monitoring of construction activities" (Wolforth et al. 1998:ii). The other sites identified were an artifact concentration, human skeletal remains and temporary habitations. Excavations uncovered ash lenses, midden deposits, possible postholes, rock alignments, and a segment of the OR&L railway. Radiocarbon dates obtained from test excavations indicates that the pondfields were in use between 10th and 17th A.D.

2.5 SITE PREDICTABILITY

Due to the impacts of residential and road development, ranching, sugarcane cultivation, and military activities, prehistoric surface remains were not expected within the project area. However, it is possible that excavations will expose sinkholes that have been filled in by alluvium moving downslope, numerous cultivation activities and by various residential and commercial developments. These sinkholes often contain archaeological deposits (i.e. human remains, hearths and extinct bird bones). Numerous sinkholes have been recorded on Barbers Point Naval Air Station and at other areas in 'Ewa. Human burials may also be uncovered during the course of pipeline excavations. Sinkholes and human burials are the most probable site types that may be encountered during the course of the project.

3.0 METHODS

The archaeological survey was conducted on May 17, 2001. Paul L. Cleghorn, Ph.D., served as principal investigator and main point of contact while James McIntosh, B.A. and Bonnie Whitehead, B.A., conducted the field survey.

A vehicular survey was conducted around the outer edges of the project area. When areas of interest were identified the archaeologists conducted a pedestrian survey. Given the vast amount of visibility in the area, spacing between archaeologists was between 25-35 m. The project area was photo documented using a digital camera.

4.0 RESULTS

The archaeological survey determined that the entire project area had undergone significant impacts from agricultural and developmental use. In fact, evidence of irrigation lines were still present in a large portion of the project area (Figure 2). The entire project area was devoid of any natural features or contours. No archaeological resources were present within the project area.

The area south of the Coral Creek Golf Course contains a large drainage area (Figure 3). This drain apparently serves for runoff purposes of the golf course. The drainage consists of an excavated area approximately 40 m wide and 3-4 m deep. The entire face of the drain is coral and limestone. A check of the wall of the drain failed to identify any exposed subsurface features.

The survey also determined that parcels adjacent to the current project area are currently being developed for residential housing (Figure 4). This area located along the far eastern end of the project area was previously surveyed by Jayatilaka et al. (1992). See Appendix for additional photographs of the modified nature of the project area.

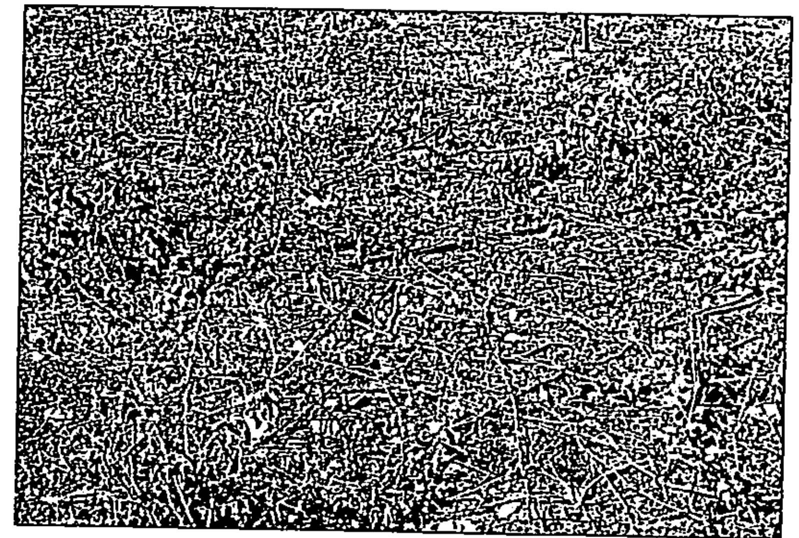


Figure 2. Drip irrigation lines still visible in project area.

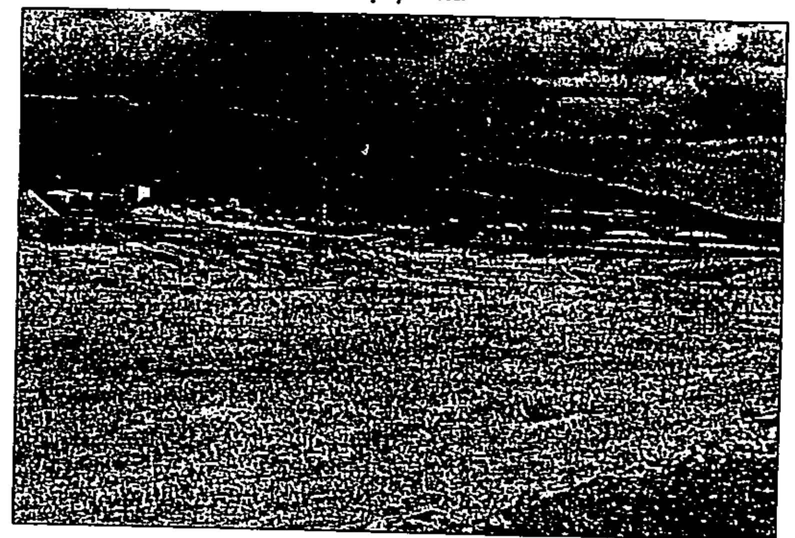


Figure 3. Photo showing drainage extending south from Coral Creek Golf Course. View to north.

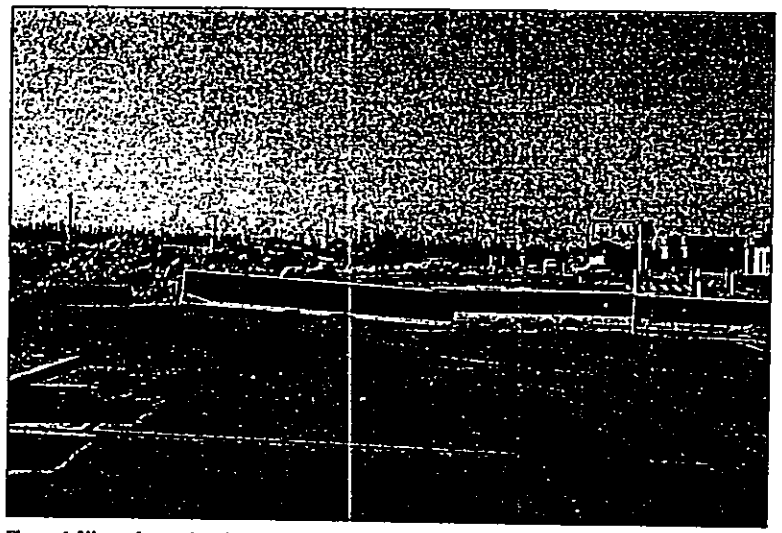


Figure 4. View of on-going development to the northeast of the project area.

5.0 SUMMARY AND DISCUSSION

The archaeological survey determined that no archaeological sites are present within the current project area. The archival research and a review of previous archaeological studies on the #Ewa Plain demonstrate that the area has undergone dramatic and extensive alterations over its long land use history. A review of the previous archaeology for the area indicated that the project area was previously surveyed by Davis (1988) Jayatilaka et al. (1992) and Goodman and Cleghorn (1991) and Goodman (1993). None of these surveys identified any cultural resources within the project area. This fact was confirmed when the current survey also failed to locate any cultural resources within the current project area (See Appendix for photographs).

Given that the project area was under sugar cane cultivation for approximately 100 years, it seems unlikely that any subsurface cultural materials are still present within the project area. While there are no surface archaeological sites, there is the possibility of encountering subsurface resources in the form of sinkholes containing cultural materials and possibly human burials. These features could be as deep as 3 feet below ground surface. It is recommended that an archaeologist be retained on an on-call basis to assist the contractor in the event that subsurface archaeological resources are encountered.

6.0 REFERENCES CITED

Armstrong, Warrick R. (ed.)
1983 *Atlas of Hawaii*. University of Hawaii Press, Honolulu.

Briggs, L.V.
1926 *Experiences of a Medical Student in Honolulu and on the Island of Oahu: 1881*. David D. Nickerson, Boston.

Charvet-Pond A. and B. Davi.
1992 West Beach Data Recovery Program, Phase 4, Archaeology and Paleontological Excavations, 2 vols. Report for West Beach Estates. Paul H. Rosendahl, Inc. Hilo.

Clark, S. and R. Connolly.
1975 Archaeological Reconnaissance Survey for Honouliuli Sewage Treatment Plant and Barbers Point Ocean Outfall. Report on file at the State Historic preservation Division, Kapolei.

Davis, Bertell D.
1979 Report on Archaeological Survey of the Proposed Ewa-Marina Community Development Ewa Beach, Oahu Island. Hawaii Marine Research, Inc., Hawaii.

1988 Archaeological Subsurface Survey of the Proposed Ewa Gentry Project Area, Honouliuli, O'ahu. Public Archaeology Section, Applied Research Group, Bishop Museum, Honolulu.

Dicks, A., A. Haun, and P. H. Rosendahl.
1987 Archaeological Reconnaissance Survey for Environmental Impact Statement, West Loch Estates-Golf Course and Parks. PHRI, Hilo.

Frierson, Barbara.
1973 A study of Land Use and Vegetation Change: Honouliuli, 1790-1925. MS. On file, Department of Geography, University of Hawaii, Honolulu.

Foote, D. E., E. L. Hill, S. Nakamura, and F. Stephens.
1972 Soil Survey of the Islands of Kauai, Oahu, Maui, and Lanai, State of Hawaii. United States department of Agriculture, Soil Conservation Service. U.S. Government Printing Office, Washington D.C.

Goodman, W. and P. Cleghorn.
1991 Historical Documents and Literature Search, and Archaeological Surface Survey of the Proposed Laulani/Fairways Housing Project at Pu'uloa, Honouliuli, 'Ewa, O'ahu Island (TMK 9-1-10: por. 7 and 9-1-69: por. 5). Public Archaeology section, Applied Research Group, Bishop Museum, Honolulu.

Goodman, W., H. Jatatilaka, T. Patolo, B. Nakamura, R. Nees and B. Dixon.

1993 An Archaeological Reconnaissance of a Proposed 20-Acre Commercial Project, Honouliuli, 'Ewa, O'ahu Islands. Public Archaeology Section, Applied Research group, Bishop Museum, Honolulu.

Hammatt, H., D. Shideler and W. Folk.
1990 Archaeological Reconnaissance of the 'Ewa Villages Project Site, Honouliuli, 'Ewa O'ahu. Cultural Surveys Hawaii, Kailua.

Handy, Craighill, E.S.
1940 The Hawaiian Planter, Volume 1. Bernice P. Bishop Museum Bulletin No. 161. Bishop Museum Press, Honolulu.

Handy, C. E. S. and El. G. Handy
1972 Native Planters in Old Hawaii, Their Life, Lore, and Environment. Bernice P. Bishop Museum Bulletin No. 233. Bishop Museum Press, Honolulu.

Haun, Allan E.
1991 An Archaeological Survey of the Naval Air Station, Barber's Point, O'ahu, Hawaii. Prepared for Commander, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Applied Research Group, Boshop Museum, Honolulu.

Hommon, R. and H. Ahlo.
1983 Archaeological Test Excavations at the Proposed Ewa Marina Community Development Area, 'Ewa O'ahu. MS. On file at the Dept. of Land and natural Resources, Kapolei.

Jayatilaka, H., T. Patolo, B. Nakamura, R. Nees, and B. Dixon.
1992 Archaeological Survey and Subsurface Testing of the Proposed Hawaii Prince Golf Course Ahupua'a Honouliuli, 'Ewa District, Island of O'ahu. Public Archaeology Section, Applied Research Group, Bishop Museum, Honolulu.

Jourdane, Elaine H. R.
1979 Archaeological Reconnaissance Survey of Proposed Ewa Marina Community, Campbell Estate Properties, One'ula, Honouliuli, O'ahu, Hawaii. Prepared for Pearson and Wuesthoff, AIA. Department of Anthropology, Bishop Museum, Honolulu.

Kelly, Marion
1991 Notes on the History of Honouliuli. In A.E. Haun, An Archaeological Survey of the Naval Air Station, Barbers's Point, O'ahu, Hawai'i. Appendix A. Prepared for Commander, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Applied Research Group, Boshop Museum, Honolulu.

Kennedy, J., J. Berlin and T. Denham.
1991 Archaeological Inventory Survey Report for the Puuloa Golf Course Site, TMK: 9-1-01: 27&6, located at 'Ewa, Island of Oahu. Archaeological Consultants of Hawaii, Inc., Hawaii.

Kennedy, J. and T. Denham.
1992 Archaeological Data recovery Report for the Puuloa Golf Course located at 'Ewa, Island

of Oahu, TMK: 9-1-01:27&6. Revised May 1992. Archaeological Consultants of Hawaii, Inc., Hawaii.

Kirch, P.V.
1985 *Feathered Gods and Fishhooks*. University of Hawaii Press. Honolulu.

Macdonald, G.A.and A.T. Abbott.
1970 *Volcanoes in the Sea*. University of Hawaii Press, Honolulu. 1983 Edition.

McAllister, J. Gilbert
1933 *Archaeology of O'ahu*. Bernice P. Bishop Museum Bulletin No. 104. Bishop Museum, Honolulu, 1976 Edition.

Neal, Marie, C.
1965 *In Gardens of Hawaii*. Bernice P. Bishop Museum, Special Publication 50. Bishop Museum Press, Honolulu, Hawai'i.

Pantaleo, J. and A. Sinoto.
1993 Archaeological Inventory Survey for the Proposed Off-Site Drainage System, Ewa Gentry East Honouliuli, 'Ewa, O'ahu Island. Aki Sinoto Consulting, Honolulu.

Rosendahl, Paul H.
1987 Archaeological Reconnaissance Survey for Environmental Impact Statement, West Loch Estates-Residential Increments I and II. PHRI Report 322-040787. Prepared for the City and County of Honolulu. PHRI, Hilo.

Sinoto, A.
1978 Archaeological and Paleontological Salvage at Barbers Point, O'ahu. Manuscript on file at the Bernice Pauahi Bishop Museum, Honolulu, Hawai'i.

Spear, Robert.
1996 Letter report to Mr. David Hulse, PBR Hawaii. Copy on file at the State Historic preservation Division, Kapolei. Scientific Consulting Services, Honolulu.

Tuggle, David.
1995 Archaeological Inventory Survey for Construction Projects at Naval Air Station, Barbers Point, O'ahu, Hawaii. International Archaeological Research Institute, Inc., Honolulu.

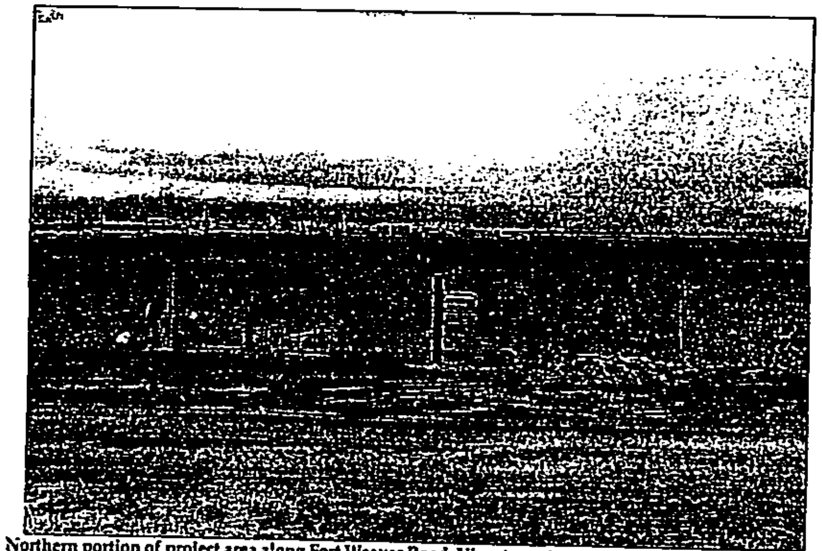
Tuggle, D., H. and M. J. Tuggle.
1997 Synthesis of Cultural Resource Studies of the 'Ewa Plain. Task 1a: Archaeological Research Services for the Proposed Cleanup, Disposal and Reuse of Naval Air Station Barbers Point, O'ahu, Hawai'i. International Archaeological Research Institute, Inc., Honolulu.

Wilcox, Carol
1996 *Sugar Water: Hawaii's Plantation Ditches*. University of Hawaii Press, Honolulu.

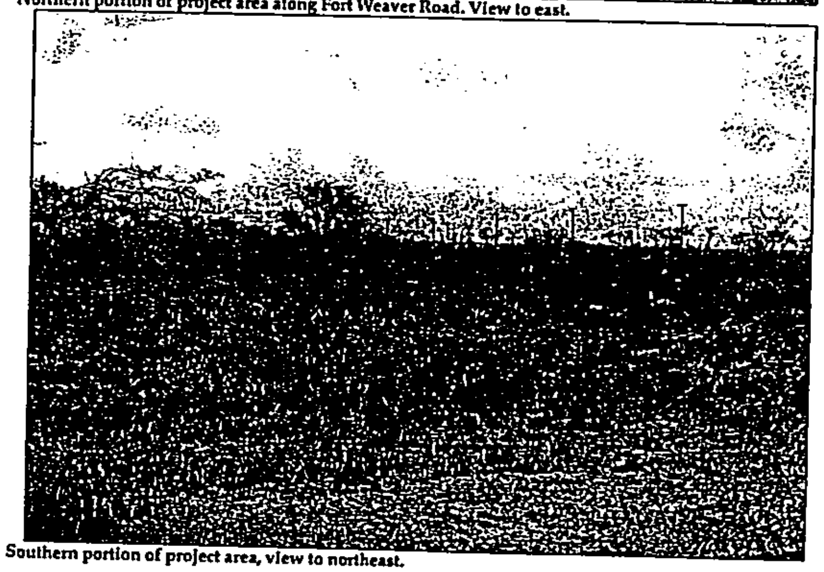
Wolforth, T.R., W. Wulzen, and S. Goodfellow.
1998 Archaeological Data Recovery at West Loch Estates Residential Increment I, and Golf Course and Shoreline Park. Land of Honouliuli, 'Ewa District, Island of O'ahu. Final Report. Paul H. Rosendahl, Inc. Hilo, Hawai'i.

APPENDIX

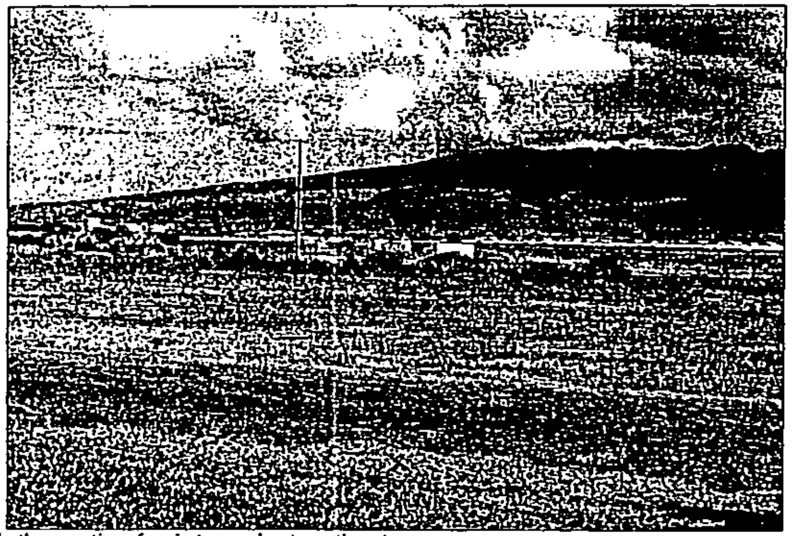
PHOTOGRAPHS



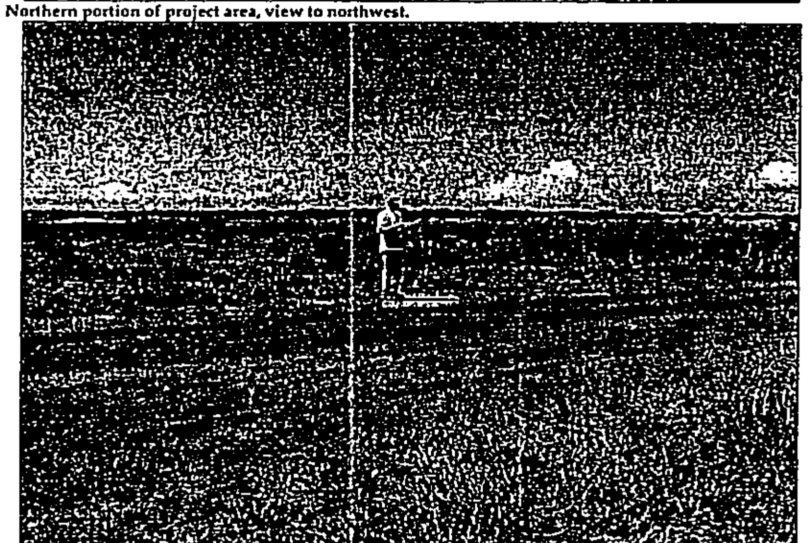
Northern portion of project area along Fort Weaver Road. View to east.



Southern portion of project area, view to northeast.

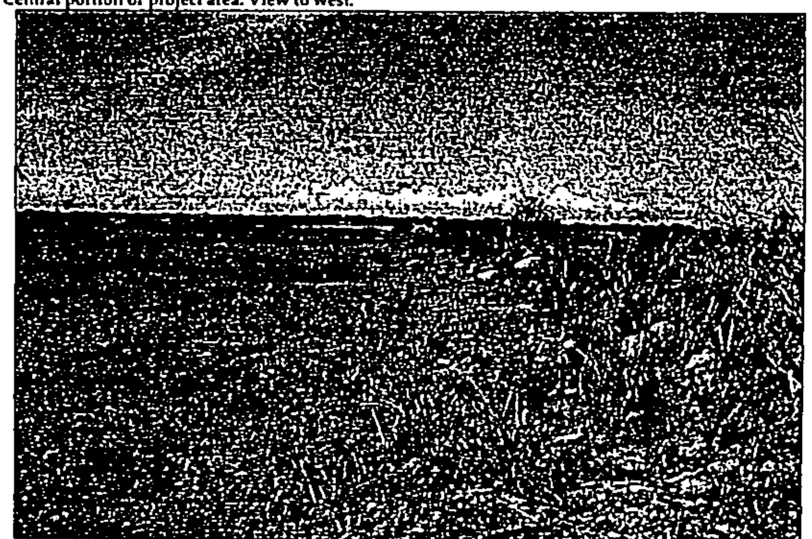


Northern portion of project area, view to northwest.



Central portion of project area along former cane road. View to south.

Central portion of project area. View to west.



Central portion of project area, showing a bull-dozed berm, view to south.

APPENDIX I

A CULTURAL IMPACT ASSESSMENT FOR THE PROPOSED ʻEWA GENTRY MAKAI DEVELOPMENT PROJECT ʻEWA, OʻAHU

Prepared by

C. Celeste LeSuer, B.A.
and
Paul L. Cleghorn, Ph.D.
Pacific Legacy, Inc.
332 Uluniu St.
Kailua, HI 96734

Prepared for

Environmental Communications
1188 Bishop Street, Suite 2210
Honolulu, HI 96734

April 2002

ABSTRACT

Gentry Properties is proposing a development project named ʻEwa Gentry Makai, located in ʻEwa on the island of Oʻahu. As part of the Environmental Impact Statement process, a Cultural Impact Assessment was conducted and is reported upon in this document. This assessment consists of archival and oral historical research.

The research conducted indicates that this area has a long and rich cultural and legendary history. The area was an important thoroughfare for travelers to settlements on the western coastline. Oral history information gathered indicates that a traditional trail existed between nearby Puʻu o Kapolei and Puʻu o Palailai. The area was also noted as a place of mischievous wandering spirits or *ao kuewa*.

Importance is also ascribed to certain landmarks of the area. In particular, Puʻu o Kapolei was a sighting point for the summer solstice.

The area, however, has been subjected to extensive major land alterations associated with cattle raising and sugar cane cultivation. These agricultural activities have destroyed the material evidence of the traditional activities that took place in this area. It does not appear that the proposed development will have any adverse effect to traditional cultural activities in the area.

TABLE OF CONTENTS

FIGURES

TABLE

1.0 INTRODUCTION

Gentry Properties is proposing a development project named 'Ewa Gentry Makai, located in 'Ewa on the island of O'ahu. As part of the Environmental Impact Statement process, Pacific Legacy, Inc., at the request of Environmental Communications, conducted a Cultural Impact Assessment for the proposed 'Ewa Gentry Makai development project.

The following cultural impact assessment investigations are intended to satisfy Act 50, required by law as of April 26, 2000. Act 50 requires that information concerning traditional cultural practices and features that might be affected by the proposed development be identified, and that any potential impact is assessed.

The development project will include residential housing, commercial and industrial use facilities. The project area is a 283-acre parcel located in the district of 'Ewa (TMK 9-1-10:7 and 9-1-69:5), on the 'Ewa Coral Plain in Honouliuli *ahupua'a*, island of O'ahu (Figure 1). The proposed project area is currently zoned for agriculture and presently consists of fallow agricultural land formerly used for sugar cane production and limited grazing activities

2.0 KUPUNA INFORMANTS

Individuals and organizations knowledgeable about the area and/or cultural practices or features relating to the area were identified and contacted. Table 1 summarizes the knowledgeable individuals and organizations that were consulted. Oral history interviews and consultations were conducted. In addition, archival research was undertaken to identify additional cultural features in the area and traditional practices that may have been conducted in the area. The following individuals were contacted:

Van Diamond is chairman of the O'ahu burial council, and was initially contacted to assist in locating knowledgeable traditional and historic informants and possible descendents of past residents of the project area. He suggested that we contact two knowledgeable *kupuna*—Shad Kane and Arline Eaton.

Shad Kane serves as chairman of the Committee of Historic Sites and Cultural Properties for the Hawaiian Civic Club. He is a retired policeman who worked in the 'Ewa District from the Kapolei to Pu'uloa area, and including much of Honouliuli. He is a long time resident of the area, and currently lives in Kapolei.

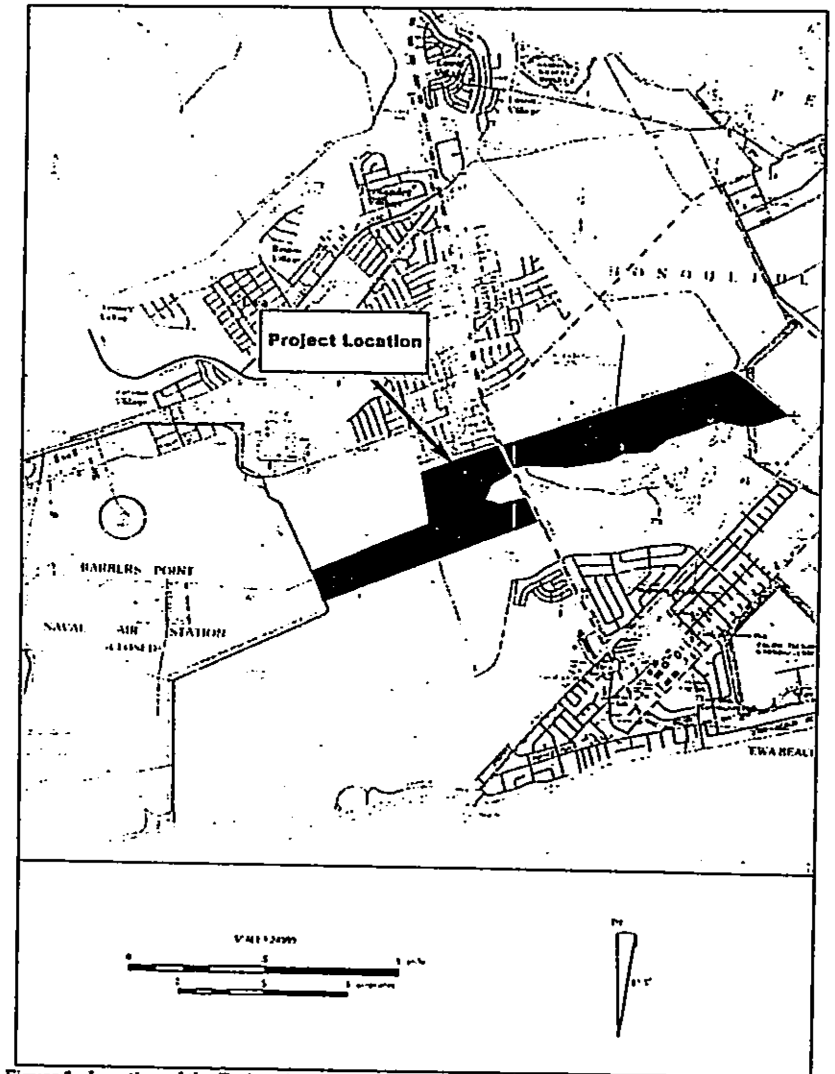


Figure 1. Location of the Project Area

Arline Wainaha Pu'ulei Brede-Eaton (born 1927) works for the Department of Education. Her family has a long history in the area, spanning four generations. She has been active in numerous cultural preservation projects.

Ms. Eaton states that to the best of her knowledge her family was the first family to move into the area in the early post contact years. She is the *hānai* (adoptive) daughter of Papa (William E.) Brede [III] and Jenny (Jane) Brede. Ms. Eaton's grandfather told her that her great grandfather, William E. Brede (I), lived on the land they were now living on since sometime after Kamehameha I. He told her that the land was not owned then, but that they had been given the right to live there. They had no amenities, and lived in a sort of lean-to house.

John Kaimikaua is a Kumu Hula active in Hawaiian cultural matters.

Pat Namaka Bacon is a noted Hawaiian Cultural Scholar who is the *hanai* (adopted) daughter of Kawena Pukui. The Bishop Museum currently employs Ms. Bacon as a Cultural Resource Specialist.

Dr. Bruce Carlson is director of the Waikiki Aquarium. He joined the staff in 1976 as a graduate student, served as Acting Director from 1986-1990, and as Director since 1990.

Table 1. Summary of Individuals and Organizations Consulted

Van Diamond	O'ahu Burial Council Chair	Referred to Shad Kane and Arline Eaton
Shad Kane	Hawaiian Civic Club: Committee of Historic Sites & Cultural Properties, Chair	Interview, referred to Arline Eaton and Kumu John Kaimikaua
Arline Eaton	Department of Education	Interview, referred to Thelma Parish
Thelma G. Parish	Member of early resident family, Retired Nun	Referred to oral history given in 1997 with K. Maly
John Kaimikaua	Kumu Hula	Telephone consultation, referred to Pat Bacon
Pat Bacon	Bishop Museum, Cultural Resource Specialist	No knowledge of area, will locate source, no response at writing
Bruce Carlson	Waikiki Aquarium, Director	Discussion of Mahina'ona

3.0 TRADITIONAL HISTORY

Pre- and early post-contact histories of the research area convey a setting that usually refers to the entire 'Ewa Coral Plain as a unit rather than the individual *ahupua'a* of Honouliuli or Pu'uloa. The 'Ewa plain is relatively flat and inclines slightly to the coastline (south, east, and west), with topography varying little. Coral sinkholes and the volcanic cone Pu'u o Kapolei are the main topographic deviation.

Pu'u o Kapolei is a traditional landmark with a rich legendary history, noted from the time of the earliest of ancient settlements in Hawaii. Historic activities, however, have destroyed much of the area and its ancient Hawaiian cultural features. The numerous cultural coral sinkholes on the plain—which includes the project area—were filled-in and plowed over during the historic cattle-grazing and later sugarcane production.

Tuggle and Tomonari-Tuggle (1997) have provided a synthesis of the 'Ewa Plain cultural environment. This information will not be restated here, however, culturally informative themes within their synthesis include: environment, vegetation and fauna, landform subdivisions, archaeology, subsistence resources, cultivation potential, important places, traditions, resources, traditional themes and pre and post-historical documentation. The reader is directed to this report for additional information.

Fresh water on the barren coral plain has often been reported as being insufficient to support a permanent or substantial Hawaiian settlement during pre-contact years. Tuggle and Tomonari-Tuggle (1997:18-21), however, summarize their in-depth research on water availability on the 'Ewa Plain asserting that their findings may have made permanent Hawaiian settlement possible in at least a number of specific locales, if not generally across the entire area. Water was identified at various locales on the plain including: the watertable in sink holes, in the wetlands, sheet runoff, spring and creek water from now dry gulches, natural limestone water traps, a few ponds mapped and documented on the plain or along the coastline, and from the major Honouliuli Stream and various lesser Honouliuli *ahupua'a* streams. The streams provided fresh *mauka* (mountain) water at the more fertile inland and internal bay locales. Fresh water is documented at the spring Hoaka lei at Kualaka'i on the 'Ewa coastline, in oral history chant—"He Mo'olelo Ka'ao No Hi'iaka I Ka Poli O Pele"—translated by Kawena Pukui et al. (1974:119) and by Kep Maly (1999:31).

Important locales of the 'Ewa Plain are mapped and summarized in Tuggle and Tomonari-Tuggle (1997:21-24). A few of these locations are important to the traditional history of the project area. They include: Pu'u o Kapolei (a volcanic cone or hill), the plain of Kaupe'a (barren home for wandering spirits), Hoaka lei (legendary spring), Pu'uloa salt works, residence of chiefs at Pu'uloa and Lihu'e, Honouliuli Gulch and agricultural fields, Kalaeloa (Barbers Point) and its lighthouse, Kaihuopala'ai (West Lock Bay), and Ko'olina village the later residence of James Campbell "Lanikohonua" (Figure 2) Additional information concerning Pu'u o Kapolei and the Plain of Kaupe'a is documented below.

The extent of pre-contact settlement on the 'Ewa coral plains is debated. Early contact observations account for a marginal population on the plain, and two more populace settlements on the coastline within Kaihu o Pala'ai (West Lock Bay). Early Hawaiians in the 'Ewa Coral Plains area, as documented by oral histories and archaeological investigations, had access to various resources such as a rich variety of: marine fish, shellfish, and seaweed. These resources were found along the coastline, in cultural fishponds, and in Keawalau o Pu_uloa (Pearl Harbor). The upper stream gulches and the inland harbor coastline provided fertile grounds for irrigation and agricultural cultivation, predominately *taro*. Inland and plain sinkhole cultivation provided access to sweet potato, banana, coconut, *milo, noni*, sugar cane, breadfruit, *ti, koali'ai, 'ahea'hea, and pai'hi'iha* vegetation, etc. (Fornander 1916-20,II: 400;

Kamakau 1991:110; Tuggle and Tomonari-Tuggle 1997:13,15).

The 'Ewa Plain was home to a variety of wild terrestrial plants and birds. In the legend—"He Mo'olelo Ka'ao No Hi'iaka I Ka Poli O Pele"—Hi'iaka travels through 'Ewa, noting important geographical locales as well as many trees, plants, and flowers. Flora mentioned include: *nene* grasses, *kupukupu* ferns, noni trees, *ma'o* (*Gossypium tomentosum*, yellow Hybiscus), varieties of *lehua, koai'a, 'ilima* (*Sida fallax*), *'ohai* (*Sesbania tomentosa*), *Kukui, Kauno'a* (*Cuscuta sandwichiana*), *'uala* (sweet potato), *pilipili-'ula* (*Chrysopogon aciculatus* [grass]), *wiliwili* trees (*Erythrina* sp.), and *noho* (*Tribulus cistoides*). This legend was first published in Hawaiian in the Hawaiian newspaper *Ka Hoku o Hawai'i* from September 18, 1924 -July 17, 1928. Emerson (1978:167) translated parts of this legend, and more recently Kepa Maly (1999:31) translated parts relating to 'Ewa. Maly paraphrases a portion of his translations within the Hi'iaka legend chant mentioned above:

> Descending to the flat lands of Honouliuli, Hi'iaka then turned and looked at Pu'uokapolei and Nawahineokama'oma'o who dwelt there in the shelter of the growth of the *'ohai* (*Sesbania tomentosa*), upon the hill...When Hi'iaka finished her chant, Pu'uoKapolei said...So it is that you pass by without visiting the two of us. Lo, we have no food with which to host you. Indeed, the eyes roll dizzily with hunger. So you do not visit us two elderly women who have cultivated the barren and desolate plain. We have planted the *'uwala* (sweet potato) shoots, that have sprouted and grown, and have been dedicated to you, our lord. Thus as you travel by, pull the potatoes and make a fire in the *imu*, so there will be relief from the hunger. For we have no food, we have no fish and no blanket to keep us warm. We have but one *Kapa* (covering)...in the time when the grasses dry, and none is left on the plain, we two are left to live without clothing. (Maly 1999:35)

The Hi'iaka chant—"He Mo'olelo Ka'ao No Hi'iaka I Ka Poli O Pele"—discussed above describes the travels of Hi'iaka through the plains of 'Ewa as she has been sent by her sister *Pele* (volcano goddess) to bring her desired lover from Kaua'i to Hawai'i Island; there are descriptions of a diverse area environment and reference to the natives of Pu'uloa, and persons living on Pu'u o Kapolei and the plains (Maly 1999:31-35). Pu'uokapolei and Nawahineokama'oma'o may refer to mythological persons or land features; Pu'uokapolei has long been the name of a hill on the 'Ewa Plain, however a physical association with the term Nawahineokama'oma'o has not yet been identified. The above reference clarifies that in ancient times, the plain was indeed considered marginal in regards to flora and subsistence during the dry seasons; it also shows that the plain usually had enough water to support grasses and other plants and trees. Habitation may have been difficult at many locations on the 'Ewa Plain, but references such as the selections above and below show that the variety of resources available were, although difficult and tedious, accessible.

Emma Metcalf-Nakuina notes that:

> Kamapuaa subsequently conquered most of the island of Oahu, and, installing his grandmother as queen, took her to Puuokapolei, the lesser of the two hillocks forming the southeastern spur of the Waianae mountain range, and made her establish her court

> there. This was to compel the people who were to pay tribute to bring all the necessities of life from a distance, to show his absolute power over all,
>
> Puuokapolei is some little distance from Sisal, towards Waianae, and is as desolate a spot as could be picked out on the whole island. It is almost equally distant from the sea, from which came the fish supplies; from the taro and potato patches of Ewa, and from the mountain ravines containing the banana and sugar cane plantations. (Emma Metcalf-Nakuina 1904:50)

The environment in the research area is documented in numerous historic descriptions as being barren, desolate, and generally unpopulated. Ancient oral histories also refer to the area as barren, however, in considering the flora and avifauna depicted in ancient chants and oral history accounts such as those above, the references to *barren* may have much to do with the relative comparative island environments. Archaeological investigations, reported in the next section, show that sinkholes on the plain were utilized for agricultural purposes. It is likely that any ancient and pre-contact permanent habitations were close to the coastline or stream outlets, at least for those who did not rely on tribute subsistence.

Following the contact years, the area attracted a minimal number of foreign settlers. Only those that could use the area as commercial investment desired land in this area. Initially, the salt-works and cattle (grazing) industries dominated the land, and later sugar cane agriculture extended *makai* into the plain beyond the current project area.

4.0 KUPUNA TESTIMONY

4.1 *AHUPUA'A* BOUNDARY

Ms. Eaton asserts that the current *ahupua'a* map is inaccurate (Figure 2). The boundaries as she knew them extended Pu'uloa some distance to the west and north from its current northern-western boundary with Honouliuli ', and further across Pearl Harbor to the eastern

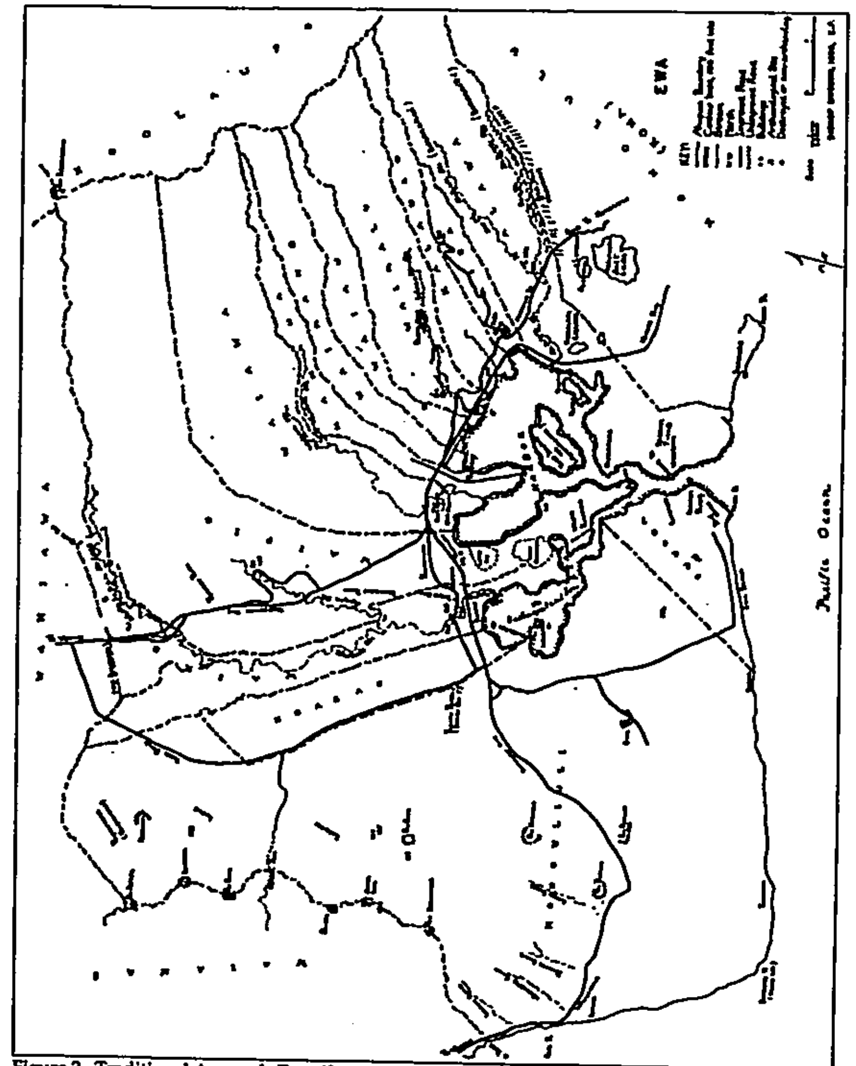


Figure 2. Traditional Areas of _Ewa (from Sterling and Summers 1978)

shore. She believes that the current project area is actually in the Pu'uloa *ahupua'a*, not in Honouliuli *ahupua'a*. She describes the project area as being desolate and uninhabited during her childhood prior to sugarcane production, and recalls it being referred to as Kealia. Sterling and Summers (1978) indicate Pu'uloa as a separate *ahupua'a*. On the other hand, Tuggle and Tomonari-Tuggle (1997) indicate that Pu'uloa was an *'ili* within the *ahupua'a* of Honouliuli. The Hawaiian Studies Institute (1987) seems to support Tuggle and Tomonari-Tuggle.

4.2 KAUPE'A AND THE *AO KUEWA* (REALM OF THE WANDERING SPIRITS)

Mr. Shad Kane conveyed the following insights into the history of the lands of Pu'uloa and Honouliuli; he believed that the 'Ewa inter-coastal plains remained fairly desolate during the pre and early post-contact years. He attributed this to two factors: the marginal environment, and ancient-traditional oral histories that identify the area as the "barren place for mischievous wandering spirits." Hawaiians, he states, believed in a concept called *wailua* (the dream spirit) that contained two energies within the body, one good and one bad. The concept held that one's *'aumakua* (deified deceased ancestors and family or personal gods) would help the spirit of a deceased Hawaiian descendent, when it left the body, to travel to a leaping point where the new spirit could leap into the next realm. Kaena Point is the leaping point most often referred to near the project area (each island had its own geographical leaping points). Lanaakahuhani was the desired afterlife spirit realm where one's good *wailua* spirit energy experienced a favorable existence, as a result of the assistance received from one's *'aumakua*. If one did not conduct one's self in life to the satisfaction of their *'aumakua* they might not receive the assistance needed to reach Lanaakahuhani. This would cause the bad *wailua* spirit energy a type of banishment to a local *ao kuewa*—realm of the earthly wandering homeless and mischievous spirits. One such *ao kuewa* is on the 'Ewa plains in an area called Kaupeaa (crisscrossing, intermingled)—this area then is known as the "barren place for wandering mischievous spirits." Mr. Kane added that throughout his many years as a policeman in the area he saw many unexplainable situations that made him contemplate the undesirable *wailua* spirit in the *ao kuewa* of Kaupe'a, 'Ewa.

Martha Beckwith writes that Hawaiian teachings, according to *kahuna* pose that:

> ...death to the body (kino) does not entail death to the spirit (uhane [or wailua]) ...experiences of the soul after it leaves the body at death...follow traditional ideas...probably influenced by later development of the aumakua belief. There is a place of the dead, reached at some leaping place, with which is connected a branching tree as roadway of the soul. Elaborations enter...as a result of the part conceived to be played by the aumakua in protecting and sheltering the soul and leading it to its aumakua world. The worst fate that can befall a soul is to be abandoned by its aumakua and left to stray, a wandering spirit (kuewa) in some barren and desolate place, feeding upon spiders and night moths. Such spirits are believed to be malicious and to take delight in leading travelers astray; hence the wild places which they haunt on each island are feared and avoided. Such are the plains of...the rough country of Kaupea at Puuloa on Oahu...In these desolate places lost spirits wander until some friendly aumakua takes pity upon them.

> Other leaping places of the soul (Leina-ka-uhane) are named at different points...and Kaena on Oahu; (Beckwith 1976:154,156)

Sterling and Summers document two historical references to the wandering spirits and their O'ahu home Kaupe'a, which were spoken of by Mr. Kane. The first reference was translated from the Place Names – O'ahu stories in the Hawaiian newspaper *Ke Au Hou*, an edition dated July 12, 1911:

> The plain of Kaupea on the plain of Puuloa was where the ghosts wandered to catch night moths and spiders for food. It extended from the wiliwili trees of Kaupea to Kanehili. (Sterling and Summers 1978:44)

The second reference by Kamakau reveals that:

> On the plain of Kaupe'a, beside Puuloa, wandering souls would go to catch moths and spiders. However, wandering souls would not go far in the places mentioned earlier before they would be found...by [the] 'aumakua souls, and be helped to escape. Those souls who had no such help were indeed friendless, (Kamakau 1964:49)

There appears to be a possible discrepancy concerning the *ahupua'a* in which Kaupe'a lies. In the 1911 *Ke Au Hou* newspaper article, Kaupe'a is said to be on the plain of Pu'uloa, but extends west to Kanehili. Mr. Kane places the location of Kanehili within the boundaries of Honouliuli *ahupua'a*, to the west of the current project area. Kamakau's earlier reference (written in the mid-half of 19th century) places Kaupe'a beside Pu'uloa. It is not clear if Kamakau is referring to Pu'uloa as the *ahupua'a* or the locale area along the west coastline at the mouth of the harbor, but the *Ke Au Hou* reference clarifies that the Kaupe'a area extended west to Kanehili. Oral testimony documented above indicates that an error may exist for the current boundaries of the *ahupua'a* of Pu'uloa and Honouliuli. Nonetheless, both *ahupua'a* are relative to the history of the 'Ewa Coral Plain and the current project parcel. The location of the Kaupe'a *wili wili* trees was not clearly established, thus Kaupe'a perimeters could not be accurately mapped. The current project parcel, however, definitely lies within the traditional area of Kaupe'a, according to these descriptions.

4.3 THE LANDS OF 'EWA

The lands of 'Ewa are described by several early historical sources, with reference to the barren lands of Pu'uloa and Honouliuli; Vancouver, while anchored at the entrance to *Kaihu o Pala'ai* (West Lock Bay) in 1793, noted that:

> The part of the island opposite to us was low...forming a level country between the mountains that compose the east and the west ends of the island." (Vancouver 1883,v3: 361, 363)

The coral plains of Pu'uloa and Honouliuli lie west of Vancouver's location. He adds that:

> This tract of land was of some extent, but did not seem to be populous, nor to

> This tract of land was of some extent, but did not seem to be populous, nor to possess any great degree of natural fertility; although we were told that, at a little distance from the sea, the soil is rich, and all the necessaries of life are abundantly produced. (Vancouver 1883,v3: 361, 363)

The latter more fertile lands referred to are likely those, which lie to the northwest, inland of the inner bay coastline.

McAllister in referring to the 'Ewa coral plains during his survey in 1930 (Site 146) states that there are remains of many sites throughout this area, and that

> It is probable that the holes and pits in the coral were formerly used by the Hawaiians. Frequently the soil on the floor of larger pits was used for cultivation...bananas and Hawaiian sugar cane still growing in them...I doubt if previous to the time of Cook there was ever a large population here. (McAllister 1933:109)

Mr. Shad Kane's oral testimony (above), in part, agrees with the observations of Vancouver in 1793 and McAllister in 1930, and with the historical sources of Beckwith (1940) and Sterling and Summers (1978). These sources support a similar pre-contact and early post-contact environment for the 'Ewa Coral Plains of Pu'uloa and Honouliuli *ahupua'a*; the area supported a marginal early population and agricultural environment. Much of the land to the west of the harbor was barren in pre-contact years, gaining its reputation as the "barren place for wandering spirits."

Ms. Eaton discussed a collaboration interview that she and her good friend Sister Thelma Genevieve Parish had participated in with Kepa Maly, in May of 1997 (Maly 1999:44). Sister Parish was not available at the present time, but she had shared extensive information about the 'Ewa plains with Maly in 1997. Portions of her testimony describe the early 20th century environment of the Honouliuli Pu'uloa area—the current project area—and include comments relating to historic cultural practices, place names of her childhood era, and the environmental settings of the area during her youth:

> ...the pasturage seems unlikely in our terms today, because it's not meadow-like, but it was just virgin country and the *pipi*, the cattle were turned loose. And then there were divisions (many of them were stone wall enclosures) so that you had one paddock [fattening grounds] following another paddock, following another paddock. So when we left Honouliuli, we were coming through the tail end of the cane lands, then we'd come to a gate, we'd have to stop and get out...and so we had to break or hack-hack at the branches of the *kiawe* trees that had grown over the road after our last visit. And we'd come down, and I'd have to jump out of the car again, and open the next gate, wait until he'd gone through and close that gate. I think we had to do that three or four times...There were coral stone walls and also many were wire fencing, the barbed wire...strung from one *kiawe* wood post to the next...And the gates were swung from larger posts, embedded in the coral.

> My grandmother's property was always...sort of located by the height of the windmill. She had the only windmill in the area and it was a landmark... Kupaka, as I knew it then, is now Parish Drive...And so we referred to that whole area...the area we went through, before reaching my grandmother's country home, was that of Mitsuyasu...[they had] a charcoal burning establishment...Mitsuyasu must have been here before 1925. I know, I found my grandmother's records, and she built her home in '25...So they had come around that time...could have been here before that.
>
> ...The salt works were the focal point of the ownership, of my great grandfather's ownership...[he] commercialized in salt, and sold it.
>
> The only other habitation, if I can refer to it as such, was my cousin's country home, and she was the daughter of Samuel Dowsett. And [he] had an old country home down in this area. And then beyond to the west of my grandmother's holdings was, where the holdings of my grand uncle Alika, that's Alexander Cartwright Dowsett. And his old home was visible from the beach area outside my grandmother's home.
>
> Ewa Village was the last plantation area of this whole locale, and Ewa Plantation was very much in the works, and they had their extensive cane fields, through Honouliuli and all the way around, along Farrington Highway, almost to Nanakuli...The changes have been tantamount, but they've come about primarily with the closing down of sugar. (Maly 1999:44)

Maly noted that "the aunties were talking about new place names in the 'Ewa District, and how inappropriate they were, some not even of Hawaiian origins]" He asked their opinion on this and Sister Parish stated that "There's no excuse for them not to research and find names applicable to the area". Auntie Arline stated "That's what happened with that Gentry, they just...look at the names they have." Sister Parish added, "It reflects a good deal of the *po'e haole* [foreign] thinking...It's so stupid! To have to put up with these nonsensical names.".

Ms. Eaton provided the following information to us regarding the area of her childhood.

As a young child Ms. Eaton spent her weekdays at their home in Kalihi and weekends and holidays at the Pu'uloa residence, later making the Pu'uloa residence her full time home. She states that her childhood playmates at Pu'uloa roamed the area freely, and ventured as far as Kalaeloa (Barber's Point) to the west. Ms. Eaton and her childhood friends often visited the Robins family at their home near and a little inland of the lighthouse at Kalaeloa. The Robins were the third family to move into the area, as she recalls, because Mr. Robins was to be the lighthouse keeper. She and her friends explored the coral plains and the coastline, and came to know it well. She recalls that they often came upon individuals fishing along the beaches, who sometimes shared fish they were cooking with her and her friends. She recalls the meals as being very delicious, and often including lobster. Auntie Arline shared that although they were just small children, they had no fear of persons coming to utilize the beaches. "Anyway" she states "if they had tried any mischief we had just to run, because no one knew the area as we did. We often played in the wetlands, they are of particular importance to us then and now."

of her family the Brede's, the Dowsett-Parish families, and the Robins' family.

Papa Brede, Ms. Eaton's father, told her that sometime during the time of Kamehameha II or III, she was unsure—the king sold the Dowsett family most of Pu'uloa. Being the second permanent residents in the area, they established a home in Kupaka (the area of present day Parish Road), but their land ran from Iroquois point to Campbell high school and west through what is now called 'Ewa Beach and Pohakupuna Road to just before Oneula Beach. Ms. Eaton believes that the king, possibly being Liholiho, may have needed money at the time and thus deciding that the barren lands of Pu'uloa and Honouliuli were suitable for selling. Sometime after this land sale, the Dowsett-Parish family sold William Brede (I) the land on which they lived. The first ventures of the Dowsett's enterprises included the commercialized salt-works and the cattle business. Papa Brede began to work for the Dowsett's Ranch, overseeing operations.

4.4 *Mahina'ona*

Mr. Kane added that the term Kaupe'a also referred to the Hawaiian celebration of ancestors and their relationship and use of the Southern Cross Constellations.

Mr. Kane discussed a particular migration of very early inhabitants, sun-worshipers from Tahiti, who may have occupied or used for a time the area that includes the current project parcel. The construction of at least two *heiau*, one in Wai'anae and one in Waikiki are attributed to these early sun-worshipers. He did not recall the exact names of the two heiau, but knew that the Waikiki heiau was near Diamond Head. The *Opunaha Altar*, which stood on the grounds of the present day Waikiki Aquarium, is also attributed to these sun-worshipers; this site was the primary observation location for the traditional practice of viewing an event called the *Mahina'ona*. The *Mahina'ona*, he explains, refers to a vision of a bright glowing crown visible through sunset, which takes place at the beginning of *Kau* (or *Makali'i*) the warm season for the Hawaiian calendar. The date coincides with May 1 in the Western calendar. Near this date, from the area of the ancient *Opunaha Altar*, the sun sets in the west behind Pu'u o Palailai and Pu'u o Kapolei creating the vision of the glowing crown. The current project area lies in the direct path of the traditional viewing direction for the *Mahina'ona* Crown.

Tuggle and Tomonari-Tuggle also note the common associations between 'Ewa and Kahiki (the traditional homeland of Hawaiians). Kahiki is most often referred to as defining Tahiti.

Emma Metcalf-Nakuina states:

> There were sun-worshippers among the original arrivals in Hawai'i, and there were two temples dedicated to the sun on O'ahu—one at Kaneloa (a part of the present Kapiolani Park), and one at Kau'o Kala, Waianae. These temples were not for the whole population, but for only a few who claimed it as a privilege...(Nakuina 1904:8)

Dr. Bruce Carlson, director of the Waikiki Aquarium, published a historical informational flyer for the Aquarium in 1985 that details the traditional *Mahina'ona* viewing event. He stated that "Hawaiians watched the setting sun as a way of marking the seasons, and that the Waikiki

Aquarium grounds near the seal pool once contained the alter mentioned above; an important site for a significant cultural event called the *Mahina'ona*. When the sun moved north it would at one point in the year align in the west and set directly behind Pu'u o Kapolei and Pu'u o Palailai (two hills northwest of the project area). When the sun set behind these two hills at the particular alignment, a glowing crown was the result. This crown can be seen from the ancient altar site on the Aquarium grounds, which is in direct alignment. Carlson understood that this event was suppose to occur near May 1st, forty days after the spring equinox, and has personally viewed the event a few times on May 2nd.

Mr. Carlson stated that his main source was an article by Akin, Akin, and Scudder entitled "Puu o Kapolei":

> Pu'u o Kapolei is a small hill at the southern foot of the Waianae mountain range, also known more recently as Fort Barrett. Puu o Kapolei is an important cultural site and at one time contained a heiau on its peak...we have found that...an observer at the stone enclosure at Queens Surf, Kapiolani Park sees the sun setting into a crown. The crown is actually Puu o Palailai, the hill directly behind Puu o Kapolei as viewed from Kapiolani Park. Thus, on Lei Day, May 1 (...the official beginning of Kau) the sun is seen to set into Puu o Palailai... (Akin, Akin, and Scudder 1985: volume IX, no.12)

Sterling and Summers cite a Kamakau reference to the *Mahina'ona* and Pu'u o Kapolei:

> ...and the Makali'i season when the sun set (kau) from Ka'ula to Kawaihoa was called Kau...When it set at Ka'ula and turned south the season was called Ho'oilo. In the same way the people of Oahu reckoned from the time when the sun set over Pu'uokapolei until it set in the hollow of Mahinaona and called this period Kau, and when it moved south again from Pu'uokapolei and it grew cold and the time when young sprouts started, the season was called from their germination (oilo) the season of Ho'oilo. There were therefore two seasons, the season of Makali'i [Kau] and the season of Ho'oilo. (Kamakau as cited in Sterling and Summers 1978:34)

Kamakau may be referring to the hollow of the *Mahina'ona* vision, however, another reading would attribute *Mahina'ona* as another name for Pu'u o Palailai. Pukui's translation of *mahina* is moon, moonlight, or glow; and *'ona* is intoxicating, etc. (Pukui 1986:219-220;288). An intoxicating glow or moonlight translation for *Mahina'ona* could refer to the vision of the crown itself, the frequent breathtaking moonlight views near the two hills, or a unique combination of the two.

4.5 Kelea, Surf-riding Chiefess from Hana, Maui

Ms. Eaton remembered being told by her grandmother, that at some point in traditional history the area of the project parcel was known as Kelea. The Kelea area, as Ms. Eaton states, acquired its name from an oral history about Kelea a famous female *ali'i* surfer from Hana, Maui, and Chief Lo Lale who abducted her from Maui and made her his wife at his court in Lihu'e, 'Ewa, O'ahu. Ms. Eaton distinguishes the project parcel with the geographical name Kelea. This oral history was conveyed to her by her kupuna:

> ...having heard of the famous Kelea, Chief Lo Lale of Lihue sent his men to Hana to surf with Kelea to Oahu. They enticed her into surfing with them in Hana, and they kept the ride going until they arrived on the beach in Puuloa. Kelea was confused when she saw her surroundings, but Chief Lo Lale was so kind and loving to her that she went to his home in Lihue to live with him, often coming down to the beaches of Ewa to surf. They were quite happy for a time, but eventually Kelea was homesick and the chief, although heartbroken, let her return to her home.

A different variation of this story is recorded in Thrum (1930:58-62) as translated from Kamakau's version. In this version, Kelea is a chiefess and the sister of Kawao who is the king of the Hamakuapoko and Kekaha sections of Maui. She is known for her beauty and expertise in surfing. Chief Lo Lale from Lihu'e, O'ahu sent a group of his attendants to find him a wife. After searching other islands they reached Maui and were told of the famous surfing Chiefess Kelea. They were told that they could find her "indulging in the rolling surf in the early morning," at Hamakuapoko. The bride delegation boarded their canoe and sailed for Hana. The delegation called to Kelea "O chiefess, make your landing on this canoe." Kelea agreed reluctantly, and "knew not that this was a woman-snatching canoe, into which she was enticed." The group rode the surf to shore and went out again, and again they landed successfully ashore. During the third trip the wind arose and the delegation stole away to sea, for their O'ahu home. They landed at Waialua, and Kelea was taken to Lo Lale in Lihu'e. He claimed her for his wife and they had three children "who became some of the ancestral chiefs of Hawaii nei." After close to ten years Kelea asked her husband for permission to go sightseeing down into 'Ewa, reluctantly he agreed.

The story continues with the trip through 'Ewa, and cites many place names. When Kelea reaches "the rumbling stream of Waipahu" she delights in "the view of the lochs of Puuloa", and they travel on through Halawa and Kawehewehe. The residents of Kawehewehe tell Kelea that "near by is the kou grove of Kahaloa from which to see the surf-riding of the chiefs, and the king, Kalamakua." Arriving at Kahaloa, Kelea secures a surfboard, and the beach crowd cheers her surfing ability and grace. At a distance King Kalamakua heard the cheers and asked what the noise was about. When told that a skilled woman chiefess caused the cheering the king guessed it was the famed Kelea of Maui. The king went to the shore and awaited Kelea. When she came in he asked if she was the Maui chiefess? "Yes," was the reply. The king then said: "Stand forth." And she did so, the king took off his kihei (mantle) and wrapped it around her as a skirt, to shield her...she became his willing spouse". They lived together as husband and wife and had a daughter, Laielohelohe.

There are several variations to this story. Most place Kelea in various 'Ewa locations. A few additional variations can be found in "Legends and Myths of Hawaii" by Kalakaua (1888:209-225,229-246), "Myths and Legends of Our New Possessions" by Skinner (1900:217-219), In The Path of The Trade Winds" by Thorpe (1924:3-12), and "More Hawaiian Folk Tales" by Thrum (1923:77-86).

Kumu Hula John Kaimikaua was contacted, and stated that he was not familiar with any cultural practices in the area in question, and that there were no chants that he knew of which referred to the area of the proposed development. He referred us to Pat Bacon. Ms. Bacon said she was not familiar with the area, but that she would try to find someone to contact. At the time of writing, she had not yet responded.

5.0 DISCUSSION

The archival and oral historical research conducted indicates that the project parcel is located on the 'Ewa Coral Plain within an area traditionally referred to as the plain of Kaupe'a – the barren place for mischievous wandering spirits called *ao kuewa*. Further distinction places the project parcel in an area named Kelea.

This area is documented as having been a main thoroughfare for travelers to the settlements on the western coastline. A trail is documented in oral history as having passed between Pu'u o Kapolei and Pu'u o Palailai.

Any permanent Hawaiian residents of the coral plains, during both pre- and post-contact years, would have had an arduous time of acquiring subsistence resources, particularly during drought. Resources within the *ahupua'a* of Honouliuli and Pu'uloa included access to marine resources, and fertile coastline and stream gulch area agricultural lands. The abundant forest resources, mentioned above, were located north of the Honouliuli *Ahupua'a*. Avifauna was also available on the plain.

Although the project parcel and surrounding area did not support a large human settlement area, it has a rich cultural history and legendary fame. The area is referred to in many chants and oral histories. The importance of Pu'u o Kapolei as a seasonal solstice landmark related to an ancient cultural viewing event, of which the project area lies in the direct path, is of particular cultural importance. The traditional place name Kaupe'a, and its cultural significance as the "earthly place for wandering mischievous *ao kuewa*" who did not make it to the desired afterlife realm, identifies the area as an important part of the ancient Hawaiian belief system.

The only archaeological sites documented in the project parcel area thus far are the coral sinkholes, which were used for agriculture. The traditional surface for these sites have long been destroyed, with in-fill during the cattle grazing years and plowing during clearing for sugarcane agriculture.

It does not appear that the proposed development will have any adverse effect to traditional cultural activities in the area.

6.0 REFERENCES

Akin, J., M. Akin, and R. Scudder
1985 Pu'u o Kapolei. *The Native Hawaiian*, November, volume IX, no. 12. Honolulu, Hawaii.

Beckwith, Martha
1970 *Hawaiian Mythology*. University of Hawaii Press, Honolulu, Hawaii.

Emerson, N. D.
1978 *Pele and Hiiaka: a Myth from Hawaii*. Originally published 1915. Charles E. Tuttle, Rutland, Virginia.

Fornander, Abraham
1916-1920 *Fornander Collection of Hawaiian Antiquities and Folklore*. Memoirs of the B.P. Bishop Museum, Vols. 4-6. Originally published 1870s. Bishop Museum Press, Honolulu, Hawaii.

1996 Ancient History of the Hawaiian People. Mutual Publishing, Honolulu, Hawaii.

Hawaiian Annual
1930 Kelea, The Surf Rider. *The Hawaiian Annual* for 1931. Thos. G. Thrum, Honolulu, Hawaii.

Hawaiian Studies Institute
1987 O'ahu: Pre-Mahele Moku and Ahupua'a. University of Hawaii at Manoa.

Kalakaua, David
1888 *Legends and Myths of Hawaii*. C. L. Webster & Co., New York, New York.

Kamakau, S.M.
1961 *Ruling Chiefs of Hawaii*. Revised Edition. Originally published 1868-1870. The Kamehameha Schools Press, Honolulu, Hawaii.

1964 *Ka Po'e Kahiko, the People of Old*. Bishop Museum Special Publication d1. Originally published 1866-1871. Bishop Museum Press, Honolulu, Hawaii.

1991 *Tales and Traditions of the People of Old; Na Mo'olelo a Ka Po'e Kahiko*. Originally published 1865-1869. Bishop Museum Press, Honolulu, Hawaii.

Maly, Kepa
1999 *Phase III – Archaeological Site Preservation Plan Phased Mitigation Program 'Ewa Marina Community Project Land of Honouliuli, 'Ewa District, Island of O'ahu.* Prepared for HASEKO ('Ewa), Inc., Honolulu, Hawaii. Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawaii.

McAllister, J. Gilbert
1933 *Archaeology of Oahu*. B.P. Bishop Museum Bulletin 104. Bishop Museum Press, Honolulu, Hawaii.

Metcalf-Nakuina, Emma
1904 *Hawaii, Its People, Their Legends*. [no publisher] Honolulu, Hawaii.

Pukui, M. K., S. H. Elbert and E. T. Mookini
1974 *Place Names of Hawaii*. University of Hawaii Press, Honolulu, Hawaii.

Pukui, Mary Kawena
1986 *Hawaiian Dictionary*. University of Hawaii Press, Honolulu, Hawaii.

Skinner, Charles M.
1900 *Myths and Legends of Our New Possessions*. J. B. Lippincott & Co., Philadelphia, Pennsylvania.

Sterling, E.P. and C. C. Summers
1978 *Sites of Oahu*. Bishop Museum Press, Honolulu, Hawaii.

Thorpe, Cora Wells
1924 *In The Path of The Trade Winds*. G. P. Putman's Sons, New York, New York.

Thrum, T. G.
1923 *More Hawaiian Folk Tales*. A. C. Mc Clure & Co., Chicago, Illinois.

Tuggle, David H. and M.J. Tomonari-Tuggle
1997 *Synthesis of Cultural Resource Studies of the 'Ewa Plain Task 1a: Archaeological Research Services for the Proposed Cleanup, Disposal and Reuse of Naval Air Station Barbers Point, O'ahu, Hawaii.* Prepared for Belt Collins Hawaii. International Archaeological Research Institute, Inc., Honolulu, Hawaii.

Vancouver, G.
1798 *A Voyage of Discovery to the North Pacific Ocean, and Round the World*...3 Volumes. Robinson and Edwards, London.

APPENDIX J

TRAFFIC IMPACT ANALYSIS

EWA BY GENTRY
MAKAI DEVELOPMENT

EWA, OAHU, HAWAII

December 2002

PARSONS BRINCKERHOFF
Over a Century of Engineering Excellence

TRAFFIC IMPACT ANALYSIS

EWA BY GENTRY - MAKAI DEVELOPMENT

Ewa, Oahu, Hawaii

December 2002

Prepared For:
Gentry Investment Properties
P.O. Box 295
Honolulu, Hawaii 96809

Prepared By:
Parsons Brinckerhoff Quade & Douglas, Inc.
Pacific Tower - Suite 3000
1001 Bishop Street
Honolulu, HI 96813
(808) 531-7094

PBQD Reference Number:
16332C

TABLE OF CONTENTS

Figures

Tables

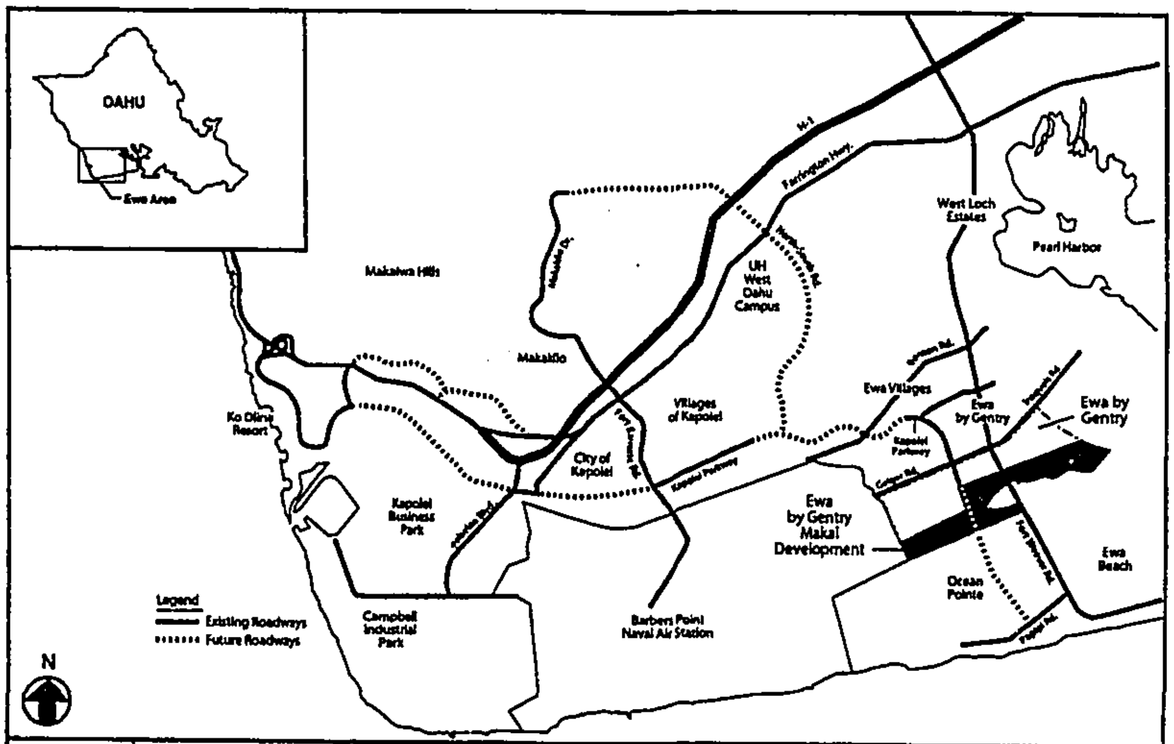
I. INTRODUCTION

This report documents the assumptions and methodology used and summarizes the findings and recommendations of a traffic impact assessment study for the proposed Ewa by Gentry - Makai development in Ewa, Oahu, Hawaii. Existing and projected Year 2010 traffic conditions at key roadway intersections located within the project study area were evaluated. Figure 1 shows the general location the proposed project, and Figure 2 illustrates a conceptual development plan for the proposed project. As shown in Figure 2, the study area is defined by the entrance to the Hawaii Prince Golf Club to the south, Geiger Road to the north, Keaunui Drive to the east, and Kalaeloa to the west.

The proposed project will include single and multi-family residential development, light industrial uses, and recreational and public facilities. The land for the project is proposed to be re-designated from agricultural to urban use through the State Land Use District Boundary Amendment (SLUDBA) process with the State Land Use Commission. After re-designation, the land will also need to be rezoned for the proposed uses. Figure 2 illustrates the boundaries of the land proposed for SLUDBA re-designation action.

Ewa by Gentry - Makai is the logical extension of the Ewa by Gentry Development currently under development in Ewa, Oahu, Hawaii. A significant proportion of the homes planned to be within Ewa by Gentry has already been constructed. Within this development, the new Holomua Elementary School and the Coral Creek Golf Course are complete. As part of the Ewa by Gentry development, the segment of Kapolei Parkway between the Oahu Railway and Land (OR&L) right-of-way and Ewa by Gentry property line, south of Geiger Road, has been constructed to its ultimate cross-section by Gentry Homes, Ltd.

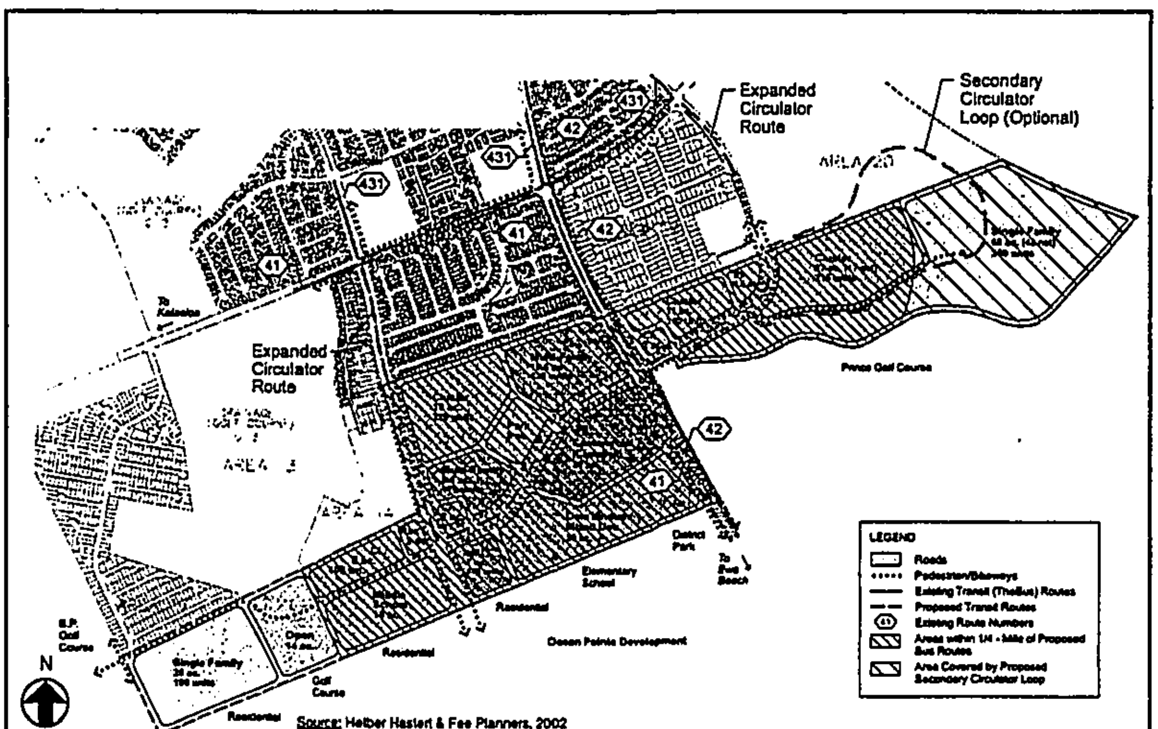
The proposed Ewa by Gentry - Makai project will add 550 singe-family and 1329 multi-family residential units, about 30 acres of light industrial uses, a community recreational center, a new middle school site, two church sites, and two neighborhood park sites. Kapolei Parkway will be extended from Geiger Road south to the Ewa by Gentry - Makai property line. The conceptual development plan is shown in Figure 2.



PB

VICINITY MAP

Figure 1



PB

CONCEPTUAL DEVELOPMENT PLAN

Figure 2

II. EXISTING CONDITIONS

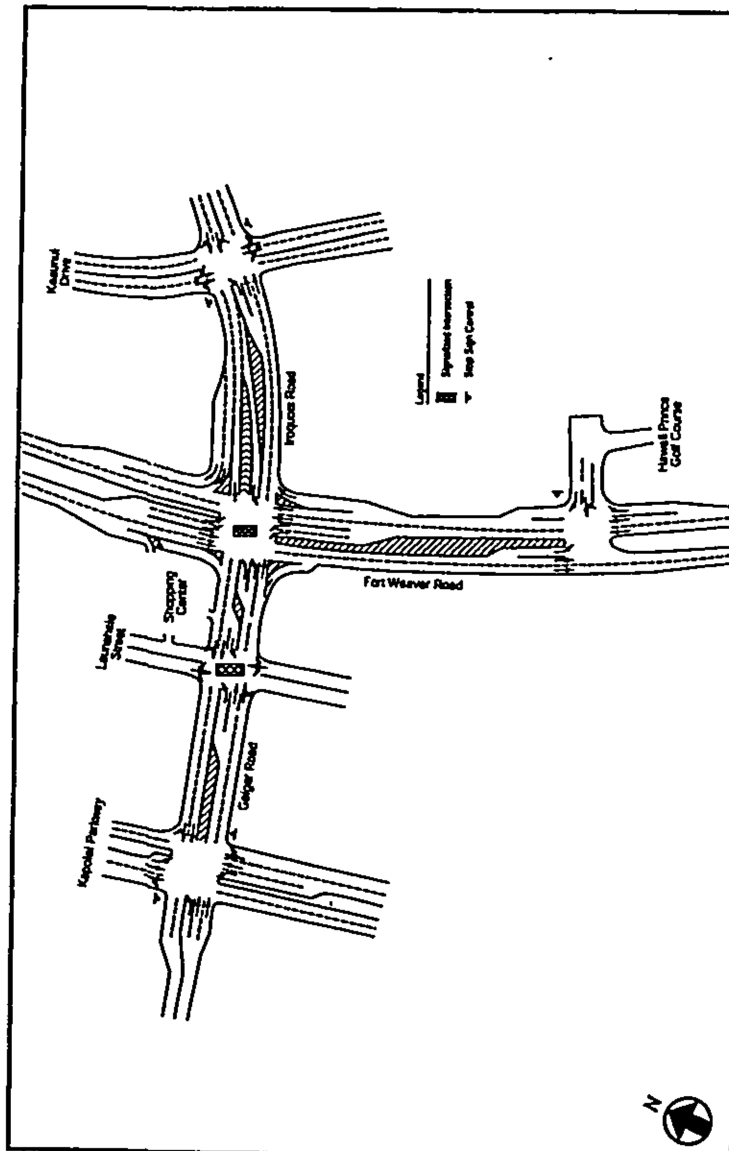
A. EXISTING ROADWAY SYSTEM

Interstate H-1, Farrington Highway, and Fort Weaver Road/Kunia Road provide regional and sub-regional access to the Ewa by Gentry - Makai Development study area. Within the study area, Geiger Road/Iroquois Point Road provides the primary east-west circulation. Fort Weaver Road, Kapolei Parkway, and Keaunui Street provide north-south circulation. Launahele Street, located between Fort Weaver Road and Kapolei Parkway, provides north-south access to existing development. Figure 3 shows the existing roadway lane configurations described in this section.

Fort Weaver Road/Kunia Road

Currently, Fort Weaver Road is the principal north-south arterial roadway serving Ewa and Ewa Beach. It provides access to Interstate H-1 and Farrington Highway. North of Farrington Highway, it becomes Kunia Road. The southern terminus is east of the Ewa Beach International Golf Club where it merges with Cormorant Avenue, leading into the Iroquois Point Naval Housing. Fort Weaver Road/Kunia Road is a six-lane expressway between Interstate H-1 and Farrington Highway with interchanges at H-1 and Farrington Highway. It is a four-lane principal arterial from Farrington Highway to North Road and a two-lane minor arterial through the rest of Ewa Beach.

Within the project study limits on Fort Weaver Road, there is a signalized intersection at Geiger Road/Iroquois Road and an unsignalized intersection with the access to the Hawaii Prince Golf Club. The posted speed limit on Fort Weaver Road is 45 mph at the intersection with Geiger/Iroquois Road and 35 mph at the Hawaii Prince Golf Club access. The Hawaii Prince Golf Club access intersection is where the proposed Keaunui Street extension would intersect Fort Weaver Road.



EXISTING LANE CONFIGURATIONS

Figure 3

Kapolei Parkway

Kapolei Parkway is a divided arterial roadway, currently open to traffic between the south end of Ewa by Gentry property line and the OR&L right-of-way. Ultimately it will be a major arterial providing north-south mobility within the Ewa and Ewa Beach communities. Currently, because only a portion of Kapolei Parkway is open to traffic, it is striped as a 4-lane arterial, and parking is permitted on both sides of the roadway. Future plans call for it to be striped as a 6-lane arterial with no on-street parking. The currently posted speed limit is 30 mph.

Geiger Road/Iroquois Road

Geiger Road is a collector road providing east-west mobility and circulation within the study area. To the west of Fort Weaver Road, it crosses Kapolei Parkway and continues into Kalaeloa (formerly Barber's Point). Between Fort Weaver Road and Kapolei Parkway, Geiger Road is a four-lane roadway with left-turn lanes at intersections (see Figure 3). West of Kapolei Parkway, Geiger Road is, currently, a two-lane, undivided roadway. To the east of Fort Weaver Road, this roadway is named Iroquois Point Road and continues into the U.S. Naval Magazine - Lualualei West Loch Branch. Closer to Fort Weaver Road, this segment also provides access to Keaunui Drive and Holomua Elementary School. It is a four-lane roadway with left-turn lanes at intersections from Fort Weaver Road to a point just east of Keaunui Drive. It then transitions to a two-lane, undivided roadway. The posted speed limit is 30 mph within the Ewa by Gentry study area.

Launahele Street

Launahele Street is, primarily, a north-south collector roadway providing access to Geiger Road. It currently serves multi-family residential development located north of Geiger Road along Hanapouli Circle. South of Geiger Road, it serves a single-family, residential development, curving to the west and eventually becoming an east-west street that intersects Kapolei Parkway. Launahele Street is a signalized intersection with Geiger Road, and its posted speed limit is 25 mph.

Keaunui Drive

Keaunui Drive is a north-south residential collector roadway that provides access to Iroquois Point Road and Kolowaka Drive. Holomua Elementary School is located adjacent to and obtains its access directly from Keaunui Drive. It currently services single-family and multi-family residential development north and south of Iroquois Point Road. Keaunui Drive forms an unsignalized intersection with Iroquois Road, and its posted speed limit is 25 mph.

B. PUBLIC TRANSIT

The City and County of Honolulu Department of Transportation Services - Public Transit Division currently provides an island-wide public bus transit system called TheBus. TheHandi-Van provides para-transit service for semi-ambulatory and non-ambulatory persons with disabilities. Both systems are operated by Oahu Transit Services (OTS), and carries over 80 million passengers annually.

The following bus routes serve the Ewa area:

- Route 42 - This route travels between Ewa Beach and Waikiki via Fort Weaver Road, Farrington Highway, Kamehameha Highway, Nimitz Highway, Dillingham Boulevard, King/Beretania Streets, and Ala Moana Boulevard.
- Route 431 - This route provides circulator service between Ewa Beach and the Waipahu Transit Center. Within Ewa/Ewa Beach, it provides service to development along Geiger Road, Keaunui Drive, Kolowaka Drive, and Renton Road.
- Route 421 - This route provides circulator service within Ewa Beach. It connects Pohakupuna/Papipi with Fort Weaver/Popoi areas passing through the Ewa Beach Transit Center located near the intersection of Fort Weaver Road and North Road.
- Route 41 - This route travels between the City of Kapolei and Ewa Beach via Kamokila Boulevard, Farrington Highway, Fort Barrette Road, Roosevelt Avenue, Geiger Road, and Fort Weaver Road.

- Routes 91 and 101- These are express routes that operate only during weekdays in the morning and afternoon peak periods. The routes travel from specific residential areas within Ewa/Ewa Beach to downtown Honolulu.

Additionally, the CityExpress! Route A and other express buses operate out of the Waipahu Transit Center, accessible to Ewa and Ewa Beach riders through Route 431.

C. EXISTING INTERSECTION GEOMETRY AND CONTROL

Existing traffic conditions were observed and documented, and operations of study area signalized and unsignalized intersections were analyzed. The existing intersection operational characteristics established base conditions for comparison to future operations with and without the project.

Traffic-related data were collected for each of the five study intersections. Traffic turning movement volumes, field observations of intersection operations, and general intersection characteristics were noted. Geometric lane configurations, intersection traffic control, and traffic signal phasing and timing data were collected. Intersection geometry inventory included the following:

- Number of lanes and lane widths,
- Crosswalk locations,
- Unsignalized intersection control,
- Signalized intersection locations,
- Entrance and driveway locations,
- and Posted speed limits.

These data were used as inputs into the intersection analyses. The existing lane configurations are illustrated in Figure 3.

D. EXISTING TRAFFIC VOLUMES

Traffic turning movement counts were conducted at the following intersections on Wednesday 8 May 2002 for the PM peak hour and Thursday 9 May 2002 for the AM peak hour.

- Geiger Road and Kapolei Parkway,
- Geiger Road and Launahele Street,
- Fort Weaver Road and Geiger Road,
- Iroquois Road and Keaunui Road.

The AM and PM peak hours were found to occur from 7:00 to 8:00 AM and from 4:00 to 5:00 PM, respectively. Figure 4 shows the existing peak hour traffic volumes for each turning movement at these intersections. Existing traffic count data can be found in Appendix A.

E. EXISTING INTERSECTION OPERATIONS

The intersections were analyzed using the methodologies for unsignalized and signalized intersections outlined in the *2000 Highway Capacity Manual (HCM)*. Operating conditions at an intersection by approach are expressed as a qualitative measure known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with low delay, while LOS F represents congested conditions with relatively high delay. The overall intersection LOS is a weighted average of the LOS of individual traffic movement groups. Appendix B has more detailed definitions of intersection LOS.

Field observations were performed at selected intersections to verify the results of the intersection analyses.

1. Results of Unsignalized Intersections

Table 1 displays the existing conditions level of service (LOS) for each unsignalized intersection. Most movements operate at acceptable LOS.

Left turn and through movements from Kapolei Parkway experience delay during both morning and evening peak hours due to through traffic demand on Geiger Road. This through traffic is the result of the opening of Kalaeloa (Barber's Point) to non-military traffic. The southbound left-turns from Kapolei Parkway onto eastbound Geiger Road experience the highest delay during both peak hours. This condition occurs around 7:30 A.M. for a concentrated 10 to 15 minute period and a less intense situation occurs around 4:30 P.M. Mitigating this condition somewhat are gaps in the westbound traffic flow on Geiger Road created by the adjacent traffic signal at Launahele Street.

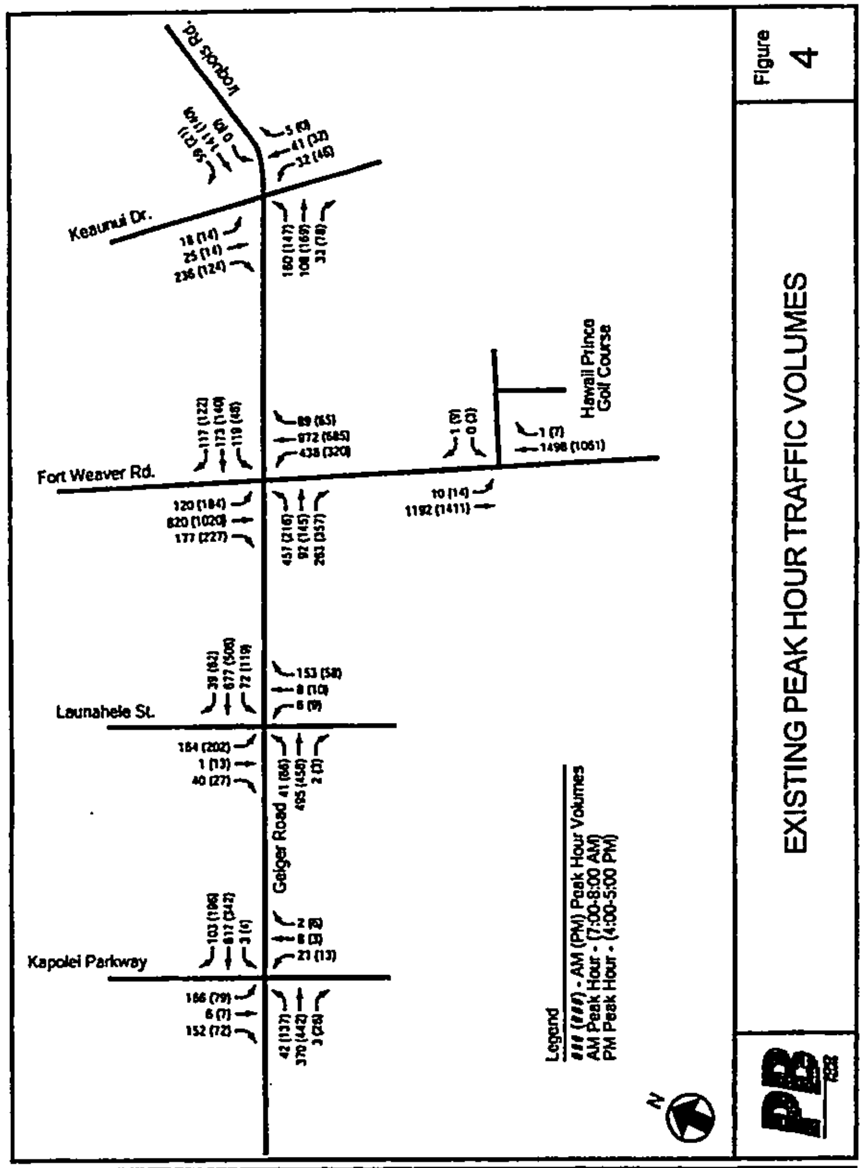


Table 1

Existing Conditions Level of Service Summary

Unsignalized Intersections

Intersection	AM Peak Hour LOS	AM Peak Hour Delay (sec/veh)	PM Peak Hour LOS	PM Peak Hour Delay (sec/veh)
Geiger Road/Kapolei Parkway	**Unsignalized**			
Geiger EB Left	A	9.6	A	9.3
Geiger WB Left	A	8.1	A	8.4
Kapolei NB Left	D	29.3	D	31.9
Kapolei NB Thru	D	29.3	E	36.0
Kapolei NB Right	C	22.8	B	13.7
Kapolei SB Left	F	152.8	F	52.6
Kapolei SB Thru	D	27.5	D	32.7
Kapolei SB Right	B	13.8	B	11.8
Iroquois Point Road/Keaunui Drive	**Unsignalized**			
Iroquois Pt EB Left	A	8.1	A	7.9
Iroquois Pt WB Left	A	7.5	A	7.8
Keaunui NB Left	C	23.1	C	24.7
Keaunui NB Thru and Right	C	16.2	C	18.4
Keaunui SB Left	C	18.7	C	18.5
Keaunui SB Thru and Right	B	11.4	C	10.2
Fort Weaver Rd/Keaunui Drive	**Unsignalized**			
Ft Weaver SB Left	B	14.5	B	11.2
Keaunui WB Left	E	40.3	D	27.2
Keaunui WB Right	C	16.4	B	13.1

Note: NB- northbound, SB- southbound, EB- eastbound, WB- westbound

The left-turn movement from the Hawaii Prince Golf Club access road to southbound Fort Weaver Road does not have a high demand, but vehicles attempting to execute this movement during the peak hours experience delay due to high traffic volumes on Fort Weaver Road. Observations show that the left-turn movement is currently accomplished in two steps. First, a vehicle crosses the northbound lane on Fort Weaver Road and then stops in the median area. Second, the vehicle merges into the southbound traffic flow.

These steps reduce the delay because the vehicle does not have to wait for an acceptable gap in both the northbound and southbound traffic on Fort Weaver Road.

2. Results of Signalized Intersections

Two signalized intersections are located within the study area, Fort Weaver Road/Geiger Road/Iroquois Point Road intersection and Geiger Road/Launahele Street. Cycle length at Fort Weaver/Geiger varies from 120 to 150 seconds, while cycle length averages about 60 seconds at Geiger/Launahele. Table 2 displays the existing level of service for the signalized intersections.

Table 2
Existing Conditions Level of Service
Signalized Intersections

Intersection	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
Fort Weaver Rd/Geiger/Iroquois Roads	**D**	**50.9**	**D**	**47.9**
EB Left	D	50.8	D	53.2
EB Through	D	45.2	D	54.5
EB Right	C	25.7	D	38.4
WB Left	E	59.3	D	51.2
WB Through	E	65.3	D	54.3
WB Right	B	13.4	C	21.8
NB Left	D	53.5	D	54.2
NB Through	D	48.5	D	53.6
NB Right	B	19.0	C	24
SB Left	E	58.9	D	43.5
SB Through	E	71.4	D	54.3
SB Right	B	18.2	B	18.6
Geiger Rd/Launahele St.	**B**	**12.3**	**B**	**12.0**
EB Left	B	11.5	B	11.7
EB Through	B	12.1	B	11.9
WB Left	B	11.6	B	12.6
WB Through	B	13.2	B	12.4
NB Left	A	9.1	A	9.2
NB Through	B	10.3	A	9.5
SB Through	B	11.7	B	11.7

Note: NB- northbound, SB-southbound, EB- eastbound, WB- westbound

At the Intersection of Fort Weaver Road and Geiger/Iroquois Point Road, the southbound approach experiences traffic delays during the A.M. peak because of the long signal cycle length and the large amount of green time allocated to traffic turning from eastbound Geiger Road onto northbound Fort Weaver Road. Significant green time is also allocated to the northbound to eastbound left-turn movement, adding to the delay for southbound traffic. Still, the overall intersection operates at an accepted LOS D for peak hour conditions.

Figure 5 summarizes the existing intersection levels of service. For detailed analysis information, Appendix C includes intersection capacity analysis worksheets.

F. SUMMARY OF RESULTS

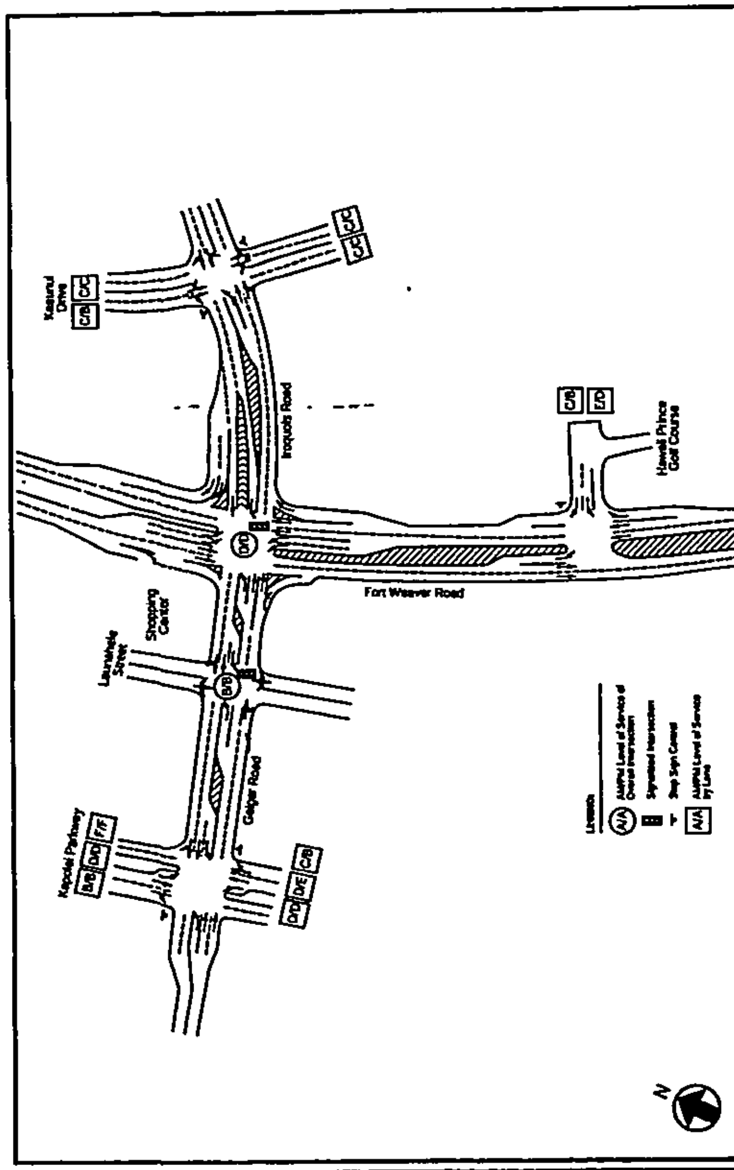
In summary, most traffic movements at the intersections along Geiger Road and Iroquois Road operate acceptably during both peak hours. There are selected movements at the intersections of Geiger Road/Kapolei Parkway, Fort Weaver Road/Geiger Road/Iroquois Point Road, and Keaunui Drive that experience delays.

Field observations during the morning peak hour confirmed an average six to seven vehicles queued for the southbound left-turn movement and one to two vehicles for the northbound through movement on the intersection of Kapolei Parkway/Geiger Road. This delay is caused by the existing through volumes on Geiger Road. The northbound through volume performing this movement is less than ten vehicles per hour (vph) during peak hours. As a result this delay affects only a few vehicles. The queued vehicles were also allowed time to discharge onto Geiger Road from the adjacent signal at Launahele Street/Geiger Road which create gaps in the westbound flow allowing time to for vehicles to execute their movements.

Vehicles queued in the southbound and northbound left-turn movements on Fort Weaver Road and through movements on Iroquois Point Road during AM peak hour. This delay is caused by the magnitude of the left-turning volume from eastbound Geiger Road onto northbound Fort Weaver Road.

The westbound left turns from the Hawaii Prince Golf Course Entrance to southbound Fort Weaver Road experience delays in both peak hours due to the high volume of traffic on

Fort Weaver Road. However, the volume of traffic performing this left-turn movement is less than five vehicles per hour (vph) during the peak hours, and, therefore, this delay affects only a few vehicles. This left-turn movement is also helped by traffic signals at the adjacent intersections on Fort Weaver Road, which create gaps in the Fort Weaver Road traffic flow, allowing merging the left-turns to execute.



EXISTING INTERSECTION LEVEL OF SERVICE

Figure 5

III. YEAR 2010 TRAFFIC CONDITIONS

The Year 2010 was used as the basis for future traffic analysis. This time frame was used because it is the time frame used to develop the Ewa Impact Fee Ordinance (Chapter 33A, Revised Ordinances of Honolulu). This chapter sets forth a regulatory scheme for the assessment and collection of impact fees to be borne on a pro-rata share basis by landowners, developers, home builders, and others who directly contribute to expanding the population and increasing economic activity in the Ewa region through new land development activities.

The proposed Ewa by Gentry - Makai develop is estimated to take 15 to 20 years to be completed, but assuming that the entire development is complete by 2010 would be conservative is concentrating its impacts within a relatively short time frame.

A. FUTURE ROADWAYS AND PUBLIC TRANSIT

Future roadway improvements assumed for the Year 2010 time frame were based on a judgment of which roadway improvements described in the *Oahu Regional Transportation Plan (ORTP)*, approved April 6, 2001 by the Policy Committee of the Oahu Metropolitan Planning Organization (OMPO), would be implemented. The ORTP describes future roadway improvements for a Year 2025 horizon. The *Ewa Transportation Master Plan* and the *North-South Road Corridor Study* were also consulted.

1. Regional Roadways

Several improvements will be made to Interstate H-1, Farrington Highway, and Fort Weaver Road, and Kapolei Parkway and North-South Road are planned for completion by the Year 2010.

<u>H-1 Freeway</u>

The following Interstate H-1 improvement is assumed to occur by the analysis year:

- North-South Road Interchange - New interchange on H-1 Freeway constructed.

<u>Fort Weaver Road</u>

- Fort Weaver Road widened to six lanes between Geiger Road and Farrington Highway.

<u>North-South Road</u>

- New north-south arterial roadway constructed between H-1 Freeway and Kapolei Parkway. The new North-South Road will provide alternative access to H-1 Freeway for Ewa and Ewa Beach areas. Within the year 2010 time frame, it may be implemented as a 2-lane roadway with the ultimate cross-section being 4 to 6 lanes.

<u>Kapolei Parkway</u>

- Kapolei Parkway completed from Papipi Road to Fort Barrette Road in Kapolei. Much of this roadway is completed today. The City and County of Honolulu is currently moving forward on the segment between the OR&L right-of-way and Renton Road. This leaves the segment between Renton Road and the drainage bridge near Kapolei Middle School as a key link to be finished for Kapolei Parkway to fulfill its arterial function to provide enhanced mobility within the Ewa plain. Additional segments makai of the current terminus near Geiger Road are also assumed to be completed. Part of the makai segment would be constructed as part of the Ewa Gentry – Makai development, while the other makai segment would be constructed by Haseko as part of the Ocean Pointe development.

<u>Farrington Highway</u>

- Farrington Highway widened to four lanes from Kapolei Golf Course Access Road to Fort Weaver Road. Farrington highway is already four lanes wide from the Kapolei Golf Course Access Road to Kamokila Boulevard.

2. Transit Service

The current bus routes reflect a "hub and spoke" system implemented recently. As population grows, the bus fleet is assumed to grow to handle the transit demand placed on the bus system. A new bus maintenance facility recently opened in Pearl City and there have new transit centers and bus stop improvements implemented. Through the *Primary Corridor Transportation Project*, the City and County of Honolulu is planning improvements that would increase the transit carrying capacity between the Ewa region and urban Honolulu.

B. TRIP GENERATION

The *Institute of Transportation Engineers (ITE), Trip Generation, 6th edition* (1998) was used to estimate the number of trips generated by the Ewa by Gentry - Makai Development based on land uses identified in the conceptual development plan (Figure 2).

The conceptual development plan identifies the boundaries of the parcel proposed for re-designation from agricultural to urban. Also included in this conceptual development plan are future development parcels for the Ewa by Gentry development that have already received zoning approvals. These are treated as background traffic. The site-generated traffic acknowledges only the development contained in the area undergoing re-designation from agricultural to urban. Table 3 summarizes the trips generated by the proposed Ewa by Gentry - Makai Development. The parcel numbers correspond to the parcel numbers in the conceptual development plan shown in Figure 2 of this report.

The ITE codes and land use descriptions are shown for each parcel. Table 3 summarizes the total trips generated by the Ewa by Gentry - Makai Development. Traffic created along adjacent streets from the middle school was assumed to be negligible during PM peak hour. During the assignment phase of the travel demand estimation analysis, adjustments were made to these total trips to account for trips that are projected to occur between land uses located within the Ewa by Gentry - Makai Development. Examples are trips traveling between residential development and future middle school Parcel 6A. Appropriate adjustments were made to eliminate double counting of trips. A similar adjustment was made to trips between residential uses and future commercial retail Parcel 4A being developed by others.

Table 3

Trip Generation Summary

Parcel	Land Use	ITE Code	Intensity	Units	AM Peak Hour		PM Peak Hour	
					Enter	Exit	Enter	Exit
17 & 34 A	Single Family	210	190	Units	34	102	117	66
1A	Single Family	210	360	Units	65	194	221	124
2A	Cluster	220	100	Units	8	42	38	19
2B	Cluster	220	220	Units	18	93	84	41
2C	Cluster	220	140	Units	11	59	53	26
2D	Cluster	220	215	Units	17	91	82	40
34G	Drainage	N/A	14	Acres	0	0	0	0
3A	Multi Family	220	140	Units	11	59	52	26
3B	Multi Family	220	170	Units	14	72	63	31
3C	Multi Family	220	330	Units	26	139	123	60
5A	Light Industrial	130	30	Acres	257	53	67	251
6A	Middle School	522	700	Students	184	138	0	0
6B	Rec Center	412	2	Acres	0	0	0	0
6C	Community Facilities	412	2	Acres	0	0	0	0
6D	Community Facilities	412	2	Acres	0	0	0	0
7A	County Park	412	8	Acres	0	0	0	0
7B	County Park	412	3.5	Acres	0	0	0	0
Total					645	1042	900	684

*The PM peak hour traffic volumes are negligible

C. TRIP DISTRIBUTION AND ASSIGNMENT

The traffic generated by the proposed Ewa by Gentry-Makai Development was directionally distributed and assigned to the future roadway network.

A summary of regional travel patterns entering and exiting the Ewa area was created from the Oahu Metropolitan Planning Organization (OMPO) travel demand model. Table 4 summarizes the distribution patterns of the generated volumes entering and exiting the Ewa area.

Table 4
Trip Distribution of Ewa by Gentry Makai Trips

Direction: Exiting	Origin: Ewa Gentry AM Peak	Origin: Ewa Gentry PM Peak
Mauka	45%	35%
Makai	15%	15%
Kapolei Pkwy	25%	25%
Roosevelt Ave	5%	5%
Within Gentry	10%	20%

Direction: Entering	Destination: Ewa AM Peak	Destination: Ewa PM Peak
Mauka	35%	45%
Makai	15%	15%
Kapolei Pkwy	20%	25%
Roosevelt Ave	5%	5%
Within Gentry	25%	10%

Traffic within Gentry was distributed to middle school, light industrial, and commercial retail development. These trips were assigned to the roadway network and are reflected in the projected traffic turning volumes. These trips within Gentry were distributed from residential development to non-residential uses as follows: In the AM peak approximately twenty-three percent to commercial retail, thirty-eight percent to light industrial, and thirty-nine percent to the middle school development and in the PM peak approximately seventy percent to commercial retail and thirty percent light industrial development.

These distributions were applied to the trips generated, and the resulting project-generated trip assignment is shown in Figure 6.

D. YEAR 2010 BACKGROUND TRAFFIC

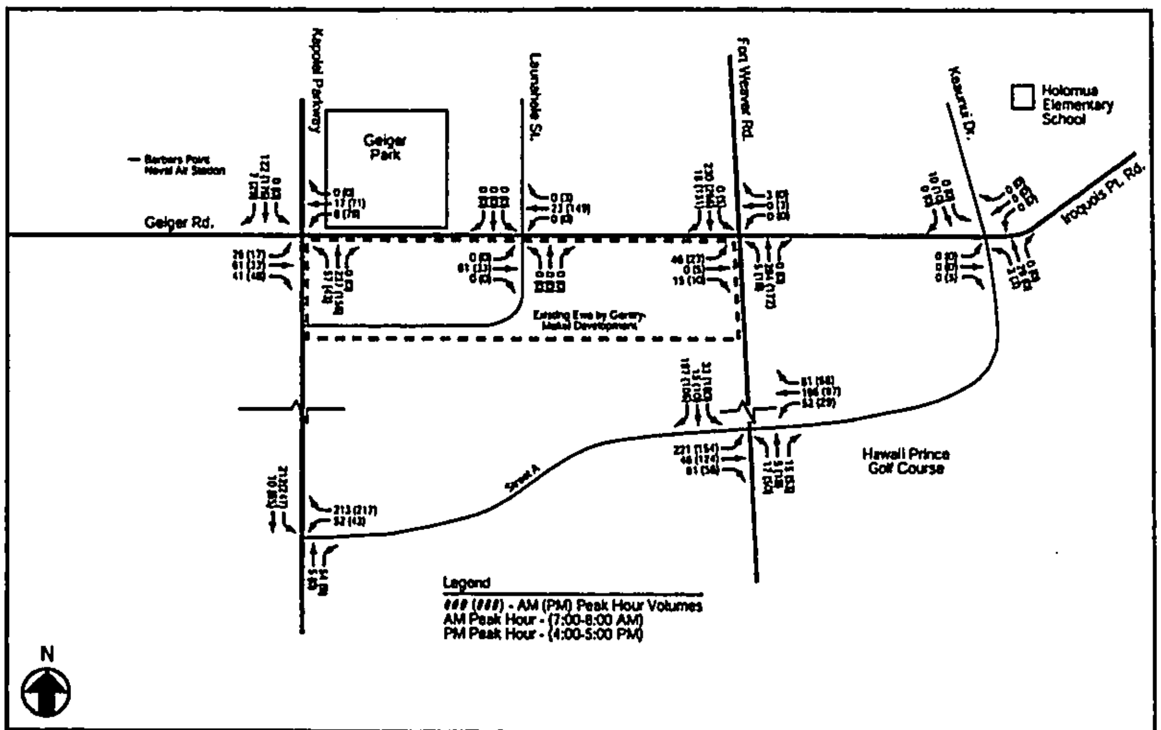
The Year 2010 background traffic volumes were derived from the computerized travel demand model being used to update the *Ewa Transportation Master Plan*. This model is also being used for the *North-South Road Corridor Study* currently completing the planning phase for a new arterial roadway in the Ewa plain. The travel demand model accounts for projected regional traffic patterns.

The future Year 2010 background traffic assumes significant completion of both the Ewa by Gentry Development and the Ocean Pointe Development (Haseko) currently under construction. These two developments account for the majority of future background traffic generated in the study area. Additionally, it was assumed that the commercial retail parcel proposed by the Estate of James Campbell at the Keaunui/Fort Weaver Road Intersection was fully developed. In areas where greater detail was necessary, background traffic was estimated using rates documented in *Trip Generation, 6th Edition*. Traffic volumes forecasted by the *Ewa Transportation Master Plan Update* computerized travel demand model were used as control totals to develop a future Year 2010 peak hour assignment for the study area.

The projected Year 2010 background traffic volumes are shown in Figure 7.

E. TOTAL TRAFFIC

The traffic generated by the Ewa by Gentry - Makai Development was added to the projected background traffic to obtain the total peak hour traffic volumes shown in Figure 8.

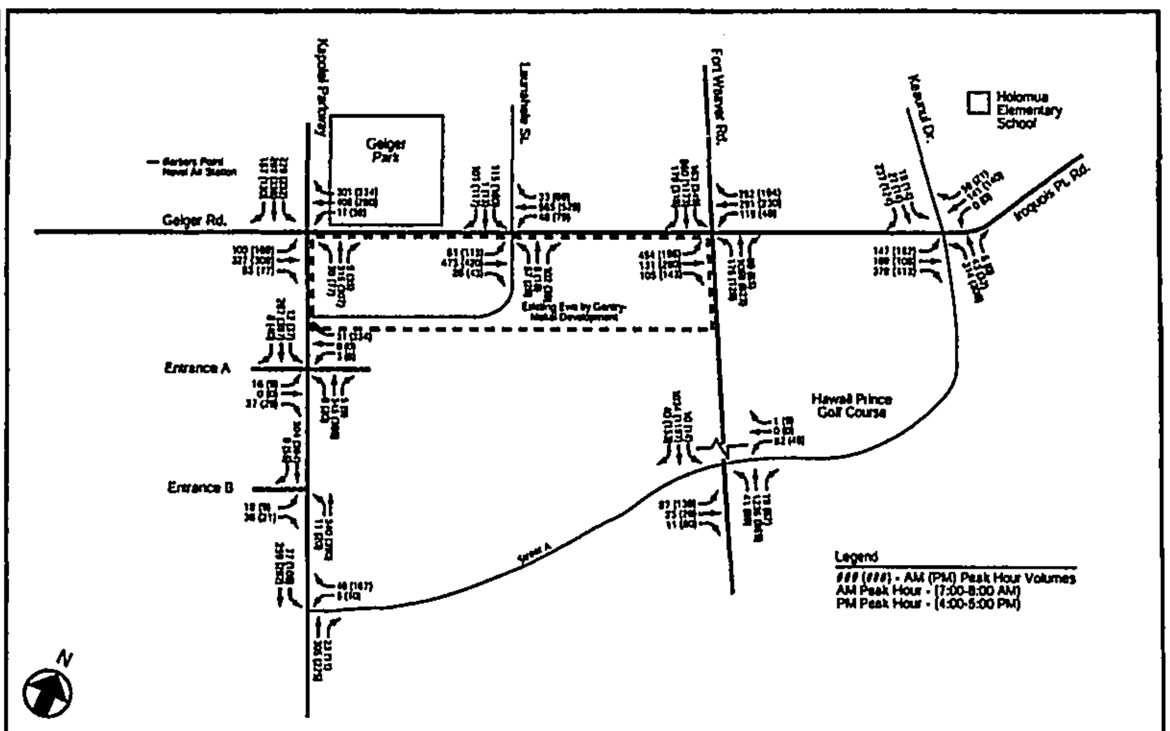


SITE GENERATED PEAK HOUR TRAFFIC VOLUMES

Figure 6

Parsons Brinckerhoff

Ewa Gentry Makai
December 2002

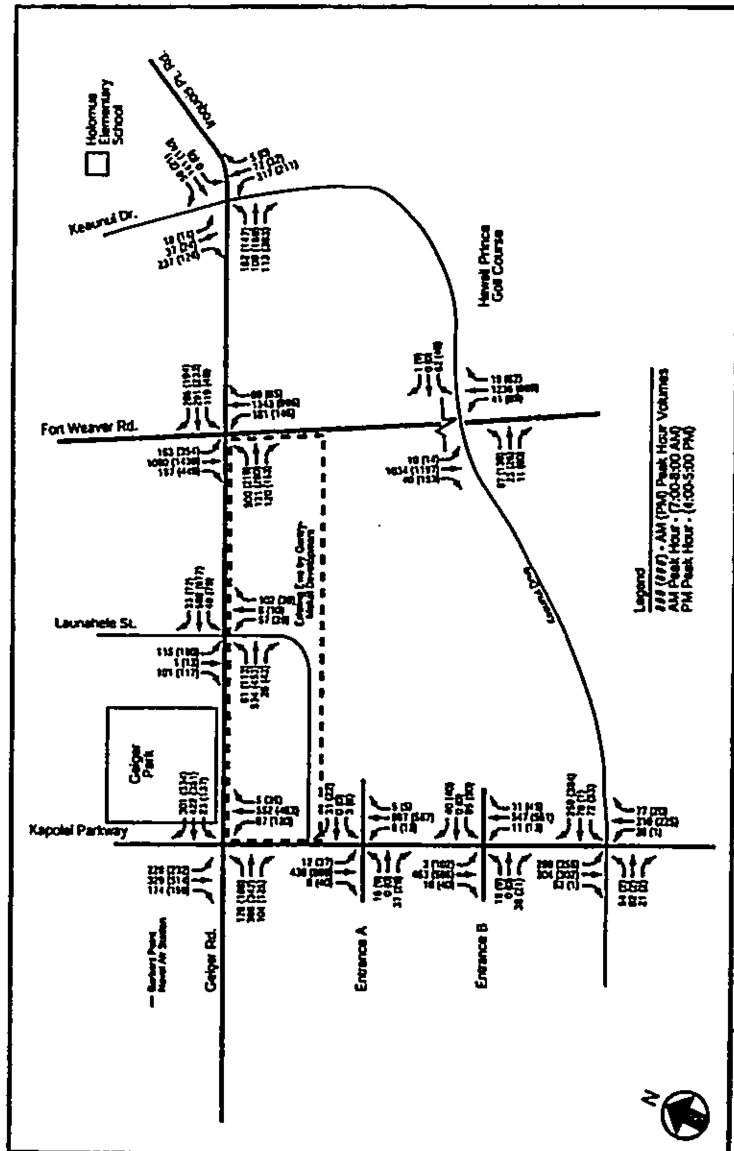


YEAR 2010 PEAK HOUR TRAFFIC VOLUMES
WITHOUT PROJECT

Figure 7

Parsons Brinckerhoff

Ewa Gentry Makai
December 2002



YEAR 2010 PEAK HOUR TRAFFIC VOLUMES WITH PROJECT

Figure 8

F. INTERSECTION OPERATIONS ANALYSIS RESULTS

Key intersections were analyzed using the methodologies for unsignalized and signalized intersections outlined in the *2000 Highway Capacity Manual (HCM)*. Operating conditions at an intersection are expressed as qualitative measures known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with low delay, while LOS F represents congested conditions with relatively high delay. The approach LOS is a weighted average of the LOS of individual traffic movement groups. Appendix B has more detailed definitions of intersection LOS.

Field observations were performed at selected intersection to verify reasonableness of the analysis results.

1. Projected Operations at Unsignalized Intersections

Three intersections were analyzed as unsignalized intersections:

- Kapolei Parkway/Launahele Street/Entrance A (Access Road to Area 14 &12);
- Kapolei Parkway/Entrance B (Access Road to Parcel 34D);
- Geiger Road/Entrance C (Access to Parcels 16, 17, 34A).

Table 5 displays the projected Year 2010 peak hour unsignalized intersection level of service without and with the Ewa by Gentry - Makai Development. As shown in Table 5, the unsignalized intersections generally operate well. The left-turn movement out of the side street tends to experience some delay during the peak hours because of the magnitude of through traffic on the main road. The left-turn movements projected to experience delays occur at the following locations:

- Eastbound left turn out of Entrance A to northbound Kapolei Parkway;
- Westbound left turn out of Launahele Street (Entrance A) to southbound Kapolei Parkway;
- Eastbound left turn out of Entrance B to northbound Kapolei Parkway;
- Westbound left turn out of Entrance B to southbound Kapolei Parkway;
- Northbound left turn out of Entrance C to westbound Geiger Road.

Table 5

Year 2010 Without and With Ewa by Gentry Makai
Level of Service Summary
Unsignalized Intersections

Intersection	With Project				Without Project			
	AM		PM		AM		PM	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Kapolei Pkwy/ Entrance A	Unsignalized				Unsignalized			
Entrance A Eastbound Left	C	23.1	F	43.7	B	14.4	C	21.6
Entrance A Eastbound Right	B	10.1	B	11.8	A	9.4	B	10.1
Entrance A Westbound Left	D	25.3	E	38.0	B	14.8	C	20.9
Entrance A Westbound Right	B	11.0	B	10.6	A	9.6	A	9.8
Kapolei Pkwy Northbound Left	A	8.4	A	9.8	A	7.9	A	8.5
Kapolei Pkwy Southbound Left	A	9.1	A	9.2	A	8.1	A	8.4
Kapolei Parkway/Entrance B	Unsignalized				Unsignalized			
Entrance B Eastbound Left	C	23.1	C	23.5	B	13.3	C	16.5
Entrance B Eastbound Right	B	10.2	B	10.2	A	9.5	B	10.1
Entrance B Westbound Left	E	44.9	D	32.8	No Entrance			
Entrance B Westbound Right	B	10.8	B	11.0				
Kapolei Pkwy Northbound Left	A	8.5	A	8.6	A	8.0	A	8.5
Kapolei Pkwy Southbound Left	A	8.9	A	9.0	No Entrance			
Geiger Road/ Entrance C	Unsignalized				Unsignalized			
Geiger Road Westbound Left	A	8.3	B	10.6	A	8.2	A	9.8
Entrance C Northbound Left	C	18.3	D	29.2	C	16.7	C	20.7
Entrance C Northbound Right	C	15.5	C	15.7	B	12.9	B	13.8

The left-turn movements at entrances A and B along Kapolei Parkway are projected to experience delays during the peak hour time periods. There is significant traffic volume traveling along Kapolei Parkway, but future adjacent traffic signals at Geiger Road and at Keaunui Drive Extension would create gaps in traffic on Kapolei Parkway, providing time for vehicles turning from side streets to complete their desired movement.

At Entrance C on Geiger Road, left-turn movements out of the access would experience delays due to projected through volumes on Geiger Road. It is recommended to provide median storage in Geiger Road for the left-turn movement out of Entrance C, so that vehicles could accomplish the movement in two steps: first a turn out of the access to the median and second, a merge movement from the median into westbound Geiger Road.

2. Projected Operations at Signalized Intersections

Table 6 summarizes the projected Year 2010 peak hour intersection level of service (LOS) for the signalized intersections. As depicted in Table 6, all intersections analyzed are projected to operate at overall LOS D or better during the peak hours, without or with the Ewa by Gentry - Makai Development. The main street approaches along Kapolei Parkway and Fort Weaver Road are projected to operate at LOS D or better. There are selected movements that are projected to operate at LOS E, due primarily to the long cycle lengths used at these intersections. Observations of existing conditions indicate that during peak periods, the traffic signals on Fort Weaver Road operate with cycle lengths approaching 240 seconds. This expedites the mainline Fort Weaver traffic, but creates delays for the side streets. Side street queues were found to clear within one phase, however, and queue lengths on Geiger Road appeared reasonable, not exceeding 10 vehicles per lane. Similar conditions are projected for the future. Appendix C includes intersection capacity analysis worksheets.

In these analyses, Fort Weaver Road was assumed to be a four-lane facility. There is a project sponsored by the State of Hawaii Department of Transportation (HDOT) that will widen Fort Weaver Road to a six-lane facility between Farrington Highway and Geiger Road. It is currently in the design phase. Construction funds have not been programmed

Table 6

Year 2010 Without and With Ewa by Gentry Makai
Level of Service Summary
Signalized Intersections

Intersection/Approach	Without Ewa by Gentry Makai				With Ewa Gentry Makai			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Ft Weaver Rd/ Geiger Rd	D	40.7	C	34.0	D	50.6	D	49.2
Eastbound	D	42.4	D	37.9	D	48.8	D	43.3
Westbound	C	32.9	C	32.7	D	37.5	C	33.0
Northbound	D	52.3	D	38.3	E	76.7	D	46.5
Southbound	C	31.5	C	30.8	C	29.3	E	55.7
Geiger Rd/ Launahele St	B	11.6	B	11.3	B	11.8	B	11.6
Eastbound	B	11.5	B	10.7	B	11.8	B	11.0
Westbound	B	11.9	B	11.0	B	12.0	B	11.6
Northbound	B	10.4	B	10.5	B	10.4	B	10.5
Southbound	B	12.1	B	13.4	B	12.1	B	13.4
Geiger Rd/ Kapolei Pkwy	C	23.5	C	21.4	C	25.3	C	22.9
Eastbound	C	21.2	C	20.2	C	22.2	C	21.5
Westbound	C	29.0	C	24.2	C	29.6	C	24.5
Northbound	C	21.2	C	20.3	C	23.7	C	21.5
Southbound	C	20.0	C	20.3	C	24.9	C	23.4
Keaunui Drive Ext./ Kapolei Pkwy	A	8.5	A	9.5	C	27.3	C	27.1
Eastbound	No Driveway				D	35.3	C	32.8
Westbound	B	12.2	B	12.9	C	22.4	B	19.3
Northbound	A	9.0	A	8.7	C	26.9	C	25.8
Southbound	A	7.4	A	8.4	C	28.8	C	32.9
Ft Weaver Rd/ Keaunui Dr.	D	38.5	C	32.3	D	37.8	C	33.0
Eastbound	D	37.2	C	34.0	D	40.9	D	37.8
Westbound	D	35.7	D	36.0	D	38.0	C	32.9
Northbound	D	46.8	C	27.0	D	47.5	C	27.1
Southbound	C	29.0	C	35.8	C	27.1	D	35.5
Iroquois Rd/ Keaunui Dr.	C	25.5	B	15.9	C	25.6	B	16.1
Eastbound	B	19.6	B	10.4	B	19.6	B	10.4
Westbound	C	33.8	C	30.6	C	33.6	C	30.6
Northbound	C	34.6	C	25.8	C	34.5	C	25.8
Southbound	B	15.5	B	10.1	B	15.9	B	11.5

yet, but HDOT indicates that the project is expected to proceed into construction within the next five years. Assuming a four-lane facility makes the intersection analyses conservative by overestimating the impacts during the peak periods.

The Keaunui Drive/Iroquois Point Road intersection is projected to warrant signalization by the year 2010. The left-turn movements from Keaunui Drive at the Iroquois Point Road/Keaunui Drive intersection are projected to experience delay in the future due to the increase left-turning vehicles traveling towards Fort Weaver Road and Kapolei Parkway. It is recommended to monitor this intersection and, when warranted, signalize the intersection.

d. SUMMARY OF RESULTS

Intersections analyzed are projected to operate acceptably for peak hour conditions without or with the Ewa by Gentry - Makai Development. Implicit in these analysis results are specific roadway and intersection improvements, and these are summarized in the following chapter of this report.

IV. RECOMMENDATIONS AND CONCLUSION

A. RECOMMENDED ROADWAY IMPROVEMENTS

Gentry Homes, Ltd. has already implemented major roadway improvements as part of the Ewa by Gentry Development such as Kapolei Parkway between the OR&L right-of-way and a point south of Geiger Road, widening Geiger Road/Iroquois Point Road between Kapolei Parkway and Keaunui Drive, construction of Kolowaka Drive, construction of part of Keaunui Drive, signalization of the Geiger Road/Fort Weaver Road intersection, signalization of Kolowaka Drive/Fort Weaver Road intersection, and signalization of Launahele Street/Geiger Road intersection.

As they progress into the Ewa Gentry – Makai Development, Gentry Homes, Ltd. will continue internal roadway and intersection improvements. Additionally, the Honolulu City Council has passed, and the Mayor of Honolulu is expected to sign an ordinance that would establish a mechanism for collecting roadway impact fees in the Ewa region for major roadway improvements. Improvements covered by the impact fee ordinance include widening of Fort Weaver Road between Farrington Highway and North Road, completion of Kapolei Parkway between Papipi Road and Ko Olina, and the proposed North-South Road and interchange. The Ewa Gentry – Makai property is included within the influence area of the impact fee ordinance and will, therefore, contribute to the improvement fund.

This section of the report serves to identify roadway improvements that are not covered under the impact fee ordinance. These improvements would be the responsibility of Gentry Homes, Ltd. Figure 9 summarizes the improvement recommendations.

1. Keaunui Drive

As part of the Ewa by Gentry - Makai Development, the existing Keaunui Drive will be extended south and west so that it forms a continuous roadway from Iroquois Road to Kapolei Parkway. This extension will intersect Fort Weaver Road at the existing Hawaii Prince Golf Course access road location. This intersection has existing median left-turn bays and acceleration and deceleration lanes for right-turning traffic on Fort Weaver Road. It is proposed to signalize this access when warranted. The extension of Keaunui Drive will

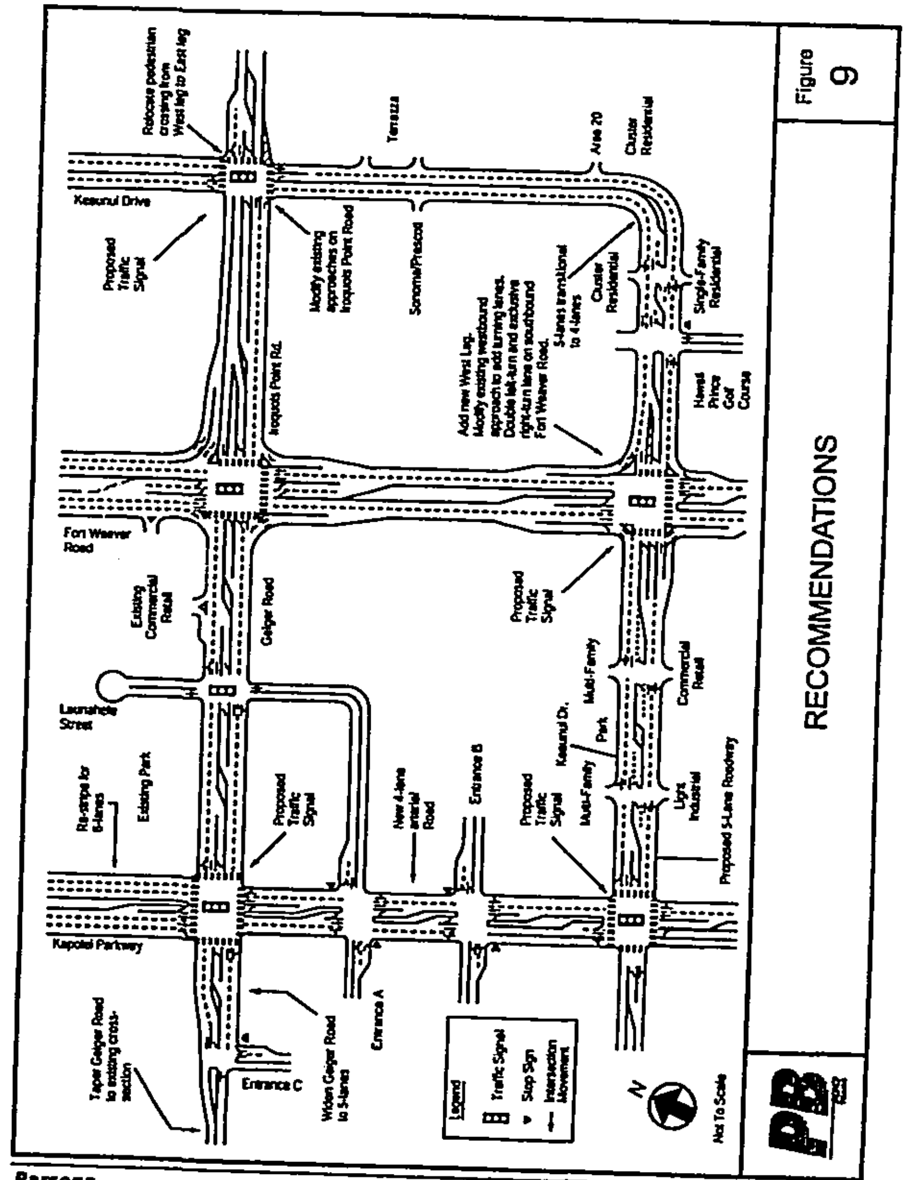


Figure 9
RECOMMENDATIONS

help to distribute traffic and reduce traffic demand at the Geiger Road/Iroquois Road approaches to Fort Weaver Road.

The Keaunui Extension is recommended to have a 5-lane cross-section from Kapolei Parkway to a point just east of the Hawaii Prince Golf Course entrance. It would then transition to a 4-lane, undivided roadway and maintain this cross-section up to Iroquois Point Road. It is also recommended that the segment of the Keaunui Extension located between Fort Weaver Road and the existing Hawaii Prince access road be kept free of accesses to reduce potential conflict with traffic turning onto Keaunui Extension from Fort Weaver Road.

It is recommended that the westbound Keaunui approach to Fort Weaver Road have one through lane, an exclusive right-turn lane, and an exclusive left turn lane. The eastbound approach would be similar except two exclusive left-turn lanes would be provided. The southbound Fort Weaver Road approach already has a southbound to eastbound median left-turn lane. A southbound to westbound right-turn deceleration lane and a southbound acceleration similar to the configuration at the Geiger Road/Iroquois Point Road Intersection is also recommended for eastbound to southbound right turning vehicles. The northbound Fort Weaver Road approach would be configured with an exclusive northbound to westbound median left-turn lane in addition to the existing northbound right-turn lane deceleration lane.

Pedestrian crosswalks would be provided on the west, south, and east legs, similar to the configuration used at the Fort Weaver/Geiger Intersection.

2. Accesses on Keaunui Drive Extension

A painted median similar to that on Geiger Road is proposed for the Keaunui Drive Extension between Kapolei Parkway and Fort Weaver Road. At least three full-movement accesses are proposed for this segment of roadway. One would be located approximately 400 to 500 feet east of Kapolei Parkway and would serve a church parcel to the north and a multi-family residential parcel to the south. The second would be located approximately 800 to 1000 feet east of Kapolei Parkway and would serve a multi-family residential parcel to the north and a commercial/light-industrial subdivision to the south. The third would be located approximately 800 feet west of Fort Weaver Road and would serve a park, multi-

family and single-family residential parcels to the north and a commercial/retail parcel proposed by others to the south.

The segment of Keaunui Drive located between Iroquois Point Road and Fort Weaver Road is partially constructed. Accesses exist south of Iroquois Point Road for the Terrazza and the Sonoma and Prescott subdivisions. Starting at the other end from Fort Weaver Road, accesses are proposed at a point opposite the Hawaii Prince Golf Course Driveway and at two more locations to the east.

3. Geiger Road

West of Kapolei Parkway, Geiger Road is currently a 2-lane roadway. Ewa Gentry –Makai traffic could be accommodated by a 3-lane cross-section, with the third lane providing a median turn lane. Currently, traffic pressures from traffic using Roosevelt Avenue through Kalaeloa to travel between Ewa Beach and Kapolei dominate this segment of roadway. The completion of Kapolei Parkway between Fort Barrette Road and Ewa Beach would relieve this pressure, but as Kalaeloa develops trips generated from Kalaeloa itself will restore this pressure. Because the time frame for the development of Kalaeloa is uncertain, the following recommendation for Geiger Road is provided.

Geiger road, west of Kapolei Parkway is recommended to be widened to a 3-lane cross-section between Kapolei Parkway and the Access to Entrance C, the roadway that provides access to parcels 17 and 34-A as shown in Figure 2. The median lane would provide left-turn protection at the Coral Creek Golf Course entrance and at Entrance C. West of Entrance C, Geiger Road would transition back to its existing 2-lane cross-section. Acknowledging the potential for major development of Kalaeloa, it is recommended to dedicate enough right-of-way to allow Geiger Road to be widened to a four-lane roadway with median at sometime in the future.

At the approach to Kapolei Parkway, a median left-turn lane should be created so that Geiger Road west of Kapolei Parkway matches the cross-section of Geiger Road east of Kapolei Parkway. Also, an exclusive eastbound to southbound right-turn lane is recommended. This intersection should be monitored and, when warranted, a traffic signal should be installed. It appears from the analyses that peak hour traffic signal warrants would be met by the Year 2010 time frame.

4. Iroquois Point Road

Iroquois Point Road currently is configured as a 5-lane cross-section between Fort Weaver Road and Keaunui Drive. This cross-section transitions to a 2-lane roadway just east of Keaunui Drive. The eastbound approach to the Keaunui intersection is configured with an exclusive left-turn lane, a through lane, and a through/right lane. The westbound approach to this intersection is the same, although it achieves this cross-section only about 200 feet before Keaunui Drive.

It is recommended to widen the segment of Iroquois Point Road from Keaunui to the eastern boundary of the Ewa by Gentry development. The median area would be extended to the entrance driveway into the Area 23/24 parcel (Suncrest, Shores, Lombard Way and Avalon developments), then tapered out to return to the 2-lane, undivided cross-section, east of the Ewa by Gentry development. This median area would provide left-turn lanes for traffic movements turning into the Area 23/24 driveway and for traffic movements turning from westbound Iroquois Point Road to southbound Keaunui Drive. One through lane would be provided in each direction between the entrance into Area 23/24 and Keaunui Drive. About 500 feet east of Keaunui Drive, a westbound to northbound right-turn lane would be created.

It is recommended to signalize this intersection when warranted. It appears from the projected traffic volumes that peak hour traffic signal warrants would be met by the Year 2010 time frame. The proposed signal should be coordinated with the existing signal at Fort Weaver Road/Geiger Road intersection.

The northbound approach would be reconfigured as an exclusive left-turn lane and a shared left-through-right-turn lane and the southbound approach to be reconfigured as an exclusive right-turn lane and a shared left-through lane. Signal timing is recommended to be split phase and coordinated with the signals at Fort Weaver Road and Iroquois Point Road.

In conjunction with the signalization of the intersection of Keaunui Drive and Iroquois Point Road, it is recommended to relocate the crosswalk from its existing location on the west leg to the east leg of the Keaunui Drive/Iroquois Point intersection. This would lessen the potential vehicle-pedestrian conflicts between pedestrians crossing Iroquois Point Road

and traffic turning from Keaunui Drive to westbound Iroquois Point Road. Existing curb ramps associated with the existing crosswalk need to be removed. Curb ramps already exist on the east side of the intersection but need to be checked for consistency with current ADA guidelines.

The proposed geometric modifications to Iroquois Point Road, the proposed traffic signal, and the proposed pedestrian crossing improvements have been discussed with both the State of Hawaii Department of Transportation – Highways Division-Traffic Engineering Branch and the City & County of Honolulu Department of Planning and Permitting-Site Development Division-Traffic Review Branch. Both agencies have indicated that the concept is workable, subject to review of detailed design.

5. Kapolei Parkway

The existing segment of Kapolei Parkway between the OR&L right-of-way and the Ewa by Gentry property line south of Geiger Road is expected to connect to North-South Road and eventually to Interstate H-1 Freeway by the Year 2010. When the connection is made, this segment of Kapolei Parkway north of Geiger Road is recommended to be re-striped as a 6-lane arterial roadway with no on-street parking allowed. In this configuration, the outside lanes will serve as shared through/right lanes.

South of Geiger Road, Kapolei Parkway is ultimately planned to be extended to Papipi Road. As part of the Ewa by Gentry – Makai development, it will be extended to the makai Gentry property line. Kapolei Parkway could be configured as a 4-lane arterial roadway in this segment.

6. Accesses on Kapolei Parkway

South of Geiger Road, intersections on Kapolei Parkway are proposed at the existing Launahele Street, the proposed Road B, and the proposed Keaunui Drive Extension. The intersections at the existing Launahele Street and proposed Road B are proposed to be unsignalized with STOP-sign control on the side street approaches. Median left-turn lanes and separate lanes for right and left turn/through lanes are recommended at the unsignalized accesses.

The Kapolei Parkway/Keaunui Extension intersection is proposed to be signalized when warranted. It is recommended that the Middle School site (Parcel 6A) access Kapolei

Parkway opposite the proposed Keaunui Drive Extension. This would minimize the number of accesses on Kapolei Parkway and eventually provide the school with a signalized access from Kapolei Parkway. The Keaunui Drive Extension approach is recommended to have exclusive left, through, and right-turn lanes. The Middle School approach is recommended to have an exclusive left-turn lane and a through/right lane.

B. CONCLUSION

Based on the analysis of the proposed Ewa by Gentry - Makai Development, it is concluded that with roadway and traffic improvements recommended in this report, the roadway system can accommodate the traffic generated by the proposed land uses.

It should be noted that the analyses contained in this report are very conservative in that both the without and with Ewa by Gentry - Makai scenarios include new roadways such as the Keaunui Drive extension between Kapolei Parkway and Fort Weaver Road and between Fort Weaver Road and Iroquois Road. Both also include the connection of Kapolei Parkway south to the Ocean Pointe development. With these new roadways, that will be constructed as part of the Ewa by Gentry Makai development, traffic conditions on Fort Weaver Road are projected to better than conditions without these roadway improvements. It is, therefore, possible to say that the Ewa by Gentry Makai development enables the completion of a supporting roadway system that helps to distribute traffic demand in a way that increases mobility in the Ewa area.

APPENDICES

Appendix A Traffic Count Data

AM COUNT SHEET

Intersection: Geiger Rd-Iroquois Rd/Ft. Weaver Rd

Date: 5/9/2002 - 5/10/2002

By: Brad & Robbie

Weather: 0

Street: Geiger Road

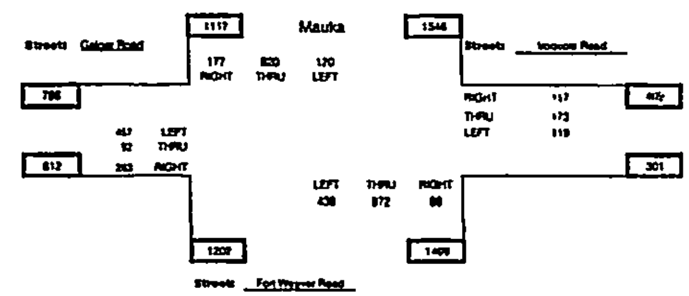
Street: Iroquois Road

Street: Fort Weaver Road

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
5:30 - 5:45	73	4	19	19	75	14	30	16	7	5	264	50	616	2544
5:45 - 6:00	80	15	29	30	84	15	32	31	8	4	229	90	586	2727
6:00 - 6:15	64	19	39	26	121	18	32	28	9	12	213	70	650	2968
6:15 - 6:30	51	16	43	53	182	21	35	24	10	4	216	57	687	3232
6:30 - 6:45	69	31	80	48	150	32	45	28	14	12	219	86	779	3479
6:45 - 7:00	69	31	63	35	212	23	40	32	11	10	229	72	827	3689
7:00 - 7:15	94	25	90	46	190	34	31	37	18	19	234	94	914	3837
7:15 - 7:30	55	30	122	42	183	32	28	44	31	26	238	87	938	
7:30 - 7:45	58	23	139	47	236	27	25	59	40	24	230	86	1020	
7:45 - 8:00	56	14	[illegible]	40	201	37	33	33	24	20	270	161	985	
PHF	0.898	0.767	0.719	0.922	0.869	0.882	0.868	0.733	0.647	0.856	0.900	0.580	Peak	PHF
7:00 - 8:00	283	92	457	177	820	130	117	173	119	89	872	428	3837	0.940

Peak Hour

7:00 - 8:00



PARSONS BRINCKERHOFF

AM COUNT SHEET

Intersection: Geiger Rd/Leoahele St
Date: 5/8/2002 - 5/9/2002
By: Danny
Weather: Overcast

Streets: Geiger Road
Street: Leoahele St

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
5:30 - 5:45	0	8	3	4	0	40	6	72	6	47	0	1	188	858
5:45 - 6:00	2	32	7	6	2	34	16	80	8	37	1	4	229	1112
6:00 - 6:15	2	49	16	7	0	31	7	130	9	42	8	4	279	1214
6:15 - 6:30	0	46	3	7	0	34	4	123	7	28	0	1	255	1356
6:30 - 6:45	0	61	6	10	1	41	8	146	11	38	0	1	342	1512
6:45 - 7:00	1	74	11	17	0	43	4	130	5	46	4	3	338	1674
7:00 - 7:15	0	114	12	16	1	46	8	165	6	48	2	2	430	1689
7:15 - 7:30	1	129	10	7	0	36	9	183	21	42	2	2	412	
7:30 - 7:45	1	164	11	8	0	43	10	181	21	33	3	1	454	
7:45 - 8:00	0	86	8	12	0	39	12	198	24	38	1	1	412	
PHF	0.500	0.755	0.854	0.667	0.250	0.891	0.813	0.855	0.780	0.781	0.667	0.750	Peak	PHF
7:00 - 8:00	2	495	41	40	1	164	39	677	77	153	8	6	1698	0.935

Peak Hour

7:00 - 8:00

205 Mauka 86

40 RIGHT 1 THRU 164 LEFT

Streets: Geiger Road

723

RIGHT 39
THRU 677
LEFT 77

789

41 LEFT
495 THRU
2 RIGHT

538

612

LEFT 6 THRU 8 RIGHT 153

75 167

Streets: Leoahele St

PARSONS
BRINCKERHOFF

AM COUNT SHEET

Intersection: Geiger Rd/Kapolei Pkwy
Date: 5/9/2002 - 5/10/2002
By: Colin
Weather: 0

Streets: Geiger Road
Street: Kapolei Parkway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
5:30 - 5:45	1	18	4	43	2	22	7	76	1	0	1	3	178	868
5:45 - 6:00	0	27	1	43	3	25	14	80	1	2	2	11	210	1015
6:00 - 6:15	2	49	6	38	0	21	13	105	1	0	0	7	243	1105
6:15 - 6:30	0	54	10	47	2	18	5	111	0	0	1	9	257	1224
6:30 - 6:45	3	72	10	43	1	19	14	136	0	0	3	5	305	1337
6:45 - 7:00	1	98	3	54	0	34	17	124	0	1	2	9	300	1405
7:00 - 7:15	0	80	11	51	2	30	12	187	0	0	2	7	382	1422
7:15 - 7:30	1	96	13	40	3	42	19	149	1	0	5	1	390	
7:30 - 7:45	1	84	7	31	1	43	21	133	0	2	1	9	353	
7:45 - 8:00	1	83	11	30	0	13	44	129	2	0	0	4	317	
PHF	0.750	0.919	0.808	0.745	0.500	0.837	0.545	0.865	0.375	0.250	0.400	0.583	Peak	PHF
7:00 - 8:00	3	353	42	152	6	158	96	578	3	2	8	21	1422	0.917

Peak Hour

7:00 - 8:00

316 Mauka 146

152 RIGHT 6 THRU 158 LEFT

Streets: Geiger Road

751

RIGHT 96
THRU 578
LEFT 3

677

42 LEFT
353 THRU
3 RIGHT

398

813

LEFT 21 THRU 8 RIGHT 2

12 31

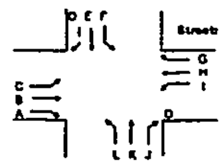
Streets: Kapolei Parkway

PARSONS
BRINCKERHOFF

AM COUNT SHEET

Intersection: Iroquois Rd/Kapuna Rd
Date: 5/8/2002 - 5/10/2002
By: Wayne
Weather: Overcast

Street: Iroquois Road

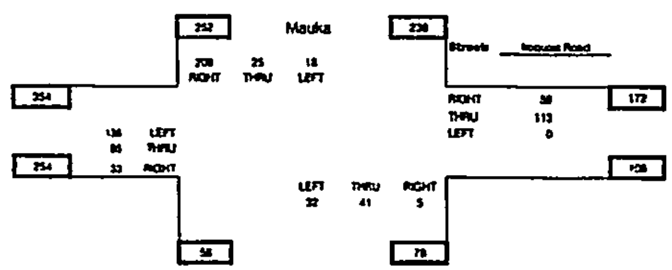


Street: Kapuna Road

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Movmt	Total Hour
5:30 - 5:45	2	10	9	13	3	0	7	35	0	0	5	14	96	474
5:45 - 6:00	5	17	7	18	0	0	7	28	0	0	8	14	102	508
6:00 - 6:15	8	21	15	22	0	2	8	24	0	1	5	8	112	571
6:15 - 6:30	3	25	10	17	3	2	8	26	0	1	7	12	114	630
6:30 - 6:45	14	45	22	25	0	5	7	38	0	0	12	12	180	700
6:45 - 7:00	7	30	22	28	2	1	14	38	1	0	8	14	165	736
7:00 - 7:15	7	17	33	38	5	0	16	25	0	2	12	6	161	747
7:15 - 7:30	4	25	42	58	1	5	15	23	0	0	12	8	194	
7:30 - 7:45	6	17	42	60	8	5	17	28	0	1	11	11	216	
7:45 - 8:00	16	26	19	45	11	8	11	38	0	2	6	5	185	
PHF	0.516	0.817	0.810	0.757	0.568	0.563	0.868	0.785	#DIV/0!	0.625	0.854	0.727	Peak	PHF
7:00 - 8:00	33	85	136	208	25	18	58	113	0	5	41	32	756	0.875

Peak Hour

7:00 - 8:00



PARSONS
BRINCKERHOFF

Parsons Brinckerhoff
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813

Site Code : 00000000
Start Date: 04/07/98
File I.D. : FWRFWAM
Page : 1

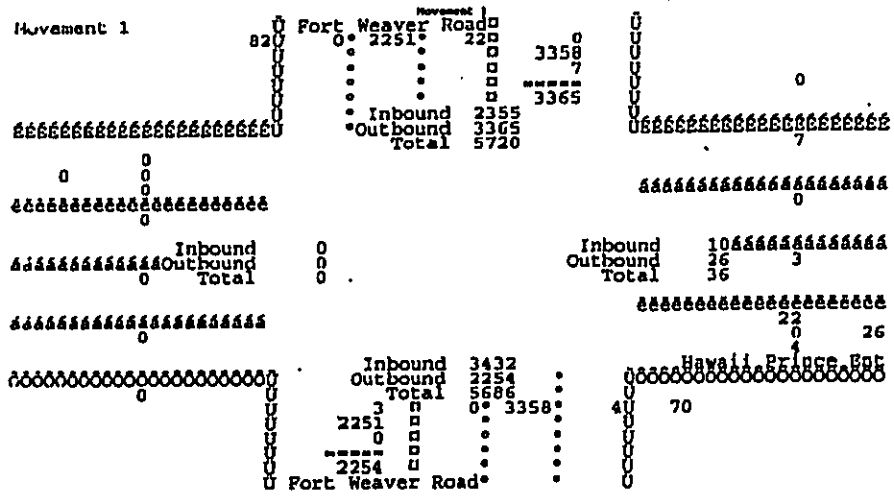
Movement 1

Start Time	Fort Weaver Road From North Left	Thru	Rght	Trck	Hawaii Prince Ent From East Left	Thru	Rght	Trck	Fort Weaver Road From South Left	Thru	Rght	Trck	From West Left	Thru	Rght	Trck	Total	Trck	Total
5:15	0	5	0	2	1	0	0	0	0	0	1	0	0	0	0	0	10	3	10
5:30	1	42	0	4	0	0	0	0	0	330	0	5	0	0	0	0	344	11	344
5:45	5	65	0	5	0	0	1	0	0	225	0	3	0	0	0	0	312	6	312
Total	6	112	0	11	1	0	1	0	0	536	1	9	0	0	0	0	674	19	674
6:00am	3	88	0	4	2	0	0	0	0	251	0	0	0	0	0	0	348	4	348
6:15	0	133	0	2	0	0	0	0	0	237	0	6	0	0	0	0	375	6	375
6:30	0	168	0	2	0	0	0	0	0	319	0	4	0	0	0	0	493	6	493
6:45	0	168	0	5	0	0	0	0	0	282	0	3	0	0	0	0	464	7	464
Hour Total	3	554	0	13	2	0	0	0	0	1096	0	18	0	0	0	0	1680	23	1680
7:00am	5	270	0	19	0	0	1	0	0	299	0	3	0	0	0	0	599	24	599
7:15	2	330	0	6	0	0	0	0	0	294	0	8	0	0	0	0	630	14	630
7:30	1	365	0	17	0	0	0	0	0	376	0	7	0	0	0	0	766	24	766
7:45	2	273	0	7	0	0	0	0	0	331	1	22	0	0	0	0	636	33	636
Hour Total	10	1238	0	49	0	0	1	0	0	1290	1	42	0	0	0	0	2631	95	2631
8:00am	3	200	0	4	0	0	4	0	0	229	1	5	0	0	0	0	444	9	444
8:15	2	145	0	1	0	0	1	0	0	209	1	5	0	0	0	0	368	10	368
Total	3	345	0	5	0	0	5	0	0	438	2	10	0	0	0	0	812	19	812
Grand	22	2251	0	82	3	0	7	0	0	3335	4	79	0	0	0	0	5797	152	5797
% of Total	.4%	38.8%	0.0%	1.4%	.1%	0.0%	.1%	0.0%	0.0%	57.5%	.1%	1.3%	0.0%	0.0%	0.0%	0.0%		2.6%	97.4%
Approch %	40.6%				.2%				59.2%										
% of Approch	.9%	95.6%	0.0%	3.5%	30.0%	0.0%	70.0%	0.0%	0.0%	97.6%	.1%	2.0%	0.0%	0.0%	0.0%	0.0%			

Parsons Brinckerhoff
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813

Site Code : 00000000
Start Date: 04/07/98
File I.D. : FWRPHAM
Page : 2

Movement 1



Parsons Brinckerhoff
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813

Site Code : 00000000
Start Date: 04/07/98
File I.D. : FWRPHAM
Page : 3

Peak Hour Analysis By Entire Intersection for the Period: 07:15am to 08:15am on 04/07/98

Direction	Street Name	Start Peak Hour	Peak Hr Factor	Volumes Left	Volumes Thru	Volumes Rght	Volumes Total	Percentages Left	Percentages Thru	Percentages Rght
From North	Fort Weaver Road	07:00am	.853	10	1238	0	1248	.8	99.1	.0
From East	Hawaii Prince Ent		.250	0	0	1	1	.0	.0	100.0
From South	Fort Weaver Road		.850	0	1290	1	1291	.0	99.9	.0
From West			.0	0	0	0	0	0.0	0.0	0.0

PM COUNT SHEET

Intersection: Geiger Rd-Iroquois Rd/Ft. Weaver Rd

Date: 5/8/2002 - 5/10/2002

By: Brad & Robbie

Weather: 0

Streets: Geiger Road

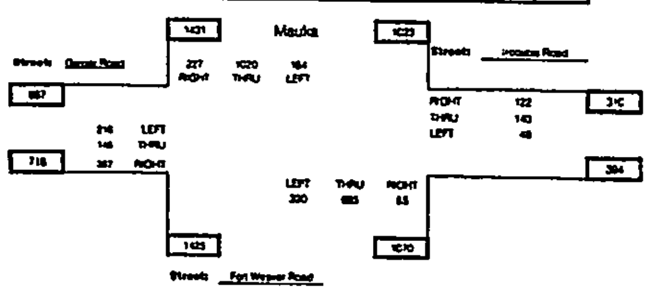
Streets: Iroquois Road

Street: Fort Weaver Road

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvts	Total Hour
3:30 - 3:45	80	32	40	56	238	42	37	40	12	22	214	78	907	3356
3:45 - 4:00	87	30	30	40	246	38	28	58	10	13	181	75	861	3522
4:00 - 4:15	88	26	46	61	271	47	33	37	12	14	180	78	882	3529
4:15 - 4:30	81	33	52	65	272	44	31	45	13	10	178	81	905	3488
4:30 - 4:45	86	41	40	52	233	52	28	28	14	25	182	82	874	3395
4:45 - 5:00	102	45	87	48	244	41	28	29	9	16	136	81	868	3330
5:00 - 5:15	96	34	66	43	252	38	21	31	4	15	148	70	841	3338
5:15 - 5:30	86	43	38	40	230	45	27	27	13	12	143	88	812	
5:30 - 5:45	80	38	81	51	243	34	30	38	18	11	145	53	809	
5:45 - 6:00	89	31	60	56	233	52	24	27	9	13	133	77	846	
PHF	0.875	0.806	0.808	0.873	0.938	0.885	0.924	0.778	0.857	0.830	0.941	0.976	Peak	PHF
4:00 - 5:00	357	145	216	227	1020	184	122	140	48	88	885	320	3529	0.875

Peak Hour

4:00 - 5:00



PARSONS BRINCKERHOFF

PM COUNT SHEET

Intersection: Geiger Rd/Laurahele St.

Date: 5/8/2002 - 5/8/2002

By: Danny

Weather: Overcast

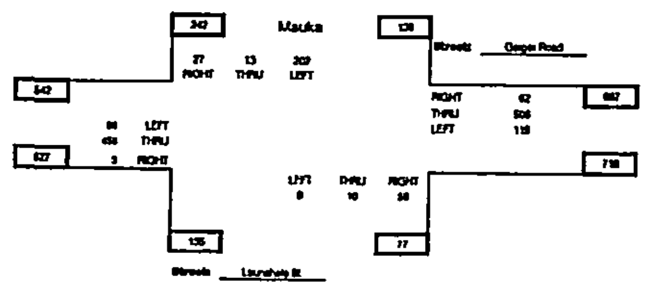
Streets: Geiger Road

Street: Laurahele St.

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:30 - 3:45	0	101	22	9	0	51	18	144	23	17	8	1	383	1504
3:45 - 4:00	3	108	15	2	2	46	10	145	22	14	3	0	369	1488
4:00 - 4:15	1	102	15	8	4	48	18	118	38	12	1	5	370	1533
4:15 - 4:30	0	100	14	3	1	48	13	148	32	17	8	1	382	1584
4:30 - 4:45	2	107	16	10	5	53	13	122	28	18	2	1	375	1588
4:45 - 5:00	0	149	21	6	3	52	18	120	21	13	1	2	408	1580
5:00 - 5:15	2	141	23	7	1	44	22	109	33	15	1	3	401	1548
5:15 - 5:30	1	127	26	6	1	54	17	118	31	17	3	5	384	
5:30 - 5:45	2	123	30	7	3	56	16	88	33	30	1	0	389	
5:45 - 6:00	0	133	24	4	1	57	25	102	33	10	2	3	384	
PHF	0.375	0.766	0.786	0.675	0.650	0.953	0.861	0.886	0.783	0.853	0.417	0.450	Peak	PHF
4:00 - 5:00	3	458	66	27	13	202	62	506	119	58	10	9	1533	0.944

Peak Hour

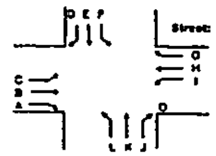
4:00 - 5:00



PARSONS BRINCKERHOFF

PM COUNT SHEET

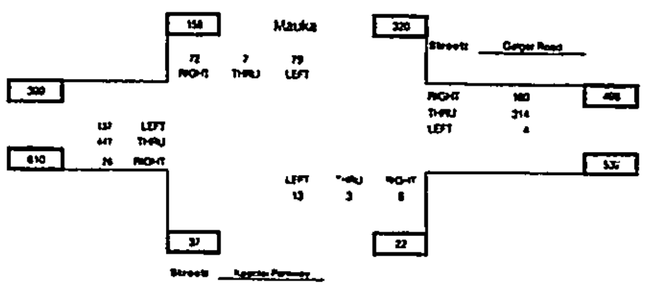
Intersection: Geiger Rd/Kapolei Pkwy
Date: 5/9/2002 - 5/10/2002
By: Colin
Weather: 0



TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:30 - 3:45	3	105	26	16	1	19	31	120	1	[illegible]	[illegible]	2	[illegible]	[illegible]
3:45 - 4:00	4	104	33	19	2	21	34	111	2	1	2	0	333	1288
4:00 - 4:15	4	102	29	19	2	10	40	77	1	1	0	3	288	1288
4:15 - 4:30	6	102	35	14	3	17	45	87	0	2	1	1	313	1302
4:30 - 4:45	7	114	34	16	2	29	60	84	0	1	1	6	354	1360
4:45 - 5:00	8	129	38	23	0	23	35	66	3	2	1	3	333	1358
5:00 - 5:15	7	147	32	18	3	15	51	87	1	0	0	1	362	[illegible]
5:15 - 5:30	12	111	33	17	4	17	35	88	3	4	5	1	[illegible]	
5:30 - 5:45	10	134	32	32	1	23	43	73	0	2	1	1	352	
5:45 - 6:00	5	109	32	18	1	29	38	63	3	1	2	4	307	
PHF	0.722	0.866	0.878	0.783	0.583	0.681	0.750	0.902	0.333	0.750	0.750	0.542	Peak	Hr
4:00 - 5:00	25	447	137	72	7	79	180	314	4	6	3	13	1288	0.910

Peak Hour

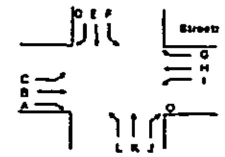
4:00 - 5:00



PARSONS
BRINCKERHOFF

PM COUNT SHEET

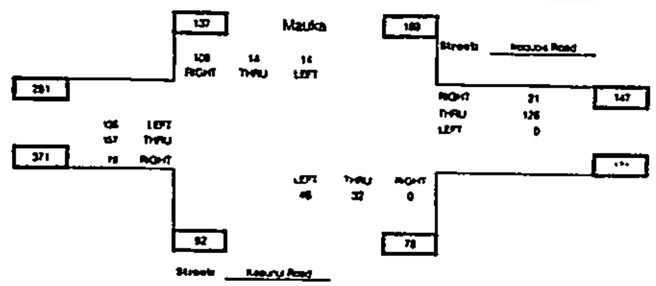
Intersection: Iroquois Rd/Kaaunui Rd
Date: 5/9/2002 - 5/10/2002
By: Wayne
Weather: Overcast



TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:30 - 3:45	13	38	20	17	6	1	7	38	0	1	5	14	157	650
3:45 - 4:00	14	35	32	20	3	5	4	29	2	1	8	14	164	715
4:00 - 4:15	16	42	32	34	2	4	5	24	0	0	5	8	172	733
4:15 - 4:30	15	33	34	21	3	3	4	25	0	0	7	12	157	716
4:30 - 4:45	20	52	38	32	5	5	8	38	0	0	12	12	222	735
4:45 - 5:00	27	30	32	22	4	3	4	38	0	0	8	14	182	688
5:00 - 5:15	13	33	33	22	2	4	3	25	0	0	12	8	156	[illegible]
5:15 - 5:30	18	45	34	24	5	2	5	23	0	0	12	8	176	
5:30 - 5:45	22	34	27	31	1	2	5	29	2	0	11	11	175	
5:45 - 6:00	27	58	40	28	4	17	7	38	0	0	6	5	226	
PHF	0.722	0.755	0.895	0.801	0.700	0.700	0.656	0.829	#DIV/0!	#DIV/0!	0.667	0.821	Peak	Hr
4:00 - 5:00	78	157	136	109	14	14	21	128	0	0	32	46	733	0.825

Peak Hour

4:00 - 5:00



PARSONS
BRINCKERHOFF

Parsons Brinckerhoff
Pacific Tower, Suite 1000
1001 Bishop Street
Honolulu, HI 96813

Site Code : 00000000
Start Date: 04/07/98
File I.D. : FWHPK
Page : 1

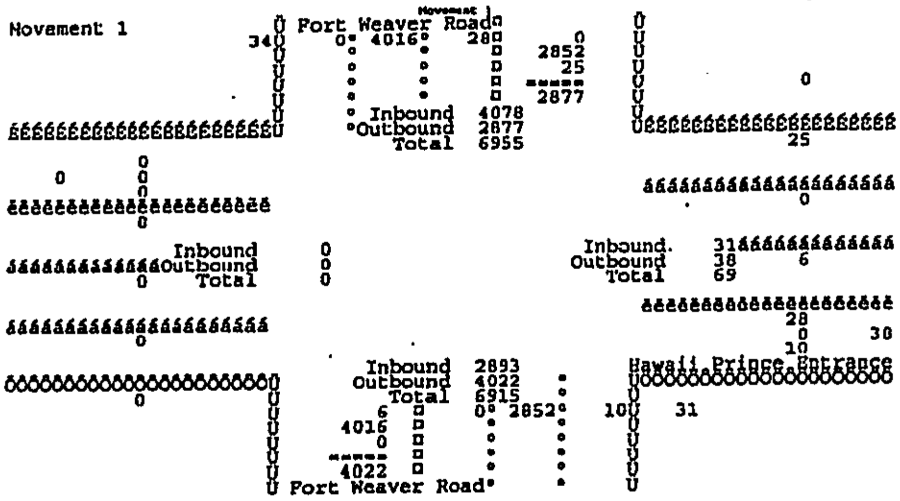
Movement 1

Start Time	Fort Weaver Road From North Left	Thru	Rght	Trck	Hawaii Prince Entrance From East Left	Thru	Rght	Trck	Fort Weaver Road From South Left	Thru	Rght	Trck	From West Left	Thru	Rght	Trck	Total	Trck	
3:00pm	4	257	0	1	1	0	3	0	0	250	1	2	0	0	0	0	518	3	518
3:15	0	303	0	4	1	0	0	0	0	331	0	1	0	0	0	0	643	5	641
3:30	4	360	0	1	1	0	4	0	0	315	3	7	0	0	0	0	697	8	697
3:45	1	351	0	2	0	0	0	0	0	316	0	3	0	0	0	0	692	5	692
Hour Total	11	1278	0	8	3	0	6	0	0	1038	4	13	0	0	0	0	2358	21	2358
4:00pm	3	346	0	2	0	0	1	0	0	233	2	2	0	0	0	0	583	4	583
4:15	4	370	0	5	3	0	4	0	0	297	2	0	0	0	0	0	692	5	692
4:30	1	352	0	2	0	0	1	0	0	223	0	2	0	0	0	0	583	4	583
4:45	4	330	0	4	1	0	4	0	0	218	0	3	0	0	0	0	563	4	563
Hour Total	12	1406	0	13	3	0	10	0	0	969	4	6	0	0	0	0	2431	19	2431
5:00pm	1	344	0	7	0	0	2	0	0	219	1	3	0	0	0	0	598	9	598
5:15	2	335	0	1	0	0	1	0	0	303	1	4	0	0	0	0	549	7	549
5:30	1	309	0	3	0	0	3	0	0	239	0	1	0	0	0	0	555	3	555
5:45	1	324	0	3	0	0	3	0	0	187	0	3	0	0	0	0	521	6	521
Hour Total	5	1334	0	13	0	0	9	0	0	848	2	13	0	0	0	0	2223	25	2223
Grand	28	4016	0	34	6	0	25	0	0	2852	10	31	0	0	0	0	7002	65	7002
% of Total	.4%	57.4%	0.0%	.5%	.1%	0.0%	.4%	0.0%	0.0%	40.7%	.1%	.4%	0.0%	0.0%	0.0%	0.0%		.9%	99.1%
Apprch %	58.3%				.4%				41.3%										
% of Apprch	.7%	98.5%	0.0%	.8%	19.4%	0.0%	80.6%	0.0%	0.0%	98.6%	.3%	1.1%	0.0%	0.0%	0.0%	0.0%			

Parsons Brinckerhoff
Pacific Tower, Suite 1000
1001 Bishop Street
Honolulu, HI 96813

Site Code : 00000000
Start Date: 04/07/98
File I.D. : FWHPK
Page : 2

Movement 1



Appendix B Levels of Service Definitions

The *Highway Capacity Manual* defines six Levels of Service (LOS), labeled A through F, from best to worst conditions. Levels of Service for signalized and unsignalized intersections are defined in terms of average user delays. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time.

For unsignalized intersections, the *Highway Capacity Manual* evaluates gaps in the major street traffic flow and calculates available gaps for left-turns across oncoming traffic and for the left and right-turns onto the major roadway from the minor street.

LEVEL-OF-SERVICE A: Little or no delay.

LEVEL-OF-SERVICE B: Short traffic delays.

LEVEL-OF-SERVICE C: Average traffic delays.

LEVEL-OF-SERVICE D: Long traffic delays.

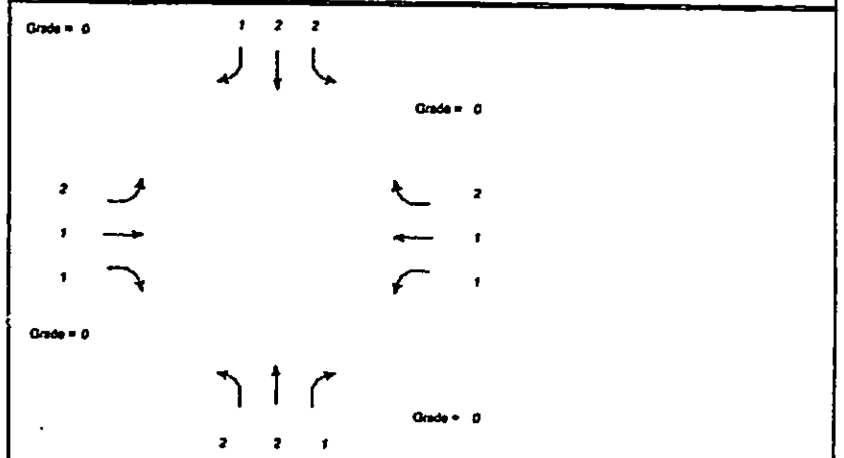
LEVEL-OF-SERVICE E: Very long traffic delays.

LEVEL-OF-SERVICE F: Demand volume exceeds capacity, resulting in extreme delays with queuing that may cause severe congestion and affect other movements at the intersection.

INPUT WORKSHEET

General Information		Site Information	
Analyst	BL	Intersection	Fort Weaver/Geiger (Iroquois)
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	457	92	263	119	173	117	438	972	89	120	820	177
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume		0			0			0			0	
Bicycle volume		0						0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing		0.0			0.0			3.0			0.0	

	EW Perm	EW Perm	03	04	Excl. Left	NB Only	Thru & RT	08
Timing	G = 36.0	G = 31.0	G =	G =	G = 26.0	G = 16.0	G = 111.0	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y = 3.0	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 240.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description: Ewa Gentry Makai Development

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	508	102	292	132	192	130	487	1080	99	133	911	197
Satflow rate	3502	1900	1615	1805	1900	2842	3502	3610	1615	3502	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.15	0.15	0.50	0.13	0.13	0.42	0.19	0.55	0.68	0.11	0.46	0.63
Lane group cap.	525	285	814	233	245	1196	671	1970	1090	379	1670	1016
v/c ratio	0.97	0.36	0.36	0.57	0.78	0.11	0.73	0.55	0.09	0.35	0.55	0.19
Flow ratio	0.15	0.05	0.18	0.07	0.10	0.05	0.14	0.30	0.06	0.04	0.25	0.12
Crit. lane group	Y	N	N	N	Y	N	Y	N	N	N	Y	N
Sum flow ratios	0.64											
Lost time/cycle	16.00											
Critical v/c ratio	0.68											

Lane Group Capacity, Control Delay, and LOS Determination

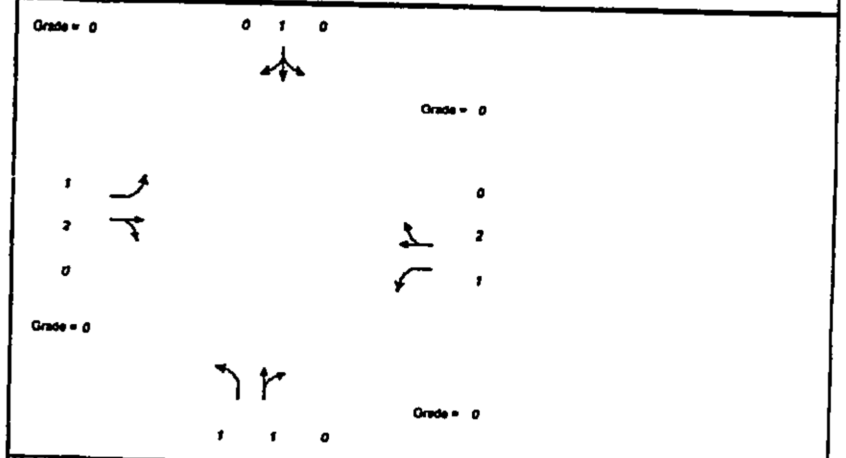
	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	508	102	292	132	192	130	487	1080	99	133	911	197
Lane group cap.	525	285	814	233	245	1196	671	1970	1090	379	1670	1016
v/c ratio	0.97	0.36	0.36	0.57	0.78	0.11	0.73	0.55	0.09	0.35	0.55	0.19
Green ratio	0.15	0.15	0.50	0.13	0.13	0.42	0.19	0.55	0.68	0.11	0.46	0.63
Unif. delay d1	101.4	91.6	38.0	98.2	101.3	42.2	91.1	35.3	13.5	99.2	48.4	18.8
Delay factor k	0.47	0.11	0.11	0.16	0.33	0.11	0.29	0.15	0.11	0.11	0.15	0.11
Increm. delay d2	51.6	0.8	0.3	3.3	16.9	0.0	4.0	0.3	0.0	0.6	0.4	0.1
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	153.0	92.4	38.3	101.4	118.2	42.2	95.1	35.6	13.5	99.7	48.7	18.9
Lane group LOS	F	F	D	F	F	D	F	D	B	F	D	B
Apprch. delay	108.4			91.6			51.7			48.0		
Approach LOS	F			F			D			D		
Intersec. delay	66.9						Intersection LOS			E		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	BL	Intersection	Launahele/Geiger
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	
Time Period	AM Peak Hour	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	41	495	2	72	677	39	6	8	153	164	1	40
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Arrival type	3	3		3	3		3	3			3	
Ped volume	0			0			0			0		
Bicycle volume	0			0			0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0			0	
Ped timing	0.0			0.0			3.0			0.0		

	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 25.0	G =	G =	G =	G = 27.0	G =	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y =	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 60.0			

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai Development

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR			LTR	
Adj. flow rate	43	518		75	746		6	167			214	
Satflow rate	539	3608		796	3580		1239	1629			1157	
Lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Green ratio	0.42	0.42		0.42	0.42		0.45	0.45			0.45	
Lane group cap.	225	1503		332	1492		558	733			521	
v/c ratio	0.19	0.34		0.23	0.50		0.01	0.23			0.41	
Flow ratio	0.08	0.14		0.09	0.21		0.00	0.10			0.18	
Crit. lane group	N	N		N	Y		N	N			Y	
Sum flow ratios	0.39											
Lost time/cycle	8.00											
Critical v/c ratio	0.45											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR			LTR	
Adj. flow rate	43	518		75	746		6	167			214	
Lane group cap.	225	1503		332	1492		558	733			521	
v/c ratio	0.19	0.34		0.23	0.50		0.01	0.23			0.41	
Green ratio	0.42	0.42		0.42	0.42		0.45	0.45			0.45	
Unif. delay d1	11.1	11.9		11.3	12.9		9.1	10.1			11.1	
Delay factor k	0.11	0.11		0.11	0.11		0.11	0.11			0.11	
Increm. delay d2	0.4	0.1		0.3	0.3		0.0	0.2			0.5	
PF factor	1.000	1.000		1.000	1.000		1.000	1.000			1.000	
Control delay	11.5	12.1		11.6	13.2		9.1	10.3			11.7	
Lane group LOS	B	B		B	B		A	B			B	
Apprch. delay	12.0			13.0			10.2			11.7		
Approach LOS	B			B			B			B		
Intersec. delay	12.3			Intersection LOS						B		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BL	Intersection	Kapolei/Geiger
Agency/Co.	PBQD	Jurisdiction	
Date Performed	5/13/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour	Project ID	Ewa Gentry Makai AM
East/West Street: Geiger Road		North/South Street: Kapolei Parkway	
Intersection Orientation: East-West		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	42	370	3	3	617	103
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	46	411	3	3	685	114
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	21	8	2	166	6	152
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	23	8	2	184	6	168
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		5			5	
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L	T	TR	L	T	TR
v (vph)	46	3	23	4	6	184	3	171
C (m) (vph)	833	1158	171	152	208	168	163	578
v/c	0.06	0.00	0.13	0.03	0.03	1.10	0.02	0.30
95% queue length	0.18	0.01	0.46	0.08	0.09	21.09	0.06	1.25
Control Delay	9.6	8.1	29.3	29.3	22.8	334.8	27.5	13.8
LOS	A	A	D	D	C	F	D	B
Approach Delay	--	--	28.1			178.9		
Approach LOS	--	--	D			F		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BL	Intersection	Keaunui / Iroquois
Agency/Co.	PBOD	Jurisdiction	
Date Performed	5/13/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour	Project ID	Ewa Gentry Makai AM

East/West Street: *Iroquois Road* | North/South Street: *Keaunui Road*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	160	108	33	0	141	59
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	181	122	37	0	160	67
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T	TR	LT		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	32	41	5	18	25	236
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	36	46	5	20	28	268
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		1			1	
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration	LT		TR	LT		TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	LT	LT		TR	LT		TR
v (vph)	181	0	59		28	34		282
C (m) (vph)	1353	1433	257		348	297		841
v/c	0.13	0.00	0.23		0.08	0.11		0.34
95% queue length	0.46	0.00	0.89		0.26	0.39		1.51
Control Delay	8.1	7.5	23.2		16.2	18.7		11.4
LOS	A	A	C		C	C		B
Approach Delay	--	--	20.9			12.2		
Approach LOS	--	--	C			B		

HCS2000™

Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BL	Intersection	Keaunui Dr/Ft Weaver Rd
Agency/Co.	PBOD	Jurisdiction	Honolulu
Date Performed	5/13/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour (Existing)	Project ID	Ewa Gentry Makai AM Peak (existing)

East/West Street: *Keaunui Drive* | North/South Street: *Fort Weaver Road*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	21	1498	1	10	1492	152
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	1664	1	11	1657	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	1	1	2	0
Configuration		T	R	L	T	
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	617	1	42	370	3
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	0	1	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
v (vph)		11	0		1			
C (m) (vph)		391	102		316			
v/c		0.03	0.00		0.00			
95% queue length		0.09	0.00		0.01			
Control Delay		14.5	40.3		16.4			
LOS		B	E		C			
Approach Delay	--	--	16.4					
Approach LOS	--	--	C					

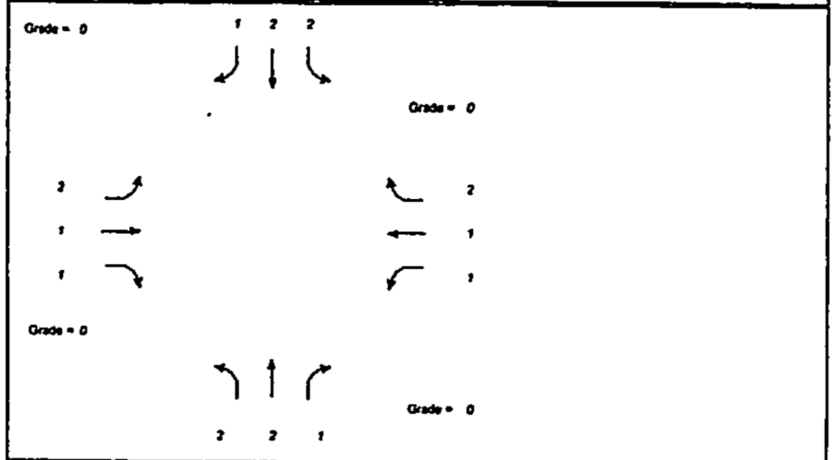
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	BL	Intersection	Fort Weaver/Geiger (Iroquois)
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	
Time Period	PM Peak Hour	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	216	145	357	48	140	122	320	685	65	184	1020	227
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume	0			0			0			0		
Bicycle volume	0						0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing	0.0			0.0			3.0			0.0		

	EW Perm	EW Perm	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 36.0	G = 36.0	G =	G =	G = 26.0	G = 16.0	G = 106.0	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y = 3.0	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 240.0		

HCS2000™

Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai Development

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	216	145	357	48	140	122	320	685	65	184	1020	227
Satflow rate	3502	1900	1615	1805	1900	2842	3502	3610	1615	3502	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.15	0.15	0.44	0.15	0.15	0.52	0.11	0.44	0.59	0.19	0.52	0.69
Lane group cap.	525	285	713	271	285	1492	379	1594	956	671	1895	1117
v/c ratio	0.41	0.51	0.50	0.18	0.49	0.08	0.84	0.43	0.07	0.27	0.54	0.20
Flow ratio	0.06	0.08	0.22	0.03	0.07	0.04	0.09	0.19	0.04	0.05	0.28	0.14
Crit. lane group	N	Y	N	N	Y	N	Y	N	N	N	Y	N
Sum flow ratios	0.52											
Lost time/cycle	16.00											
Critical v/c ratio	0.56											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	216	145	357	48	140	122	320	685	65	184	1020	227
Lane group cap.	525	285	713	271	285	1492	379	1594	956	671	1895	1117
v/c ratio	0.41	0.51	0.50	0.18	0.49	0.08	0.84	0.43	0.07	0.27	0.54	0.20
Green ratio	0.15	0.15	0.44	0.15	0.15	0.52	0.11	0.44	0.59	0.19	0.52	0.69
Unif. delay d1	92.4	93.9	48.0	89.1	93.6	28.3	105.0	46.2	20.8	82.8	37.7	13.3
Delay factor k	0.11	0.12	0.11	0.11	0.11	0.11	0.38	0.11	0.11	0.11	0.14	0.11
Increm. delay d2	0.5	1.5	0.6	0.3	1.3	0.0	18.3	0.2	0.0	0.2	0.3	0.1
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	92.9	95.4	48.6	89.4	94.9	28.3	123.3	46.4	20.9	83.0	38.0	13.4
Lane group LOS	F	F	D	F	F	C	F	D	C	F	D	B
Apprch. delay	71.4			67.9			67.8			39.9		
Approach LOS	E			E			E			D		
Intersec. delay	57.2			Intersection LOS						E		

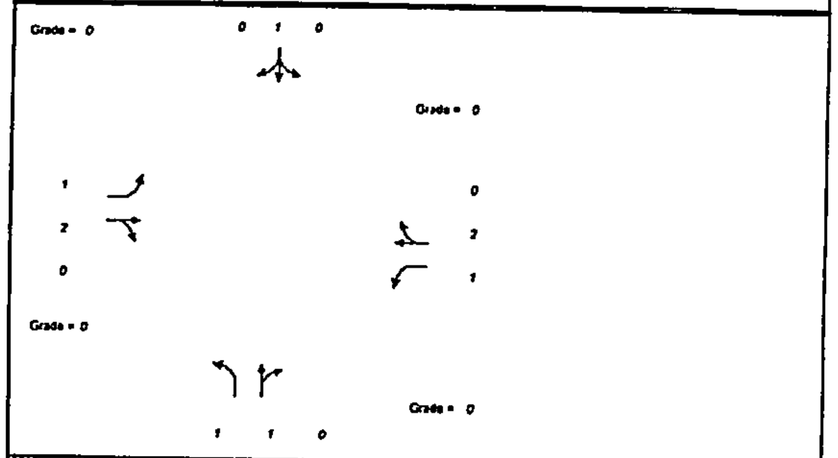
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	BL	Intersection	Launahele/Geiger
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	
Time Period	PM Peak Hour	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	66	458	3	119	506	62	9	10	58	202	13	27
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Arrival type	3	3		3	3		3	3			3	
Ped volume		0			0			0			0	
Bicycle volume		0			0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0			0	
Ped timing		0.0			0.0			3.0			0.0	

	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 25.0	G =	G =	G =	G = 27.0	G =	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y =	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 60.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai Development

Capacity Analysis

	EB		WB		NB		SB
Lane group	L	TR	L	TR	L	TR	LTR
Adj. flow rate	69	480	124	592	9	70	252
Satflow rate	706	3607	846	3551	1215	1656	1335
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.42	0.42	0.42	0.42	0.45	0.45	0.45
Lane group cap.	294	1503	352	1480	547	745	601
v/c ratio	0.23	0.32	0.35	0.40	0.02	0.09	0.42
Flow ratio	0.10	0.13	0.15	0.17	0.01	0.04	0.19
Crit. lane group	N	N	N	Y	N	N	Y
Sum flow ratios	0.36						
Lost time/cycle	8.00						
Critical v/c ratio	0.41						

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB		NB		SB
Lane group	L	TR	L	TR	L	TR	LTR
Adj. flow rate	69	480	124	592	9	70	252
Lane group cap.	294	1503	352	1480	547	745	601
v/c ratio	0.23	0.32	0.35	0.40	0.02	0.09	0.42
Green ratio	0.42	0.42	0.42	0.42	0.45	0.45	0.45
Unif. delay d1	11.3	11.8	12.0	12.3	9.1	9.5	11.2
Delay factor k	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Increm. delay d2	0.4	0.1	0.6	0.2	0.0	0.1	0.5
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	11.7	11.9	12.6	12.4	9.2	9.5	11.7
Lane group LOS	B	B	B	B	A	A	B
Apprch. delay	11.9		12.5		9.5		11.7
Approach LOS	B		B		A		B
Intersec. delay	12.0		Intersection LOS				B

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BL	Intersection	Kapolei/Geiger
Agency/Co.	PBOD	Jurisdiction	
Date Performed	5/13/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour	Project ID	Ewa Gentry Makai PM
East/West Street: Geiger Road		North/South Street: Kapolei Parkway	
Intersection Orientation: East-West		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	137	442	26	4	342	196
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	152	491	28	4	380	217
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	13	3	6	79	7	72
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	14	3	6	87	7	80
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		5			5	
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L	T	TR	L	T	TR
v (vph)	152	4	14	1	7	87	3	83
C (m) (vph)	989	1057	148	117	422	158	133	609
v/c	0.15	0.00	0.09	0.01	0.02	0.55	0.02	0.14
95% queue length	0.54	0.01	0.31	0.03	0.05	3.36	0.07	0.47
Control Delay	9.3	8.4	31.9	36.0	13.7	54.8	32.7	11.8
LOS	A	A	D	E	B	F	D	B
Approach Delay	--	--	26.3			33.8		
Approach LOS	--	--	D			D		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BL	Intersection	Keaunui / Iroquois
Agency/Co.	PBOD	Jurisdiction	
Date Performed	5/13/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour	Project ID	Ewa Gentry Makai PM
East/West Street: Iroquois Road		North/South Street: Keaunui Road	
Intersection Orientation: East-West		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	147	169	78	0	126	21
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	177	203	93	0	151	25
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T	TR	LT		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	46	32	0	14	14	124
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	55	38	0	16	16	149
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		1			1	
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration	LT		TR	LT		TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	LT	LT		TR	LT		TR
v (vph)	177	0	74		19	24		157
C (m) (vph)	1412	1277	256		288	290		852
v/c	0.13	0.00	0.29		0.07	0.08		0.18
95% queue length	0.43	0.00	1.20		0.21	0.27		0.68
Control Delay	7.9	7.8	24.8		18.4	18.5		10.2
LOS	A	A	C		C	C		B
Approach Delay	--	--	23.5			11.3		
Approach LOS	--	--	C			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BL	Intersection	Keaunui Dr/Ft Weaver Rd
Agency/Co.	PBQD	Jurisdiction	Honolulu
Date Performed	5/13/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour (Existing)	Project ID	Ewa Gentry Makai PM Peak (existing)

East/West Street: Keaunui Drive	North/South Street: Fort Weaver Road
Intersection Orientation: North-South	Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	21	1061	7	14	1411	152
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	1178	7	15	1567	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	1	1	2	0
Configuration		T	R	L	T	
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	3	617	9	42	370	3
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	3	0	10	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

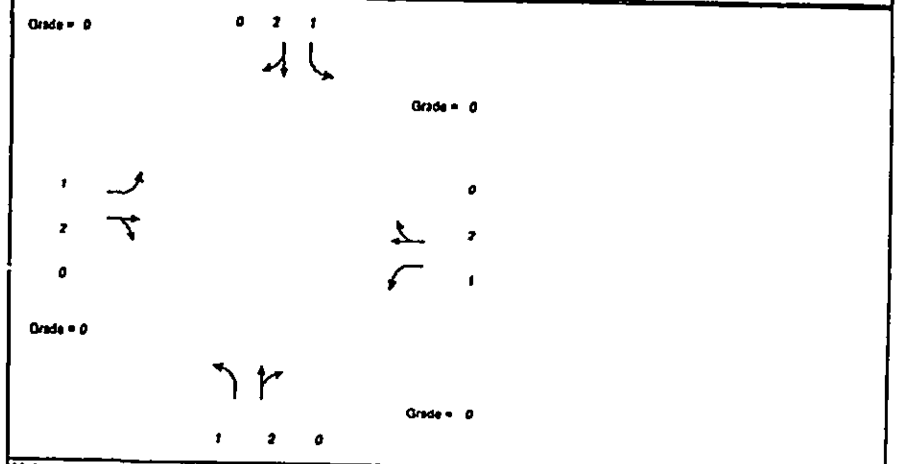
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
v (vph)		15	3		10			
C (m) (vph)		596	165		457			
v/c		0.03	0.02		0.02			
95% queue length		0.08	0.06		0.07			
Control Delay		11.2	27.2		13.1			
LOS		B	D		B			
Approach Delay	--	--	18.3					
Approach LOS	--	--	C					

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Kapolei Pkwy
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	100	327	63	17	405	301	30	315	5	228	207	167
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival type	3	3		3	3		3	3		3	3	
Ped volume	0			0			0			0		
Bicycle volume							0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0		0	0	
Ped timing	0.0			0.0			3.0			0.0		

	Excl. Left	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 8.0	G = 24.0	G =	G =	G = 8.0	G = 24.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 80.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description: *Ewa Gentry Makai (Year 2010 Base AM Peak) Geiger/Kapolei*

Capacity Analysis

	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	111	433	19	784	33	356	253	416
Satflow rate	1805	3522	1805	3379	1805	3601	1805	3368
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Lane group cap.	298	1057	427	1014	438	1080	465	1010
v/c ratio	0.37	0.41	0.04	0.77	0.08	0.33	0.54	0.41
Flow ratio		0.12		0.23		0.10		0.12
Crit. lane group	N	N	N	N	N	N	N	N
Sum flow ratios	0.53							
Lost time/cycle	16.00							
Critical v/c ratio	0.66							

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	111	433	19	784	33	356	253	416
Lane group cap.	298	1057	427	1014	438	1080	465	1010
v/c ratio	0.37	0.41	0.04	0.77	0.08	0.33	0.54	0.41
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Unif. delay d1	14.9	22.3	12.6	25.5	12.7	21.8	14.4	22.4
Delay factor k	0.11	0.11	0.11	0.32	0.11	0.11	0.14	0.11
Increm. delay d2	0.8	0.3	0.0	3.9	0.1	0.2	1.3	0.3
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	15.7	22.6	12.7	29.4	12.8	21.9	15.8	22.6
Lane group LOS	B	C	B	C	B	C	B	C
Apprch. delay	21.2		29.0		21.2		20.0+	
Approach LOS	C		C		C		C	
Intersec. delay	23.5		Intersection LOS				C	

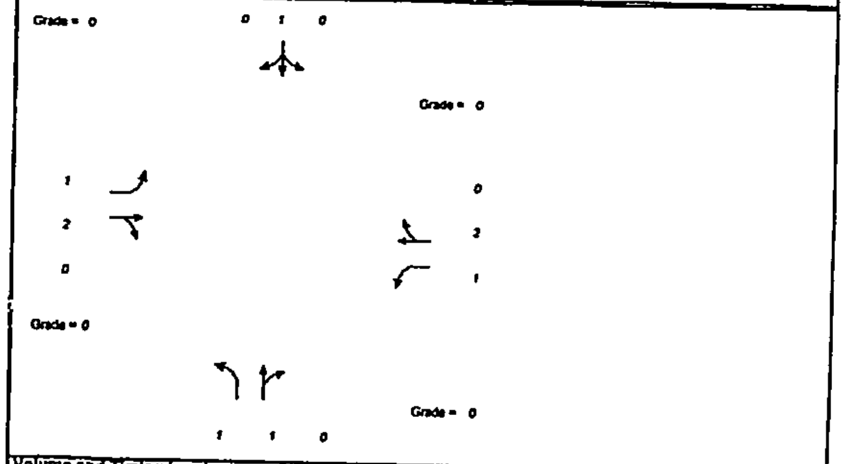
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Laumaheie St
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	61	473	26	48	565	33	57	8	102	115	1	101
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Arrival type	3	3		3	3		3	3			3	
Ped volume	0			0			0			0		
Bicycle volume												
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0			0	
Ped timing	0.0			0.0			3.0			0.0		

	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 26.0	G =	G =	G =	G = 26.0	G =	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y =	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 60.0			

HCS2000™

Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Base AM Peak) Geiger/Launahele

Capacity Analysis

	EB		WB		NB		SB
Lane group	L	TR	L	TR	L	TR	LTR
Adj. flow rate	68	555	53	665	63	122	241
Satflow rate	635	3582	760	3580	1181	1636	1398
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Lane group cap.	275	1552	329	1551	512	709	605
v/c ratio	0.25	0.36	0.16	0.43	0.12	0.17	0.40
Flow ratio	0.11	0.15	0.07	0.19	0.05	0.07	0.17
Crit. lane group	N	N	N	Y	N	N	Y
Sum flow ratios	0.36						
Lost time/cycle	8.00						
Critical v/c ratio	0.41						

Lane Group Capacity, Control Delay, and LOS Determination

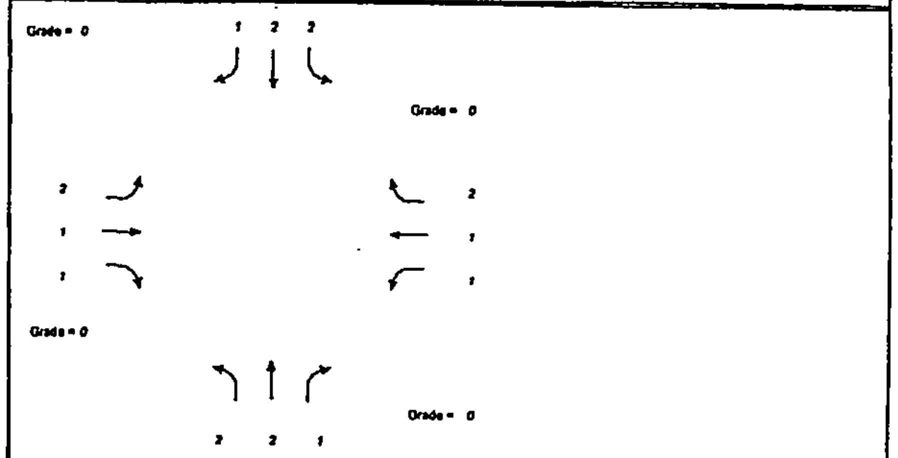
	EB		WB		NB		SB
Lane group	L	TR	L	TR	L	TR	LTR
Adj. flow rate	68	555	53	665	63	122	241
Lane group cap.	275	1552	329	1551	512	709	605
v/c ratio	0.25	0.36	0.16	0.43	0.12	0.17	0.40
Green ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Unif. delay d1	10.8	11.4	10.4	11.8	10.2	10.4	11.6
Delay factor k	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Increm. delay d2	0.5	0.1	0.2	0.2	0.1	0.1	0.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	11.3	11.5	10.6	12.0	10.3	10.5	12.1
Lane group LOS	B	B	B	B	B	B	B
Apprch. delay	11.5		11.9		10.4		12.1
Approach LOS	B		B		B		B
Intersec. delay	11.6		Intersection LOS				B

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Fort Weaver/Geiger (Iroquois)
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	454	131	105	119	291	282	176	1059	89	163	860	179
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume	0			0			0			0		
Bicycle volume							0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing	0.0			0.0			3.0			0.0		

	EB Only	WB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 18.0	G = 23.0	G =	G =	G = 9.0	G = 34.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 100.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description: *Ewa Gentry Makai (Year 2010 Base AM Peak) Geiger/Ft Weaver*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	504	146	117	132	323	313	196	1177	99	181	956	199
Satflow rate	3502	1900	1615	1805	1900	2842	3502	3610	1615	3502	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.18	0.18	0.27	0.23	0.23	0.36	0.09	0.34	0.57	0.09	0.34	0.56
Lane group cap.	630	342	436	415	437	1023	315	1227	921	315	1227	904
v/c ratio	0.80	0.43	0.27	0.32	0.74	0.31	0.62	0.96	0.11	0.57	0.78	0.22
Flow ratio	0.14	0.08	0.07	0.07	0.17	0.11	0.06	0.33	0.06	0.05	0.26	0.12
Crit. lane group	Y	N	N	N	Y	N	Y	Y	N	N	N	N
Sum flow ratios	0.70											
Lost time/cycle	16.00											
Critical v/c ratio	0.83											

Lane Group Capacity, Control Delay, and LOS Determination

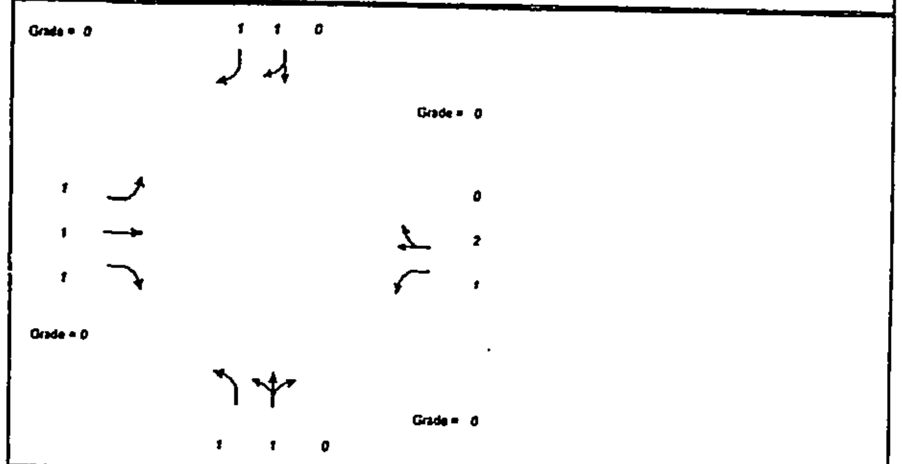
	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	504	146	117	132	323	313	196	1177	99	181	956	199
Lane group cap.	630	342	436	415	437	1023	315	1227	921	315	1227	904
v/c ratio	0.80	0.43	0.27	0.32	0.74	0.31	0.62	0.96	0.11	0.57	0.78	0.22
Green ratio	0.18	0.18	0.27	0.23	0.23	0.36	0.09	0.34	0.57	0.09	0.34	0.56
Unif. delay d1	39.3	38.4	28.7	32.0	35.7	23.0	43.9	32.3	9.8	43.7	29.6	11.0
Delay factor k	0.34	0.11	0.11	0.11	0.30	0.11	0.21	0.47	0.11	0.17	0.33	0.11
Increm. delay d2	7.7	0.9	0.3	0.4	6.8	0.2	3.8	24.3	0.1	2.6	3.4	0.1
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	47.0	37.3	29.1	32.4	42.5	23.2	47.7	56.6	9.9	48.3	33.0	11.2
Lane group LOS	D	D	C	C	D	C	D	E	A	D	C	B
Apprch. delay	42.4			32.9			52.3			31.5		
Approach LOS	D			C			D			C		
Intersec. delay	40.7			Intersection LOS						D		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Iroquois Pt Rd/Keaunui Rd
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	162	108	113	0	141	59	314	43	5	18	27	237
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Arrival type	3	3	3	3	3		3	3			3	3
Ped volume	0			0			0			0		
Bicycle volume										0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0		0	0			0	0
Ped timing	0.0			0.0			3.0			0.0		

	Excl. Left	EB Only	Thru & RT	04	NB Only	SB Only	07	08
Timing	G = 8.0	G = 10.0	G = 10.0	G =	G = 20.0	G = 16.0	G =	G =
	Y = 0.0	Y = 3.0	Y = 3.0	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 80.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Ewa Gentry Makai (Year 2010 Base AM Peak) Iroquois/Keaunui*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	TR		L	LTR			LT	R
Adj. flow rate	180	120	126	0	223		349	54			50	263
Satflow rate	1805	1900	1615	1805	3450		1805	1868			1863	1615
Lost time	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Green ratio	0.22	0.30	0.60	0.10	0.13		0.25	0.25			0.20	0.47
Lane group cap.	406	570	969	181	431		451	467			373	767
v/c ratio	0.44	0.21	0.13	0.00	0.52		0.77	0.12			0.13	0.34
Flow ratio	0.10	0.06	0.08	0.00	0.06		0.19	0.03			0.03	0.16
Crit. lane group	N	N	N	N	Y		Y	N			N	Y
Sum flow ratios	0.42											
Lost time/cycle	12.00											
Critical v/c ratio	0.50											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	T	R	L	TR		L	LTR			LT	R
Adj. flow rate	180	120	126	0	223		349	54			50	263
Lane group cap.	406	570	969	181	431		451	467			373	767
v/c ratio	0.44	0.21	0.13	0.00	0.52		0.77	0.12			0.13	0.34
Green ratio	0.22	0.30	0.60	0.10	0.13		0.25	0.25			0.20	0.47
Unif. delay d1	26.7	20.9	6.9	32.4	32.7		27.9	23.2			26.3	13.2
Delay factor k	0.11	0.11	0.11	0.11	0.12		0.32	0.11			0.11	0.11
Increm. delay d2	0.8	0.2	0.1	0.0	1.1		8.7	0.1			0.2	0.3
PF factor	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	1.000
Control delay	27.5	21.1	7.0	32.4	33.8		36.8	23.3			28.5	13.4
Lane group LOS	C	C	A	C	C		D	C			C	B
Apprch. delay	19.6			33.8			34.8			15.5		
Approach LOS	B			C			C			B		
Intersec. delay	25.5			Intersection LOS						C		

HCS2000™

Version 4.1

INPUT WORKSHEET

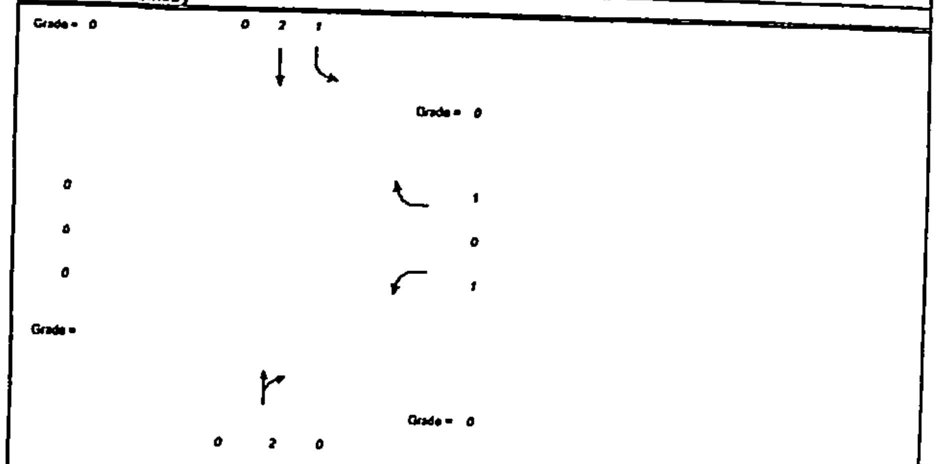
General Information

Analyst: C. Maruoka
Agency or Co.: PBQ&D
Date Performed: 9/19/2002
Time Period: AM Peak Hour (2010 Base)

Site Information

Intersection: Kapolei Pkwy/Keaunui Dr
Area Type: All other areas
Jurisdiction: Honolulu
Analysis Year: 2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)				5		46		305	23	77	259	
% Heavy veh				0		0		0	0	0	0	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time				2.0		2.0		2.0		2.0	2.0	
Ext. eff. green				2.0		2.0		2.0		2.0	2.0	
Arrival type				3		3		3		3	3	
Ped volume	0			0			0					
Bicycle volume							0					
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr				0		0		0		0	0	
Ped timing	0.0			0.0			3.0			0.0		

	WB Only	02	03	04	SB Only	Thru & RT	07	08
Timing	G = 10.0	G =	G =	G =	G = 10.0	G = 29.0	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 60.0		

HCS2000™

Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description   Ewa Gentry Makai (Year2010 Base AM)Kapolei Pkwy/Keaunui Dr

Capacity Analysis

	EB			WB			NB			SB		
Lane group				L		R	TR			L	T	
Adj. flow rate				6		51	365			86	288	
Satflow rate				1805		1615	3571			1805	3610	
Lost time				2.0		2.0	2.0			2.0	2.0	
Green ratio				0.17		0.40	0.48			0.17	0.70	
Lane group cap.				301		646	1726			301	2527	
v/c ratio				0.02		0.08	0.21			0.29	0.11	
Flow ratio				0.00		0.03	0.10			0.05	0.08	
Crit. lane group				Y		N	Y			Y	N	
Sum flow ratios	0.15											
Lost time/cycle	11.00											
Critical v/c ratio	0.19											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group				L		R	TR			L	T	
Adj. flow rate				6		51	365			86	288	
Lane group cap.				301		646	1726			301	2527	
v/c ratio				0.02		0.08	0.21			0.29	0.11	
Green ratio				0.17		0.40	0.48			0.17	0.70	
Unif. delay d1				20.9		11.2	8.9			21.9	2.9	
Delay factor k				0.11		0.11	0.11			0.11	0.11	
Increm. delay d2				0.0		0.1	0.1			0.5	0.0	
PF factor				1.000		1.000	1.000			1.000	1.000	
Control delay				20.9		11.2	9.0			22.4	3.0	
Lane group LOS				C		B	A			C	A	
Apprch. delay				12.2			9.0			7.4		
Approach LOS				B			A			A		
Intersec. delay	8.5			Intersection LOS						A		

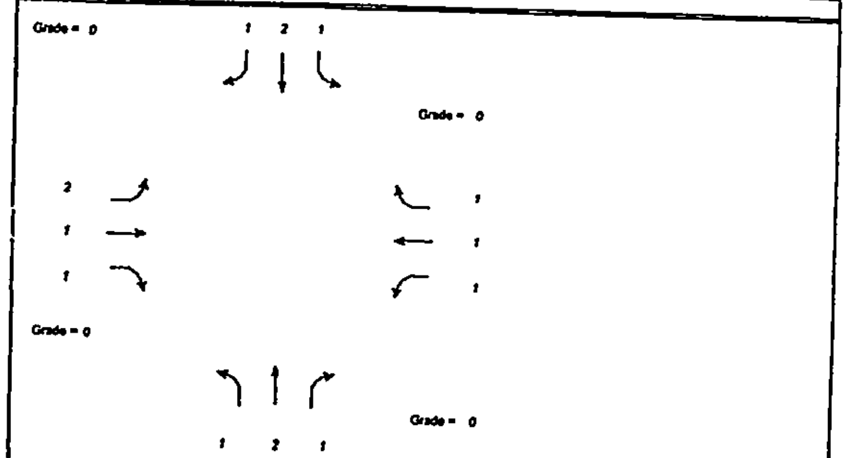
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Fort Weaver Rd/Keaunui Dr
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	87	23	11	82	0	1	41	1236	19	10	1034	40
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume	0			0			0			0		
Bicycle volume	0			0			0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing	0.0			0.0			3.0			0.0		

	EB Only	WB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 14.0	G = 18.0	G =	G =	G = 12.0	G = 40.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 100.0		

HCS2000™

Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description: *Ewa Gentry Makai (Year 2010 Total AM Base) Ft Weaver/Keaunui*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	97	26	12	91	0	1	46	1373	21	11	1149	44
Satflow rate	3502	1900	1615	1805	1900	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.14	0.14	0.26	0.18	0.18	0.34	0.12	0.40	0.40	0.12	0.40	0.58
Lane group cap.	490	266	420	325	342	549	217	1444	646	217	1444	937
v/c ratio	0.20	0.10	0.03	0.28	0.00	0.00	0.21	0.95	0.03	0.05	0.80	0.05
Flow ratio	0.03	0.01	0.01	0.05	0.00	0.00	0.03	0.38	0.01	0.01	0.32	0.03
Crit. lane group	Y	N	N	Y	N	N	Y	Y	N	N	N	N
Sum flow ratios	0.48											
Lost time/cycle	16.00											
Critical v/c ratio	0.58											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	97	26	12	91	0	1	46	1373	21	11	1149	44
Lane group cap.	490	266	420	325	342	549	217	1444	646	217	1444	937
v/c ratio	0.20	0.10	0.03	0.28	0.00	0.00	0.21	0.95	0.03	0.05	0.80	0.05
Green ratio	0.14	0.14	0.26	0.18	0.18	0.34	0.12	0.40	0.40	0.12	0.40	0.58
Unif. delay d1	38.0	37.5	27.6	35.4	33.6	21.8	39.7	29.0	18.2	39.0	26.4	9.1
Delay factor k	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.46	0.11	0.11	0.34	0.11
Increm. delay d2	0.2	0.2	0.0	0.5	0.0	0.0	0.5	18.4	0.0	0.1	3.3	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	38.2	37.7	27.6	35.9	33.6	21.8	40.2	47.5	18.3	39.1	29.7	9.1
Lane group LOS	D	D	C	D	C	C	D	D	B	D	C	A
Apprch. delay	37.2			35.7			46.8			29.0		
Approach LOS	D			D			D			C		
Intersec. delay	38.5			Intersection LOS						D		

HCS2000™

Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei Pkwy/Ent. A
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour (2010 Base)	Project ID	Ewa Gentry Makai (Year 2010 Base AM Peak) Kapolei Pkwy/Ent A
East/West Street: Entrance A		North/South Street: Kapolei Parkway	
Intersection Orientation: North-South		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	345	5	12	287	8
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	9	392	5	13	303	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	3	0	31	16	0	37
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	3	0	35	18	0	42
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	LT		R	LT		R
v (vph)	9	13	3		35	18		42
C (m) (vph)	1260	1173	372		816	400		868
v/c	0.01	0.01	0.01		0.04	0.05		0.05
95% queue length	0.02	0.03	0.02		0.13	0.14		0.15
Control Delay	7.9	8.1	14.8		9.6	14.4		9.4
LOS	A	A	B		A	B		A
Approach Delay	--	--	10.0+			10.9		
Approach LOS	--	--	B			B		

HCS2000™

Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei Pkwy/ Ent. B
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour (2010 Base)	Project ID	Ewa Gentry Makai (Year 2010 Base AM Peak) Kapolei Pkwy/Ent B
East/West Street: Entrance B		North/South Street: Kapolei Parway	
Intersection Orientation: North-South		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	11	340	11	3	304	9
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	12	386	0	0	345	10
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	115	0	40	18	0	38
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	0	0	0	20	0	43
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	12					20		43
C (m) (vph)	1215					453		841
v/c	0.01					0.04		0.05
95% queue length	0.03					0.14		0.16
Control Delay	8.0					13.3		9.5
LOS	A					B		A
Approach Delay	--	--				10.7		
Approach LOS	--	--				B		

HCS2000™

Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/ Ent C
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour (2010 Base)	Project ID	Ewa Gentry Makai (Year 2010 Base AM Peak)Geiger Rd/Ent C
East/West Street: Entrance C		North/South Street: Geiger Road	
Intersection Orientation: East-West		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	309	4	70	581	31
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	0	351	4	79	660	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	11	597	212	12	436	8
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	12	0	240	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		1			1	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
v (vph)		79	12		240			
C (m) (vph)		1215	319		695			
v/c		0.07	0.04		0.35			
95% queue length		0.21	0.12		1.57			
Control Delay		8.2	16.7		12.9			
LOS		A	C		B			
Approach Delay	--	--	13.1					
Approach LOS	--	--	B					

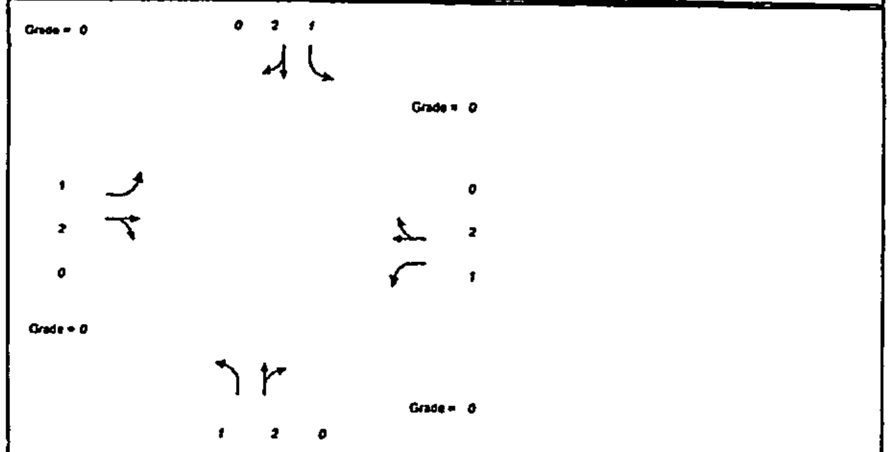
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Kapolei Pkwy
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	169	309	77	59	280	334	77	307	35	232	338	130
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival type	3	3		3	3		3	3		3	3	
Ped volume		0			0			0			0	
Bicycle volume		0			0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0		0	0	
Ped timing		0.0			0.0			3.0			0.0	

	Excl. Left	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 8.0	G = 24.0	G =	G =	G = 8.0	G = 24.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 80.0			

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Base PM Peak) Geiger/Kapolei

Capacity Analysis

	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	169	386	59	614	77	342	232	468
Satflow rate	1805	3502	1805	3315	1805	3555	1805	3460
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Lane group cap.	350	1051	450	995	411	1067	473	1038
v/c ratio	0.48	0.37	0.13	0.62	0.19	0.32	0.49	0.45
Flow ratio		0.11		0.19		0.10		0.14
Crit. lane group	N	N	N	N	N	N	N	N
Sum flow ratios	0.53							
Lost time/cycle	16.00							
Critical v/c ratio	0.66							

Lane Group Capacity, Control Delay, and LOS Determination

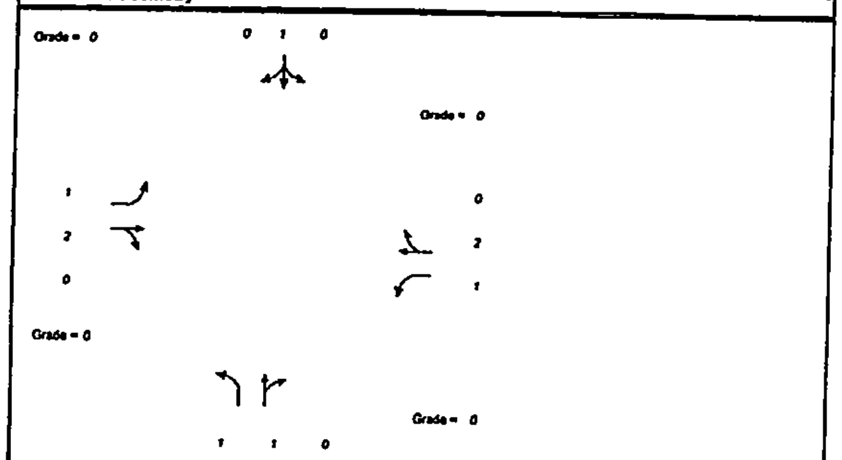
	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	169	386	59	614	77	342	232	468
Lane group cap.	350	1051	450	995	411	1067	473	1038
v/c ratio	0.48	0.37	0.13	0.62	0.19	0.32	0.49	0.45
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Unif. delay d1	14.5	22.0	12.8	24.1	13.2	21.7	14.2	22.7
Delay factor k	0.11	0.11	0.11	0.20	0.11	0.11	0.11	0.11
Increm. delay d2	1.1	0.2	0.1	1.2	0.2	0.2	0.8	0.3
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	15.6	22.2	13.0	25.2	13.4	21.9	15.0	23.0
Lane group LOS	B	C	B	C	B	C	B	C
Apprch. delay	20.2		24.2		20.3		20.3	
Approach LOS	C		C		C		C	
Intersec. delay	21.4		Intersection LOS				C	

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Launahele St
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	113	420	43	79	528	69	28	10	39	160	13	117
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Arrival type	3	3		3	3		3	3			3	
Ped volume		0			0			0			0	
Bicycle volume		0			0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0			0	
Ped timing		0.0			0.0			3.0			0.0	

	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 27.0	G =	G =	G =	G = 25.0	G =	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y =	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 60.0		

HCS2000™

Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Base PM Peak) Geiger/Launahele

Capacity Analysis

	EB			WB			NB			SB	
Lane group	L	TR		L	TR		L	TR		LTR	
Adj. flow rate	113	463		79	597		28	49		290	
Satflow rate	721	3560		883	3547		1125	1673		1443	
Lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	
Green ratio	0.45	0.45		0.45	0.45		0.42	0.42		0.42	
Lane group cap.	324	1602		397	1596		469	697		601	
v/c ratio	0.35	0.29		0.20	0.37		0.06	0.07		0.48	
Flow ratio	0.16	0.13		0.09	0.17		0.02	0.03		0.20	
Crit. lane group	N	N		N	Y		N	N		Y	
Sum flow ratios	0.37										
Lost time/cycle	8.00										
Critical v/c ratio	0.43										

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB	
Lane group	L	TR		L	TR		L	TR		LTR	
Adj. flow rate	113	463		79	597		28	49		290	
Lane group cap.	324	1602		397	1596		469	697		601	
v/c ratio	0.35	0.29		0.20	0.37		0.06	0.07		0.48	
Green ratio	0.45	0.45		0.45	0.45		0.42	0.42		0.42	
Unif. delay d1	10.8	10.4		10.0	10.9		10.5	10.5		12.8	
Delay factor k	0.11	0.11		0.11	0.11		0.11	0.11		0.11	
Increm. delay d2	0.7	0.1		0.2	0.1		0.1	0.0		0.6	
PF factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	
Control delay	11.4	10.5		10.2	11.1		10.5	10.6		13.4	
Lane group LOS	B	B		B	B		B	B		B	
Apprch. delay	10.7			11.0			10.5			13.4	
Approach LOS	B			B			B			B	
Intersec. delay	11.3			Intersection LOS						B	

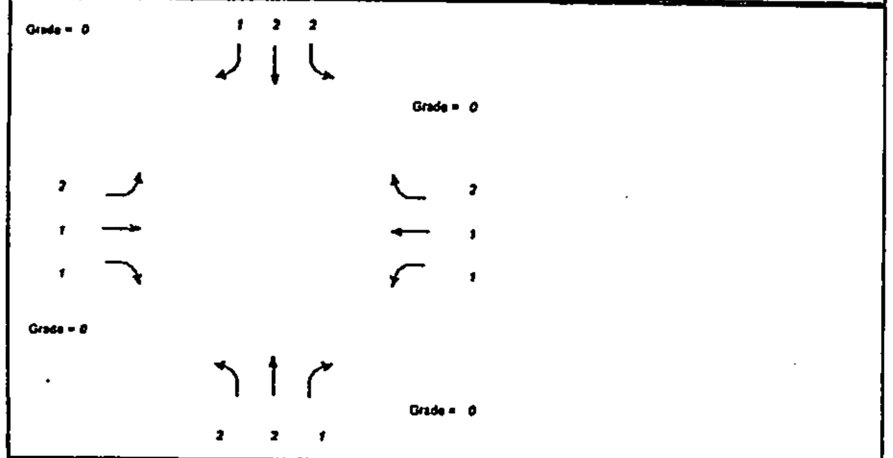
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Fort Weaver/Geiger (Iroquois)
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	196	280	143	48	230	194	128	823	65	349	1173	318
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume	0			0			0			0		
Bicycle volume	0			0			0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing	0.0			0.0			3.0			0.0		

	EB Only	WB Only	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 20.0	G = 18.0	G =	G =	G = 8.0	G = 6.0	G = 28.0	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y = 3.0	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 100.0			

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Base PM Peak) Geiger/Ft Weaver

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	196	280	143	48	230	194	128	823	65	349	1173	318
Satflow rate	3502	1900	1615	1805	1900	2842	3502	3610	1615	3502	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.20	0.20	0.28	0.18	0.18	0.40	0.08	0.28	0.46	0.18	0.38	0.62
Lane group cap.	700	380	452	325	342	1137	280	1011	743	630	1372	1001
v/c ratio	0.28	0.74	0.32	0.15	0.67	0.17	0.46	0.81	0.09	0.55	0.85	0.32
Flow ratio	0.06	0.15	0.09	0.03	0.12	0.07	0.04	0.23	0.04	0.10	0.32	0.20
Crit. lane group	N	Y	N	N	Y	N	Y	N	N	N	Y	N
Sum flow ratios	0.63											
Lost time/cycle	16.00											
Critical v/c ratio	0.75											

Lane Group Capacity, Control Delay, and LOS Determination

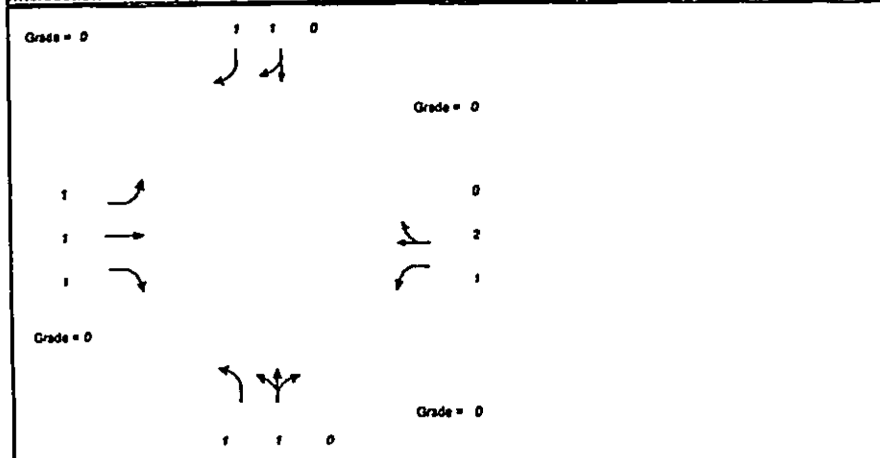
	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	196	280	143	48	230	194	128	823	65	349	1173	318
Lane group cap.	700	380	452	325	342	1137	280	1011	743	630	1372	1001
v/c ratio	0.28	0.74	0.32	0.15	0.67	0.17	0.46	0.81	0.09	0.55	0.85	0.32
Green ratio	0.20	0.20	0.28	0.18	0.18	0.40	0.08	0.28	0.46	0.18	0.38	0.62
Unif. delay d1	33.9	37.5	28.4	34.5	38.3	19.3	43.9	33.6	15.2	37.3	28.5	9.0
Delay factor k	0.11	0.29	0.11	0.11	0.24	0.11	0.11	0.35	0.11	0.15	0.39	0.11
Increm. delay d2	0.2	7.7	0.4	0.2	5.2	0.1	1.2	5.4	0.1	1.1	5.9	0.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	34.1	45.2	28.8	34.7	43.5	19.4	45.1	39.0	15.2	38.4	34.3	9.2
Lane group LOS	C	D	C	C	D	B	D	D	B	D	C	A
Apprch. delay	37.9			32.7			38.3			30.8		
Approach LOS	D			C			D			C		
Intersec. delay	34.0			Intersection LOS						C		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Iroquois Pt. Rd.
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	147	169	378	0	140	21	208	32	0	14	14	124
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Arrival type	3	3	3	3	3		3	3			3	3
Ped volume		0			0			0			0	
Bicycle volume		0			0							
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0		0	0			0	0
Ped timing		0.0			0.0			3.0			0.0	

	Excl. Left	EB Only	Thru & RT	04	NB Only	SB Only	07	08
Timing	G = 10.0	G = 12.0	G = 12.0	G =	G = 20.0	G = 10.0	G =	G =
	Y = 0.0	Y = 3.0	Y = 3.0	Y =	Y = 3.0	Y = 3.0	Y =	Y =

Duration of Analysis (hrs) = 1.00 | Cycle Length C = 80.0

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Base PM Peak) Iroquois/Keaunui

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	TR		L	LTR			LT	R
Adj. flow rate	147	169	378	0	161		208	32			28	124
Satflow rate	1805	1900	1615	1805	3539		1805	1900			1854	1615
Lost time	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Green ratio	0.28	0.35	0.82	0.13	0.15		0.25	0.25			0.13	0.65
Lane group cap.	496	665	1332	228	531		451	475			232	1050
v/c ratio	0.30	0.25	0.28	0.00	0.30		0.46	0.07			0.12	0.12
Flow ratio	0.08	0.09	0.23	0.00	0.05		0.12	0.02			0.02	0.08
Crit. lane group	Y	N	N	N	Y		Y	N			Y	N
Sum flow ratios	0.28											
Lost time/cycle	16.00											
Critical v/c ratio	0.32											

Lane Group Capacity, Control Delay, and LOS Determination

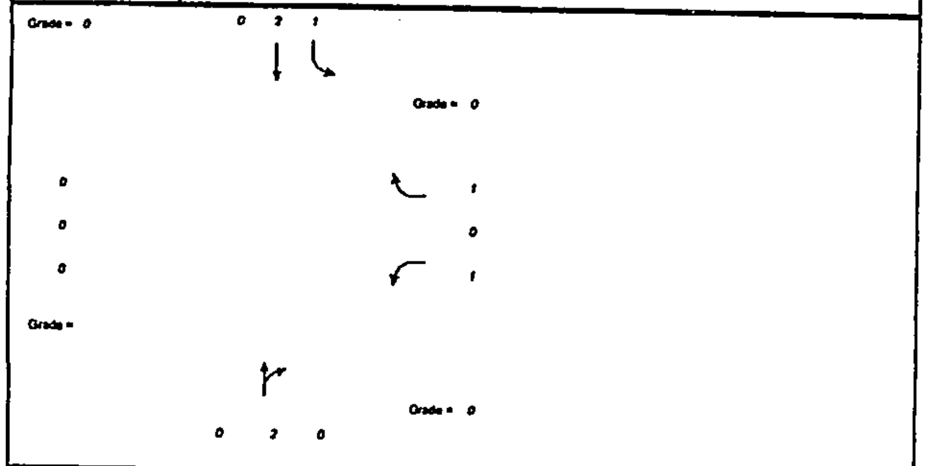
	EB			WB			NB			SB		
Lane group	L	T	R	L	TR		L	LTR			LT	R
Adj. flow rate	147	169	378	0	161		208	32			28	124
Lane group cap.	496	665	1332	226	531		451	475			232	1050
v/c ratio	0.30	0.25	0.28	0.00	0.30		0.46	0.07			0.12	0.12
Green ratio	0.28	0.35	0.82	0.13	0.15		0.25	0.25			0.13	0.65
Unif. delay d1	22.9	18.5	1.6	30.6	30.3		25.4	22.9			31.1	5.3
Delay factor k	0.11	0.11	0.11	0.11	0.11		0.11	0.11			0.11	0.11
Increm. delay d2	0.3	0.2	0.1	0.0	0.3		0.8	0.1			0.2	0.1
PF factor	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	1.000
Control delay	23.2	18.8	1.7	30.6	30.6		26.2	22.9			31.3	5.4
Lane group LOS	C	B	A	C	C		C	C			C	A
Apprch. delay	10.4			30.6			25.8			10.1		
Approach LOS	B			C			C			B		
Intersec. delay	15.9			Intersection LOS						B		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Manuoka	Intersection	Kapolei Pkwy/Keaunui Dr
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	3/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)				10		167		225	11	108	292	
% Heavy veh				0		0		0	0	0	0	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		A	A	A	A	
Startup lost time				2.0		2.0		2.0		2.0	2.0	
Ext. eff. green				2.0		2.0		2.0		2.0	2.0	
Arrival type				3		3		3		3	3	
Ped volume		0			0			0				
Bicycle volume								0				
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr				0		0		0		0	0	
Ped timing		0.0			0.0			3.0			0.0	

	WB Only	02	03	04	SB Only	Thru & RT	07	08
Timing	G = 10.0	G =	G =	G =	G = 10.0	G = 29.0	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =

Duration of Analysis (hrs) = 1.00 Cycle Length C = 60.0

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year2010 Base PM)Kapolei Pkwy/Keaunui Dr

Capacity Analysis

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane group				L		R		TR		L	T	
Adj. flow rate				11		186		262		120	324	
Satflow rate				1805		1615		3585		1805	3610	
Lost time				2.0		2.0		2.0		2.0	2.0	
Green ratio				0.17		0.40		0.48		0.17	0.70	
Lane group cap.				301		646		1733		301	2527	
v/c ratio				0.04		0.29		0.15		0.40	0.13	
Flow ratio				0.01		0.12		0.07		0.07	0.09	
Crit. lane group				N		Y		Y		N	N	
Sum flow ratios	0.19											
Lost time/cycle	7.00											
Critical v/c ratio	0.21											

Lane Group Capacity, Control Delay, and LOS Determination

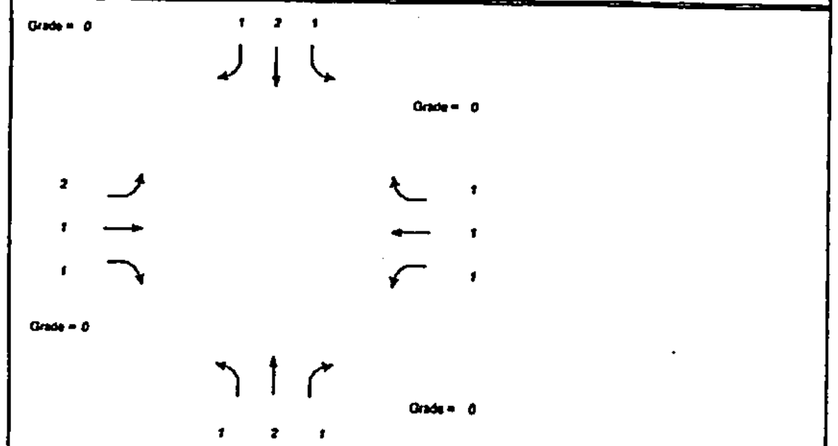
	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane group				L		R		TR		L	T	
Adj. flow rate				11		186		262		120	324	
Lane group cap.				301		646		1733		301	2527	
v/c ratio				0.04		0.29		0.15		0.40	0.13	
Green ratio				0.17		0.40		0.48		0.17	0.70	
Unif. delay d1				21.0		12.2		8.6		22.3	3.0	
Delay factor k				0.11		0.11		0.11		0.11	0.11	
Increm. delay d2				0.0		0.2		0.0		0.9	0.0	
PF factor				1.000		1.000		1.000		1.000	1.000	
Control delay				21.0		12.5		8.7		23.2	3.0	
Lane group LOS				C		B		A		C	A	
Apprch. delay				12.9			8.7			8.4		
Approach LOS				B			A			A		
Intersec. delay	9.5			Intersection LOS						A		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Fort Weaver Rd/Keaunui Dr
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Base)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	138	26	60	46	0	9	89	869	62	14	1197	153
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume		0			0			0			0	
Bicycle volume		0			0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing		0.0			0.0			3.0			0.0	

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 13.0	G = 16.0	G =	G =	G = 18.0	G = 37.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 100.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Base PM Peak) Ft Weaver/Keaunui

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	138	26	60	46	0	9	89	869	62	14	1197	153
Satflow rate	3502	1900	1615	1805	1900	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.13	0.16	0.38	0.13	0.16	0.38	0.18	0.37	0.54	0.18	0.37	0.54
Lane group cap.	455	304	614	235	304	614	325	1336	872	325	1336	872
v/c ratio	0.30	0.09	0.10	0.20	0.00	0.01	0.27	0.65	0.07	0.04	0.90	0.18
Flow ratio	0.04	0.01	0.04	0.03	0.00	0.01	0.05	0.24	0.04	0.01	0.33	0.09
Crit. lane group	Y	Y	N	N	N	N	Y	N	N	N	Y	N
Sum flow ratios	0.43											
Lost time/cycle	16.00											
Critical v/c ratio	0.52											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	138	26	60	46	0	9	89	869	62	14	1197	153
Lane group cap.	455	304	614	235	304	614	325	1336	872	325	1336	872
v/c ratio	0.30	0.09	0.10	0.20	0.00	0.01	0.27	0.65	0.07	0.04	0.90	0.18
Green ratio	0.13	0.16	0.38	0.13	0.16	0.38	0.18	0.37	0.54	0.18	0.37	0.54
Unif. delay d1	39.4	35.8	20.0	38.8	35.3	19.3	35.4	26.1	11.0	33.9	29.7	11.7
Delay factor k	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.23	0.11	0.11	0.42	0.11
Increm. delay d2	0.4	0.1	0.1	0.4	0.0	0.0	0.5	1.1	0.0	0.1	9.3	0.1
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	39.8	35.9	20.0+	39.2	35.3	19.3	35.8	27.3	11.0	33.9	38.9	11.8
Lane group LOS	D	D	C	D	D	B	D	C	B	C	D	B
Apprch. delay	34.0			36.0			27.0			35.8		
Approach LOS	C			D			C			D		
Intersec. delay	32.3			Intersection LOS						C		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei Pkwy/Ent. A
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour (2010 Base)	Project ID	Ewa Gentry Makai (Year 2010 Base PM Peak) Kapolei Pkwy/Ent A

East/West Street: Entrance A	North/South Street: Kapolei Parkway
Intersection Orientation: North-South	Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	20	388	9	37	397	40
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	24	467	10	44	478	48
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	8	0	22	9	0	29
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	9	0	26	10	0	34
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	LT		R	LT		R
v (vph)	24	44	9		26	10		34
C (m) (vph)	1051	1098	235		769	228		742
v/c	0.02	0.04	0.04		0.03	0.04		0.05
95% queue length	0.07	0.13	0.12		0.10	0.14		0.14
Control Delay	8.5	8.4	20.9		9.8	21.5		10.1
LOS	A	A	C		A	C		B
Approach Delay	--	--	12.7			12.7		
Approach LOS	--	--	B			B		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei/Ent. B
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour (2010 Base)	Project ID	Ewa Gentry Makai (Year 2010 Base PM Peak) Kapolei Pkwy/Ent B

East/West Street: Entrance B	North/South Street: Kapolei Parkway
Intersection Orientation: North-South	Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	20	390	45	3	394	55
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	24	469	0	0	474	66
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	50	0	40	9	0	21
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	0	0	0	10	0	25
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	24					10		25
C (m) (vph)	1039					324		734
v/c	0.02					0.03		0.03
95% queue length	0.07					0.10		0.11
Control Delay	8.5					16.5		10.1
LOS	A					C		B
Approach Delay	--	--				11.9		
Approach LOS	--	--				B		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/ Ent C
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour (2010 Base)	Project ID	Ewa Gentry Makai (Year 2010 Base PM Peak)Geiger Rd/Ent C

East/West Street: Entrance C		North/South Street: Geiger Road	
Intersection Orientation: East-West		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	467	11	229	290	31
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	0	530	12	260	329	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	6	597	123	12	436	8
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	6	0	139	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		1			1	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

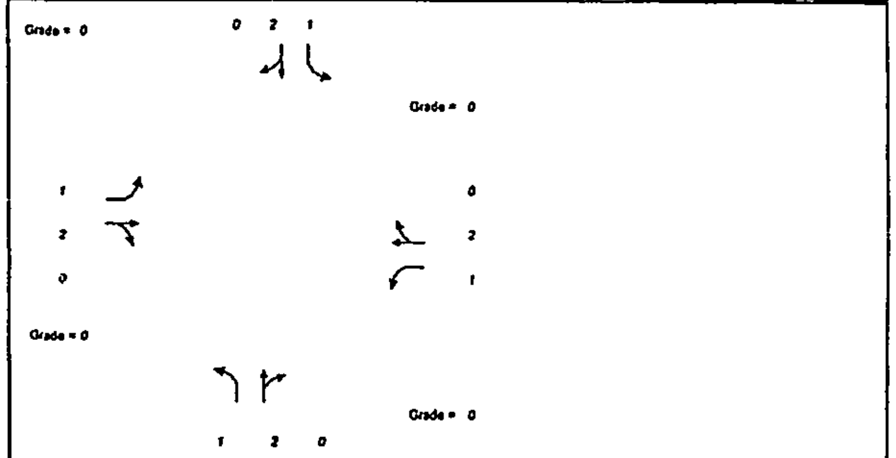
Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
V (vph)		260	6		139			
C (m) (vph)		1037	236		549			
v/c		0.25	0.03		0.25			
95% queue length		1.00	0.08		1.01			
Control Delay		9.6	20.7		13.8			
LOS		A	C		B			
Approach Delay	--	--	14.1					
Approach LOS	--	--	B					

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Kapolei Pkwy
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	126	388	104	23	422	301	87	594	5	228	329	174
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival type	3	3		3	3		3	3		3	3	
Ped volume		0			0			0			0	
Bicycle volume								0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0		0	0	
Ped timing		0.0			0.0			3.0			0.0	

	Excl. Left	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 8.0	G = 24.0	G =	G =	G = 8.0	G = 24.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 80.0			

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description   *Ewa Gentry Makai (Year 2010 Total AM Peak) Geiger/Kapolei*

Capacity Analysis

	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	140	547	26	803	97	666	253	559
Satflow rate	1805	3495	1805	3385	1805	3605	1805	3423
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Lane group cap.	298	1049	377	1016	372	1082	330	1027
v/c ratio	0.47	0.52	0.07	0.79	0.26	0.62	0.77	0.54
Flow ratio		0.16		0.24		0.18		0.16
Crit. lane group	N	N	N	N	N	N	N	N
Sum flow ratios	0.61							
Lost time/cycle	16.00							
Critical v/c ratio	0.76							

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	140	547	26	803	97	666	253	559
Lane group cap.	298	1049	377	1016	372	1082	330	1027
v/c ratio	0.47	0.52	0.07	0.79	0.26	0.62	0.77	0.54
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Unif. delay d1	15.4	23.2	13.0	25.7	13.6	24.0	15.8	23.4
Delay factor k	0.11	0.13	0.11	0.34	0.11	0.20	0.32	0.14
Increm. delay d2	1.2	0.5	0.1	4.4	0.4	1.1	11.1	0.6
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	16.5	23.7	13.1	30.1	14.0	25.1	26.9	24.0
Lane group LOS	B	C	B	C	B	C	C	C
Apprch. delay	22.2		29.6		23.7		24.9	
Approach LOS	C		C		C		C	
Intersec. delay	25.3		Intersection LOS				C	

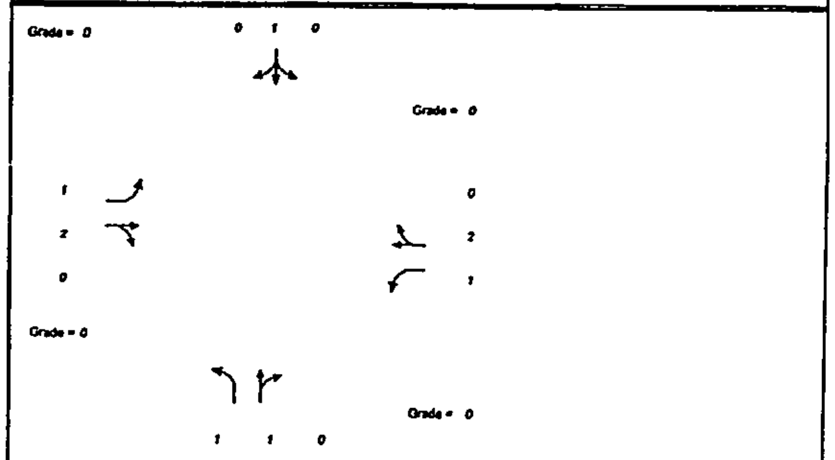
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Launahale St
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	5/13/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	61	534	26	48	588	33	57	8	102	115	1	101
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Arrival type	3	3		3	3		3	3			3	
Ped volume		0			0			0			0	
Bicycle volume								0				
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0			0	
Ped timing		0.0			0.0			3.0			0.0	

	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 26.0	G =	G =	G =	G = 26.0	G =	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y =	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 60.0			

HCS2000™

Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Total AM Peak) Geiger/Launahele

Capacity Analysis

	EB		WB		NB		SB
Lane group	L	TR	L	TR	L	TR	LTR
Adj. flow rate	68	622	53	690	63	122	241
Satflow rate	609	3585	682	3581	1181	1636	1396
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Lane group cap.	264	1554	296	1552	512	709	605
v/c ratio	0.26	0.40	0.18	0.44	0.12	0.17	0.40
Flow ratio	0.11	0.17	0.08	0.19	0.05	0.07	0.17
Crit. lane group	N	N	N	Y	N	N	Y
Sum flow ratios	0.37						
Lost time/cycle	8.00						
Critical v/c ratio	0.42						

Lane Group Capacity, Control Delay, and LOS Determination

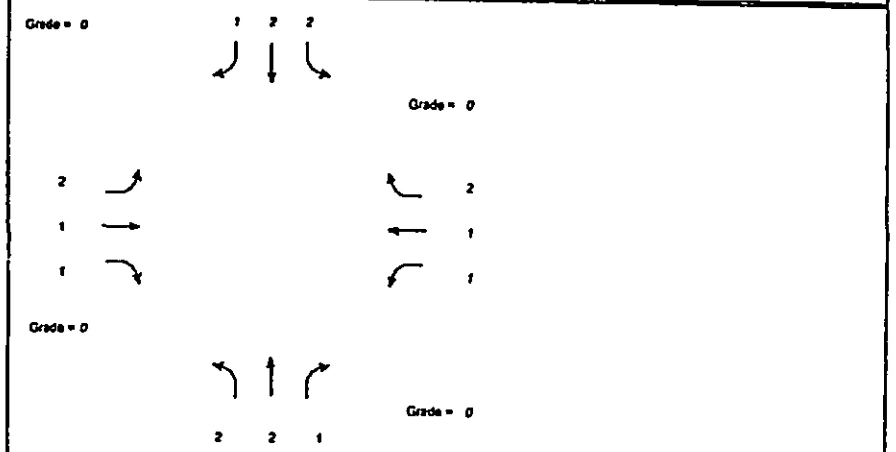
	EB		WB		NB		SB
Lane group	L	TR	L	TR	L	TR	LTR
Adj. flow rate	68	622	53	690	63	122	241
Lane group cap.	264	1554	296	1552	512	709	605
v/c ratio	0.26	0.40	0.18	0.44	0.12	0.17	0.40
Green ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Unif. delay d1	10.8	11.7	10.4	11.9	10.2	10.4	11.8
Delay factor k	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Increm. delay d2	0.5	0.2	0.3	0.2	0.1	0.1	0.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	11.4	11.8	10.7	12.1	10.3	10.5	12.1
Lane group LOS	B	B	B	B	B	B	B
Apprch. delay	11.8		12.0		10.4		12.1
Approach LOS	B		B		B		B
Intersec. delay	11.8		Intersection LOS				B

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Ft Weaver Rd/Geiger (Iroquois)
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	500	131	120	119	291	285	181	1343	89	163	1090	197
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume		0			0			0			0	
Bicycle volume					0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing		0.0			0.0			3.0			0.0	

	EB Only	WB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 18.0	G = 21.0	G =	G =	G = 8.0	G = 41.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 0.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 100.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Total AM Peak) Geiger/Ft Weaver

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	556	146	133	132	323	317	201	1492	99	181	1211	219
Satflow rate	3502	1900	1615	1805	1900	2842	3502	3610	1615	3502	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.18	0.18	0.26	0.21	0.21	0.33	0.08	0.41	0.62	0.08	0.41	0.63
Lane group cap.	630	342	420	379	399	938	280	1480	1001	280	1480	1017
v/c ratio	0.88	0.43	0.32	0.35	0.81	0.34	0.72	1.01	0.10	0.65	0.82	0.22
Flow ratio	0.16	0.08	0.08	0.07	0.17	0.11	0.06	0.41	0.06	0.05	0.34	0.14
Crit. lane group	Y	N	N	N	Y	N	Y	Y	N	N	N	N
Sum flow ratios	0.80											
Lost time/cycle	12.00											
Critical v/c ratio	0.91											

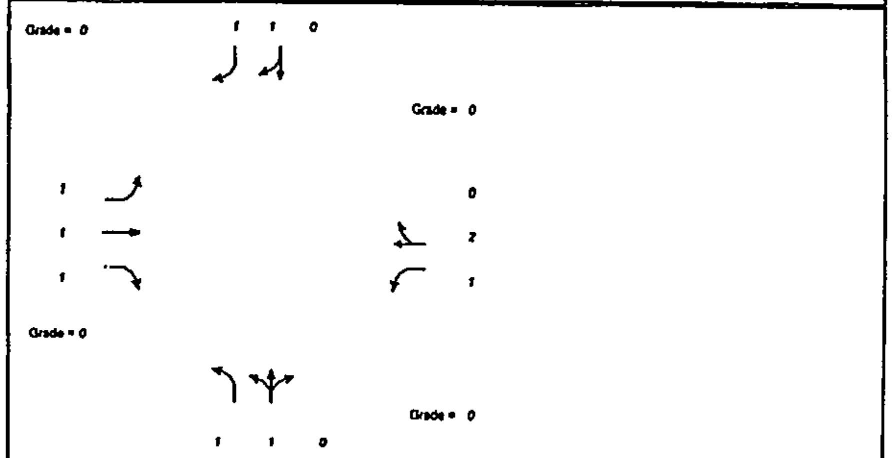
Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	556	146	133	132	323	317	201	1492	99	181	1211	219
Lane group cap.	630	342	420	379	399	938	280	1480	1001	280	1480	1017
v/c ratio	0.88	0.43	0.32	0.35	0.81	0.34	0.72	1.01	0.10	0.65	0.82	0.22
Green ratio	0.18	0.18	0.26	0.21	0.21	0.33	0.08	0.41	0.62	0.08	0.41	0.63
Unif. delay d1	40.0	36.4	29.8	33.7	37.6	25.3	44.9	29.5	7.7	44.6	26.2	7.9
Delay factor k	0.41	0.11	0.11	0.11	0.35	0.11	0.28	0.50	0.11	0.22	0.36	0.11
Increm. delay d2	16.3	0.9	0.4	0.6	13.0	0.2	9.0	54.8	0.0	5.2	3.9	0.1
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	56.2	37.3	30.3	34.2	50.8	25.5	53.9	84.3	7.7	49.9	30.1	8.0
Lane group LOS	E	D	C	C	D	C	D	F	A	D	C	A
Apprch. delay	48.8			37.5			76.7			29.3		
Approach LOS	D			D			E			C		
Intersec. delay	50.8			Intersection LOS						D		

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Iroquois Pt Rd/Keaunui Rd
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	162	108	113	0	141	59	317	72	5	18	37	237
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Arrival type	3	3	3	3	3		3	3			3	3
Ped volume	0			0			0			0		
Bicycle volume										0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0		0	0			0	0
Ped timing	0.0			0.0			3.0			0.0		

	Excl. Left	EB Only	Thru & RT	04	NB Only	SB Only	07	08
Timing	G = 8.0	G = 10.0	G = 10.0	G =	G = 20.0	G = 16.0	G =	G =
	Y = 0.0	Y = 3.0	Y = 3.0	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 80.0		

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Ewa Gentry Makai (Year 2010 Total AM Peak) Iroquois/Keaunui*

Capacity Analysis

	EB			WB		NB		SB	
Lane group	L	T	R	L	TR	L	LTR	LT	R
Adj. flow rate	180	120	126	0	223	352	88	61	263
Satflow rate	1805	1900	1615	1805	3450	1805	1880	1869	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.22	0.30	0.60	0.10	0.13	0.25	0.25	0.20	0.47
Lane group cap.	406	570	969	181	431	451	470	374	767
v/c ratio	0.44	0.21	0.13	0.00	0.52	0.78	0.18	0.16	0.34
Flow ratio	0.10	0.06	0.08	0.00	0.06	0.20	0.05	0.03	0.16
Crit. lane group	N	N	N	N	Y	Y	N	N	Y
Sum flow ratios	0.42								
Lost time/cycle	12.00								
Critical v/c ratio	0.50								

Lane Group Capacity, Control Delay, and LOS Determination

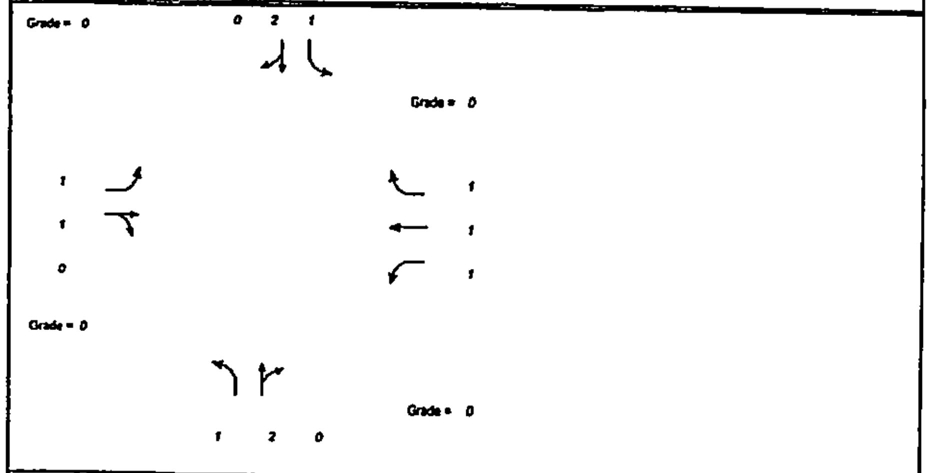
	EB			WB		NB		SB	
Lane group	L	T	R	L	TR	L	LTR	LT	R
Adj. flow rate	180	120	126	0	223	352	88	61	263
Lane group cap.	406	570	969	181	431	451	470	374	767
v/c ratio	0.44	0.21	0.13	0.00	0.52	0.78	0.18	0.16	0.34
Green ratio	0.22	0.30	0.60	0.10	0.13	0.25	0.25	0.20	0.47
Unif. delay d1	26.7	20.9	6.9	32.4	32.7	28.0	23.6	26.5	13.2
Delay factor k	0.11	0.11	0.11	0.11	0.12	0.33	0.11	0.11	0.11
Increm. delay d2	0.8	0.2	0.1	0.0	1.1	9.1	0.2	0.2	0.3
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	27.5	21.1	7.0	32.4	33.8	37.1	23.8	26.7	13.4
Lane group LOS	C	C	A	C	C	D	C	C	B
Apprch. delay	19.6			33.8		34.5		15.9	
Approach LOS	B			C		C		B	
Intersec. delay	25.6			Intersection LOS				C	

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	*C. Maruoka*	Intersection	*Kapolei Pkwy/Keaunui Dr*
Agency or Co.	*PBQ&D*	Area Type	*All other areas*
Date Performed	*9/19/2002*	Jurisdiction	*Honolulu*
Time Period	*AM Peak Hour (2010 Total)*	Analysis Year	*2002*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	54	82	21	72	78	259	28	310	77	289	304	53
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Ext. eff. green	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Arrival type	3	3		3	3	3	3	3		3	3	
Ped volume		0			0			0			0	
Bicycle volume		0			0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0	0	0		0	0	
Ped timing		0.0			0.0			3.0			0.0	

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 10.0	G = 15.0	G =	G =	G = 25.0	G = 25.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 90.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year2010 Total AM)Kapolei Pkwy/Keaunui Dr

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	L	TR	L	TR
Adj. flow rate	60	114	80	87	288	31	430	321	397
Satflow rate	1805	1842	1805	1900	1615	1805	3502	1805	3530
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.11	0.17	0.11	0.17	0.49	0.28	0.28	0.28	0.28
Lane group cap.	201	307	201	317	790	501	973	501	981
v/c ratio	0.30	0.37	0.40	0.27	0.36	0.06	0.44	0.64	0.40
Flow ratio	0.03	0.06	0.04	0.05	0.18	0.02	0.12	0.18	0.11
Crit. lane group	N	Y	Y	N	N	N	Y	Y	N
Sum flow ratios	0.41								
Lost time/cycle	15.00								
Critical v/c ratio	0.49								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	L	TR	L	TR
Adj. flow rate	60	114	80	87	288	31	430	321	397
Lane group cap.	201	307	201	317	790	501	973	501	981
v/c ratio	0.30	0.37	0.40	0.27	0.36	0.06	0.44	0.64	0.40
Green ratio	0.11	0.17	0.11	0.17	0.49	0.28	0.28	0.28	0.28
Unif. delay d1	36.8	33.3	37.2	32.7	14.3	23.9	26.8	28.6	26.4
Delay factor k	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.22	0.11
Increm. delay d2	0.8	0.8	1.3	0.5	0.3	0.1	0.3	2.8	0.3
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	37.6	34.1	38.5	33.2	14.6	23.9	27.1	31.4	26.7
Lane group LOS	D	C	D	C	B	C	C	C	C
Apprch. delay	35.3		22.4			26.9		28.8	
Approach LOS	D		C			C		C	
Intersec. delay	27.3		Intersection LOS					C	

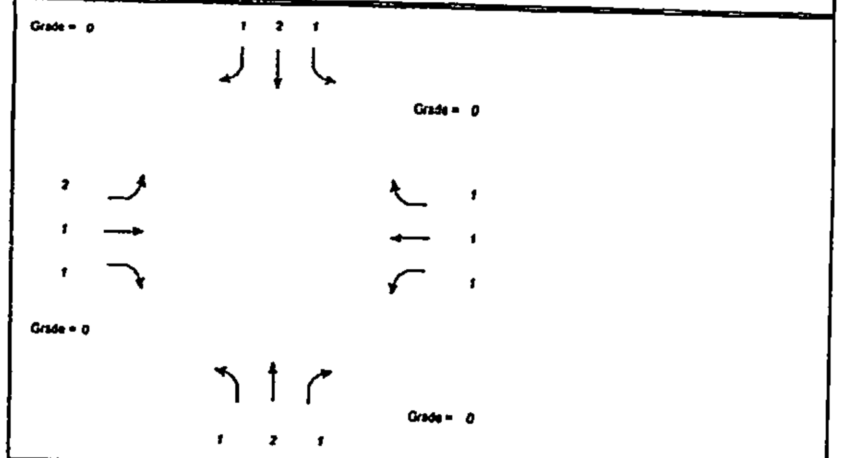
HCS2000™

Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Fort Weaver Rd/Keaunui Rd
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	AM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	310	93	57	134	186	62	58	1241	34	43	1049	237
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume	0			0			0			0		
Bicycle volume	0			0			0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing	0.0			0.0			3.0			0.0		

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 14.0	G = 18.0	G =	G =	G = 12.0	G = 40.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 100.0			

HCS2000™

Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description: Ewa Gentry Makai (Year 2010 Total AM Peak) Ft Weaver/Keaunui

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	344	103	63	149	184	69	64	1379	38	48	1166	263
Satflow rate	3502	1900	1615	1805	1900	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.14	0.18	0.34	0.14	0.18	0.34	0.12	0.40	0.58	0.12	0.40	0.58
Lane group cap.	490	342	549	253	342	549	217	1444	937	217	1444	937
v/c ratio	0.70	0.30	0.11	0.59	0.54	0.13	0.29	0.95	0.04	0.22	0.81	0.28
Flow ratio	0.10	0.05	0.04	0.08	0.10	0.04	0.04	0.38	0.02	0.03	0.32	0.16
Crit. lane group	Y	N	N	N	Y	N	Y	Y	N	N	N	N
Sum flow ratios	0.61											
Lost time/cycle	16.00											
Critical v/c ratio	0.73											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	344	103	63	149	184	69	64	1379	38	48	1166	263
Lane group cap.	490	342	549	253	342	549	217	1444	937	217	1444	937
v/c ratio	0.70	0.30	0.11	0.59	0.54	0.13	0.29	0.95	0.04	0.22	0.81	0.28
Green ratio	0.14	0.18	0.34	0.14	0.18	0.34	0.12	0.40	0.58	0.12	0.40	0.58
Unif. delay d1	41.0	35.5	22.7	40.3	37.2	22.8	40.1	29.1	9.0	39.8	26.6	10.5
Delay factor k	0.27	0.11	0.11	0.18	0.14	0.11	0.11	0.46	0.11	0.11	0.35	0.11
Increm. delay d2	4.6	0.5	0.1	3.6	1.7	0.1	0.8	19.8	0.0	0.5	3.6	0.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	45.6	36.0	22.8	43.9	38.9	22.9	40.9	48.9	9.1	40.3	30.2	10.7
Lane group LOS	D	D	C	D	D	C	D	D	A	D	C	B
Apprch. delay	40.9			38.0			47.5			27.1		
Approach LOS	D			D			D			C		
Intersec. delay	37.8			Intersection LOS						D		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C Maruoka	Intersection	Kapolei Pkwy/ Ent. A
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour (2010 Total)	Project ID	Ewa Gentry Makai (Year 2010 Total AM Peak)Kapolei Pkwy/Ent A
East/West Street: Entrance A		North/South Street: Kapolei Parway	
Intersection Orientation: North-South		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	639	5	12	436	8
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	9	726	5	13	495	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	3	0	31	16	0	37
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	3	0	35	18	0	42
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	LT		R	LT		R
v (vph)	9	13	3		35	18		42
C (m) (vph)	1071	883	180		637	217		754
v/c	0.01	0.01	0.02		0.05	0.08		0.06
95% queue length	0.03	0.04	0.05		0.17	0.27		0.18
Control Delay	8.4	9.1	25.3		11.0	23.1		10.1
LOS	A	A	D		B	C		B
Approach Delay	--	--	12.1			14.0		
Approach LOS	--	--	B			B		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei Pkwy/ Ent. B
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour (2010 Total)	Project ID	Ewa Gentry Makai (Year 2010 Total AM Peak)Kapolei Pkwy/Ent B
East/West Street: Entrance B		North/South Street: Kapolei Parway	
Intersection Orientation: North-South		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	11	589	11	3	463	10
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	12	669	12	3	526	11
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	95	0	40	18	0	38
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	107	0	45	20	0	43
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	LT		R	LT		R
v (vph)	12	3	107		45	20		43
C (m) (vph)	1041	921	196		662	219		736
v/c	0.01	0.00	0.55		0.07	0.09		0.06
95% queue length	0.03	0.01	3.35		0.22	0.30		0.19
Control Delay	8.5	8.9	44.9		10.8	23.1		10.2
LOS	A	A	E		B	C		B
Approach Delay	--	--	34.8			14.3		
Approach LOS	--	--	D			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/ Ent C
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	AM Peak Hour (2010 Total)	Project ID	Ewa Gentry Makai (Year 2010 Total AM Peak)Geiger Rd/Ent C
East/West Street: Entrance C		North/South Street: Geiger Road	
Intersection Orientation: East-West		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	309	6	102	581	31
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	0	351	6	115	660	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	16	597	309	12	436	8
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	18	0	351	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		1			1	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

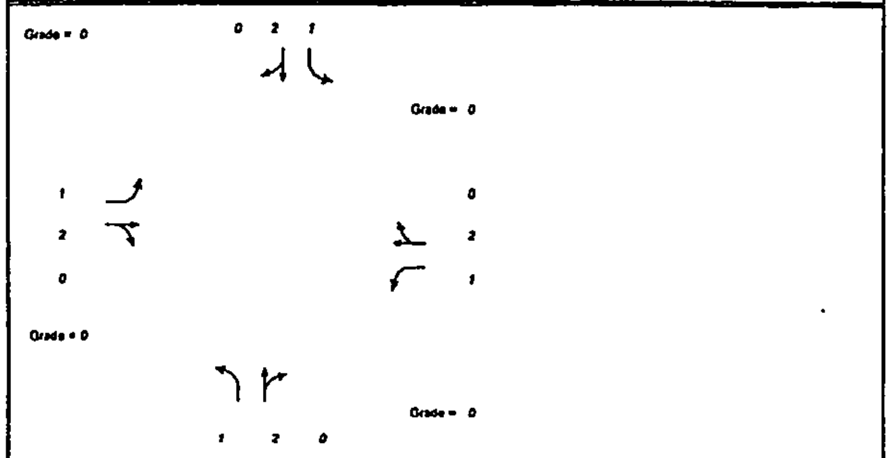
Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
v (vph)		115	18		351			
C (m) (vph)		1213	289		694			
v/c		0.09	0.06		0.51			
95% queue length		0.31	0.20		3.02			
Control Delay		8.3	18.3		15.5			
LOS		A	C		C			
Approach Delay	--	--	15.6					
Approach LOS	--	--	C					

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Kapolei Pkwy
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	186	342	125	137	351	334	120	463	35	232	514	159
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival type	3	3		3	3		3	3		3	3	
Ped volume	0			0			0			0		
Bicycle volume	0			0			0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0		0	0	
Ped timing	0.0			0.0			3.0			0.0		

	Excl. Left	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 8.0	G = 24.0	G =	G =	G = 8.0	G = 24.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =

Duration of Analysis (hrs) = 1.00 | Cycle Length C = 80.0

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Total PM Peak) Geiger/Kapolei

Capacity Analysis

	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	186	467	137	685	120	498	232	673
Satflow rate	1805	3465	1805	3346	1805	3572	1805	3482
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Lane group cap.	323	1040	412	1004	328	1072	398	1045
v/c ratio	0.58	0.45	0.33	0.68	0.37	0.46	0.58	0.64
Flow ratio		0.13		0.20		0.14		0.19
Crit. lane group	N	N	N	N	N	N	N	N
Sum flow ratios	0.61							
Lost time/cycle	16.00							
Critical v/c ratio	0.77							

Lane Group Capacity, Control Delay, and LOS Determination

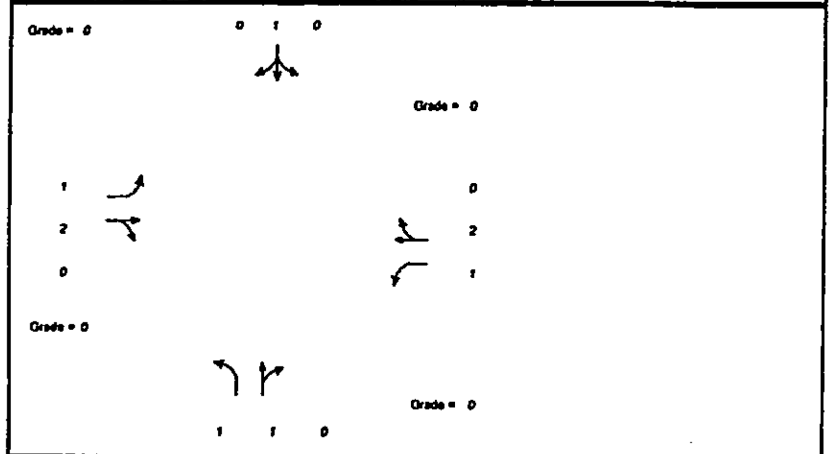
	EB		WB		NB		SB	
Lane group	L	TR	L	TR	L	TR	L	TR
Adj. flow rate	186	467	137	685	120	498	232	673
Lane group cap.	323	1040	412	1004	328	1072	398	1045
v/c ratio	0.58	0.45	0.33	0.68	0.37	0.46	0.58	0.64
Green ratio	0.45	0.30	0.45	0.30	0.45	0.30	0.45	0.30
Unif. delay d1	15.1	22.7	13.7	24.6	14.4	22.8	14.7	24.3
Delay factor k	0.17	0.11	0.11	0.25	0.11	0.11	0.17	0.22
Increm. delay d2	2.6	0.3	0.5	1.9	0.7	0.3	2.2	1.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	17.7	23.0	14.1	26.6	15.1	23.1	16.9	25.7
Lane group LOS	B	C	B	C	B	C	B	C
Apprch. delay	21.5		24.5		21.5		23.4	
Approach LOS	C		C		C		C	
Intersec. delay	22.9		Intersection LOS				C	

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/Launahele St
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	113	453	43	79	677	72	28	10	39	160	13	117
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Arrival type	3	3		3	3		3	3			3	
Ped volume		0			0			0			0	
Bicycle volume		0			0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0			0	
Ped timing		0.0			0.0			3.0			0.0	

	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 27.0	G =	G =	G =	G = 25.0	G =	G =	G =
	Y = 3.0	Y =	Y =	Y =	Y = 3.0	Y =	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 60.0			

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewe Gentry Makai (Year 2010 Total PM Peak) Geiger/Launahele

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR			LTR	
Adj. flow rate	113	496		79	749		28	49			290	
Satflow rate	562	3563		841	3558		1125	1673			1443	
Lost time	2.0	2.0		2.0	2.0		2.0	2.0			2.0	
Green ratio	0.45	0.45		0.45	0.45		0.42	0.42			0.42	
Lane group cap.	253	1603		378	1601		469	697			601	
v/c ratio	0.45	0.31		0.21	0.47		0.06	0.07			0.48	
Flow ratio	0.20	0.14		0.09	0.21		0.02	0.03			0.20	
Crit. lane group	N	N		N	Y		N	N			Y	
Sum flow ratios	0.41											
Lost time/cycle	8.00											
Critical v/c ratio	0.47											

Lane Group Capacity, Control Delay, and LOS Determination

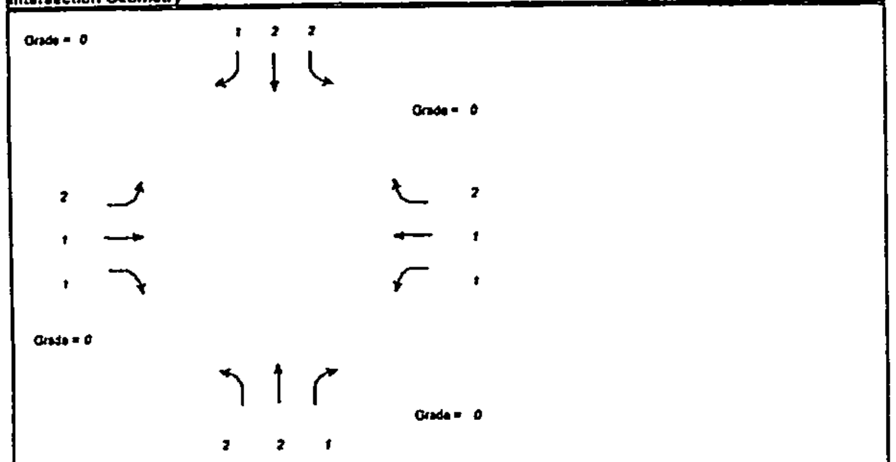
	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR			LTR	
Adj. flow rate	113	496		79	749		28	49			290	
Lane group cap.	253	1603		378	1601		469	697			601	
v/c ratio	0.45	0.31		0.21	0.47		0.06	0.07			0.48	
Green ratio	0.45	0.45		0.45	0.45		0.42	0.42			0.42	
Unif. delay d1	11.4	10.5		10.0	11.5		10.5	10.5			12.8	
Delay factor k	0.11	0.11		0.11	0.11		0.11	0.11			0.11	
Increm. delay d2	1.3	0.1		0.3	0.2		0.1	0.0			0.6	
PF factor	1.000	1.000		1.000	1.000		1.000	1.000			1.000	
Control delay	12.6	10.7		10.3	11.7		10.5	10.6			13.4	
Lane group LOS	B	B		B	B		B	B			B	
Apprch. delay	11.0			11.6			10.5			13.4		
Approach LOS	B			B			B			B		
Intersec. delay	11.5			Intersection LOS						B		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Fort Weaver/Geiger (Iroquois)
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	219	280	153	48	233	194	146	995	65	354	1439	449
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume		0			0			0			0	
Bicycle volume		0						0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing		0.0			0.0			3.0			0.0	

Timing	EB Only	WB Only	03	04	Excl. Left	SB Only	Thru & RT	08
	G = 18.0	G = 18.0	G =	G =	G = 8.0	G = 6.0	G = 30.0	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y = 3.0	Y =

Duration of Analysis (hrs) = 1.00 Cycle Length C = 100.0

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Total PM Peak) Geiger/Ft Weaver

Capacity Analysis

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	219	280	153	48	233	194	146	995	65	354	1439	449
Satflow rate	3502	1900	1615	1805	1900	2842	3502	3610	1615	3502	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.18	0.18	0.26	0.18	0.18	0.40	0.08	0.30	0.48	0.18	0.40	0.62
Lane group cap.	630	342	420	325	342	1137	280	1083	775	630	1444	1001
v/c ratio	0.35	0.82	0.36	0.15	0.68	0.17	0.52	0.92	0.08	0.56	1.00	0.45
Flow ratio	0.06	0.15	0.09	0.03	0.12	0.07	0.04	0.28	0.04	0.10	0.40	0.28
Crit. lane group	N	Y	N	N	Y	N	Y	N	N	N	Y	N
Sum flow ratios	0.71											
Lost time/cycle	16.00											
Critical v/c ratio	0.85											

Lane Group Capacity, Control Delay, and LOS Determination

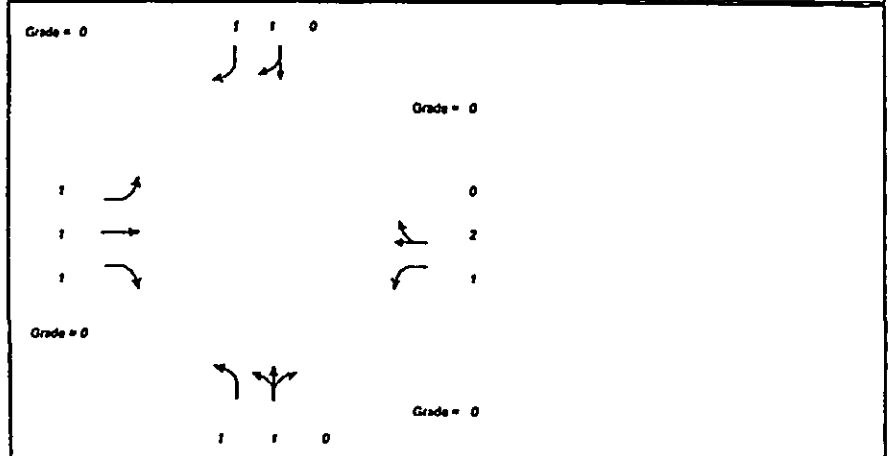
	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	219	280	153	48	233	194	146	995	65	354	1439	449
Lane group cap.	630	342	420	325	342	1137	280	1083	775	630	1444	1001
v/c ratio	0.35	0.82	0.36	0.15	0.68	0.17	0.52	0.92	0.08	0.56	1.00	0.45
Green ratio	0.18	0.18	0.26	0.18	0.18	0.40	0.08	0.30	0.48	0.18	0.40	0.62
Unif. delay d1	35.9	39.4	30.2	34.5	38.3	19.3	44.2	33.8	14.1	37.4	29.9	10.0
Delay factor k	0.11	0.36	0.11	0.11	0.25	0.11	0.13	0.44	0.11	0.13	0.50	0.11
Increm. delay d2	0.3	16.2	0.5	0.2	5.6	0.1	1.8	14.9	0.0	1.2	44.1	0.3
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	36.2	55.7	30.8	34.7	43.9	19.4	45.9	48.7	14.1	38.6	74.1	10.3
Lane group LOS	D	E	C	C	D	B	D	D	B	D	E	B
Apprch. delay	43.3			33.0			46.5			55.7		
Approach LOS	D			C			D			E		
Intersec. delay	49.2			Intersection LOS						D		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Iroquois Pt. Rd./Keaunui Rd
Agency or Co.	PB&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Volume (vph)	147	169	383	0	140	21	211	32	0	14	24	124
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Arrival type	3	3	3	3	3		3	3			3	3
Ped volume	0			0			0			0		
Bicycle volume	0			0								
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0		0	0			0	0
Ped timing	0.0			0.0			3.0			0.0		

	Excl. Left	EB Only	Thru & RT	04	NB Only	SB Only	07	08
Timing	G = 10.0	G = 12.0	G = 12.0	G =	G = 20.0	G = 10.0	G =	G =
	Y = 0.0	Y = 3.0	Y = 3.0	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00					Cycle Length C = 80.0			

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Total PM Peak) Iroquois/Keaunui

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	TR		L	LTR			LT	R
Adj. flow rate	147	169	383	0	161		211	32			38	124
Satflow rate	1805	1900	1615	1805	3539		1805	1900			1866	1615
Lost time	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	2.0
Green ratio	0.28	0.35	0.82	0.13	0.15		0.25	0.25			0.13	0.65
Lane group cap.	496	665	1332	226	531		451	475			233	1050
v/c ratio	0.30	0.25	0.29	0.00	0.30		0.47	0.07			0.16	0.12
Flow ratio	0.08	0.09	0.24	0.00	0.05		0.12	0.02			0.02	0.08
Crit. lane group	Y	N	N	N	Y		Y	N			Y	N
Sum flow ratios	0.26											
Lost time/cycle	16.00											
Critical v/c ratio	0.33											

Lane Group Capacity, Control Delay, and LOS Determination

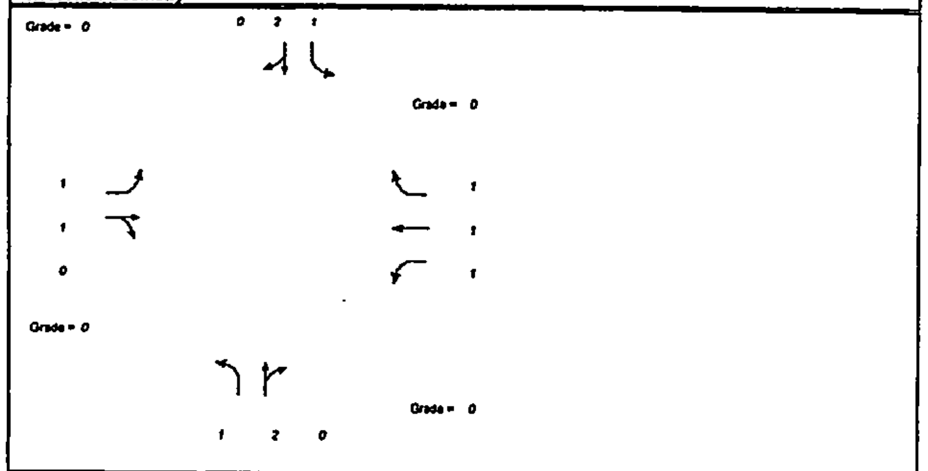
	EB			WB			NB			SB		
Lane group	L	T	R	L	TR		L	LTR			LT	R
Adj. flow rate	147	169	383	0	161		211	32			38	124
Lane group cap.	496	665	1332	226	531		451	475			233	1050
v/c ratio	0.30	0.25	0.29	0.00	0.30		0.47	0.07			0.16	0.12
Green ratio	0.28	0.35	0.82	0.13	0.15		0.25	0.25			0.13	0.65
Unif. delay d1	22.9	18.5	1.6	30.6	30.3		25.5	22.9			31.3	5.3
Delay factor k	0.11	0.11	0.11	0.11	0.11		0.11	0.11			0.11	0.11
Increm. delay d2	0.3	0.2	0.1	0.0	0.3		0.8	0.1			0.3	0.1
PF factor	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	1.000
Control delay	23.2	18.8	1.7	30.6	30.6		26.3	22.9			31.6	5.4
Lane group LOS	C	B	A	C	C		C	C			C	A
Apprch. delay	10.4			30.6			25.8			11.5		
Approach LOS	B			C			C			B		
Intersec. delay	16.1			Intersection LOS						B		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei Pkwy/Keaunui Dr
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	2	2	2	53	1	384	1	255	20	355	302	1
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Ext. eff. green	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Arrival type	3	3		3	3	3	3	3		3	3	
Ped volume		0			0			0			0	
Bicycle volume		0			0			0			0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0	0	0		0	0	
Ped timing		0.0			0.0			3.0			0.0	

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 10.0	G = 15.0	G =	G =	G = 25.0	G = 25.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =
Duration of Analysis (hrs) = 1.00						Cycle Length C = 90.0		

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year2010 Total PM)Kapolei Pkwy/Keaunui Dr

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	TR		L	T	R	L	TR		L	TR	
Adj. flow rate	2	4		59	1	427	1	305		394	337	
Satflow rate	1805	1758		1805	1900	1615	1805	3571		1805	3608	
Lost time	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Green ratio	0.11	0.17		0.11	0.17	0.49	0.28	0.28		0.28	0.28	
Lane group cap.	201	293		201	317	790	501	992		501	1002	
v/c ratio	0.01	0.01		0.29	0.00	0.54	0.00	0.31		0.79	0.34	
Flow ratio	0.00	0.00		0.03	0.00	0.26	0.00	0.09		0.22	0.09	
Crit. lane group	N	N		Y	N	Y	N	N		N	Y	
Sum flow ratios						0.39						
Lost time/cycle						11.00						
Critical v/c ratio						0.44						

Lane Group Capacity, Control Delay, and LOS Determination

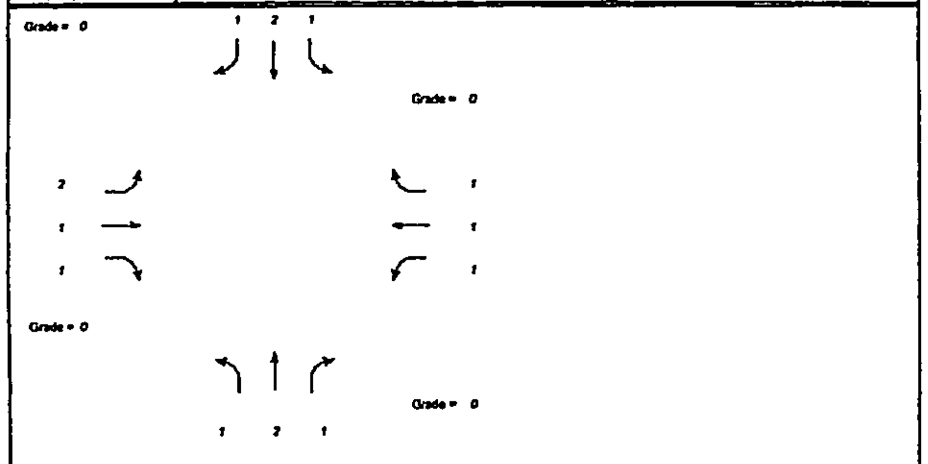
	EB			WB			NB			SB		
Lane group	L	TR		L	T	R	L	TR		L	TR	
Adj. flow rate	2	4		59	1	427	1	305		394	337	
Lane group cap.	201	293		201	317	790	501	992		501	1002	
v/c ratio	0.01	0.01		0.29	0.00	0.54	0.00	0.31		0.79	0.34	
Green ratio	0.11	0.17		0.11	0.17	0.49	0.28	0.28		0.28	0.28	
Unif. delay d1	35.6	31.3		36.8	31.3	16.0	23.5	25.7		30.0	25.9	
Delay factor k	0.11	0.11		0.11	0.11	0.14	0.11	0.11		0.33	0.11	
Increm. delay d2	0.0	0.0		0.8	0.0	0.8	0.0	0.2		8.6	0.2	
PF factor	1.000	1.000		1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Control delay	35.6	31.3		37.6	31.3	16.7	23.5	25.8		38.7	26.1	
Lane group LOS	D	C		D	C	B	C	C		D	C	
Apprch. delay	32.8			19.3			25.8			32.9		
Approach LOS	C			B			C			C		
Intersec. delay	27.1			Intersection LOS						C		

HCS2000™ Version 4.1

INPUT WORKSHEET

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Fort Weaver Rd/Kesunui Rd
Agency or Co.	PBQ&D	Area Type	All other areas
Date Performed	9/19/2002	Jurisdiction	Honolulu
Time Period	PM Peak Hour (2010 Total)	Analysis Year	2002

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	244	184	109	75	87	75	139	887	115	174	1207	259
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type	3	3	3	3	3	3	3	3	3	3	3	3
Ped volume	0			0			0			0		
Bicycle volume	0			0			0			0		
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0	0	0	0	0	0	0
Ped timing	0.0			0.0			3.0			0.0		

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 13.0	G = 16.0	G =	G =	G = 18.0	G = 37.0	G =	G =
	Y = 3.0	Y = 3.0	Y =	Y =	Y = 3.0	Y = 3.0	Y =	Y =

Duration of Analysis (hrs) = 1.00 | Cycle Length C = 100.0

HCS2000™ Version 4.1

CAPACITY AND LOS WORKSHEET

General Information

Project Description Ewa Gentry Makai (Year 2010 Total PM Peak) Ft Weaver/Kesunui

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	244	184	109	75	87	75	139	887	115	174	1207	259
Satflow rate	3502	1900	1615	1805	1900	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.13	0.16	0.38	0.13	0.16	0.38	0.18	0.37	0.54	0.18	0.37	0.54
Lane group cap.	455	304	614	235	304	614	325	1336	872	325	1336	872
v/c ratio	0.54	0.61	0.18	0.32	0.29	0.12	0.43	0.66	0.13	0.54	0.90	0.30
Flow ratio	0.07	0.10	0.07	0.04	0.05	0.05	0.08	0.25	0.07	0.10	0.33	0.16
Crit. lane group	Y	Y	N	N	N	N	N	N	N	Y	Y	N
Sum flow ratios	0.60											
Lost time/cycle	16.00											
Critical v/c ratio	0.71											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	T	R	L	T	R	L	T	R	L	T	R
Adj. flow rate	244	184	109	75	87	75	139	887	115	174	1207	259
Lane group cap.	455	304	614	235	304	614	325	1336	872	325	1336	872
v/c ratio	0.54	0.61	0.18	0.32	0.29	0.12	0.43	0.66	0.13	0.54	0.90	0.30
Green ratio	0.13	0.16	0.38	0.13	0.16	0.38	0.18	0.37	0.54	0.18	0.37	0.54
Unif. delay d1	40.7	39.1	20.6	39.5	37.0	20.2	36.4	26.3	11.4	37.2	29.8	12.6
Delay factor k	0.14	0.19	0.11	0.11	0.11	0.11	0.11	0.24	0.11	0.14	0.42	0.11
Increm. delay d2	1.3	3.5	0.1	0.8	0.5	0.1	0.9	1.3	0.1	1.8	10.1	0.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	41.9	42.5	20.7	40.3	37.5	20.2	37.3	27.6	11.5	39.0	39.9	12.8
Lane group LOS	D	D	C	D	D	C	D	C	B	D	D	B
Apprch. delay	37.8			32.9			27.1			35.5		
Approach LOS	D			C			C			D		
Intersec. delay	33.0			Intersection LOS						C		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei/Ent. A
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour (2010 Total)	Project ID	Ewa Gentry Makai (Year 2010 Total PM Peak)Kapolei Pkwy/Ent A
East/West Street: Entrance A		North/South Street: Kapolei Parkway	
Intersection Orientation: North-South		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	13	587	5	37	699	40
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	15	707	6	44	842	48
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	8	0	22	9	0	29
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	9	0	26	10	0	34
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	LT		R	LT		R
v (vph)	15	44	9		26	10		34
C (m) (vph)	770	896	118		646	103		566
v/c	0.02	0.05	0.08		0.04	0.10		0.06
95% queue length	0.06	0.15	0.25		0.13	0.32		0.19
Control Delay	9.8	9.2	38.0		10.8	43.7		11.8
LOS	A	A	E		B	E		B
Approach Delay	--	--	17.8			19.0		
Approach LOS	--	--	C			C		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Kapolei/Ent. B
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour (2010 Total)	Project ID	Ewa Gentry Makai (Year 2010 Total PM Peak)Kapolei Pkwy/Ent B
East/West Street: Entrance B		North/South Street: Kapolei Parkway	
Intersection Orientation: North-South		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	13	551	45	3	463	10
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	15	663	54	3	557	12
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	50	0	40	9	0	21
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	60	0	48	10	0	25
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	LT		R	LT		R
v (vph)	15	3	60		48	10		25
C (m) (vph)	1013	893	189		644	205		719
v/c	0.01	0.00	0.32		0.07	0.05		0.03
95% queue length	0.05	0.01	1.37		0.24	0.15		0.11
Control Delay	8.6	9.0	32.8		11.0	23.5		10.2
LOS	A	A	D		B	C		B
Approach Delay	--	--	23.2			14.0		
Approach LOS	--	--	C			B		

HCS2000™ Version 4.1

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	C. Maruoka	Intersection	Geiger Rd/ Ent C
Agency/Co.	PBQ&D	Jurisdiction	Honolulu
Date Performed	9/19/2002	Analysis Year	2002
Analysis Time Period	PM Peak Hour (2010 Total)	Project ID	Ewa Gentry Makai (Year 2010 Total PM Peak)Geiger Rd/Ent C
East/West Street: Entrance C		North/South Street: Geiger Road	
Intersection Orientation: East-West		Study Period (hrs): 1.00	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	467	17	340	290	31
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	0	530	19	386	329	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	9	597	186	12	438	8
Peak-Hour Factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Hourly Flow Rate, HFR	10	0	211	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		1			1	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
v (vph)		386	10		211			
C (m) (vph)		1031	159		546			
v/c		0.37	0.06		0.39			
95% queue length		1.79	0.20		1.87			
Control Delay		10.6	29.2		15.7			
LOS		B	D		C			
Approach Delay	--	--	16.3					
Approach LOS	--	--	C					

HCS2000™ Version 4.1

Appendix D

Trip Generation of Background Ewa by Gentry Traffic Volumes

Table D

Background Generated Volumes

Parcel	Land Use	ITE Code	Intensity	Unit	AM Peak Hour Trips		PM Peak Hour Trips	
					Enter	*Exit*	*Enter*	*Exit*
14	Multi Family	220	222	Units	18	94	87	43
17	Single Family	210	420	Units	74	223	229	129
19	Single Family	210	280	Units	50	149	153	86
20	Single Family	210	215	Units	17	91	84	41
21	Multi Family	220	322	Units	57	171	176	99
4A	Commercial Retail	820	20	Acres	114	73	360	389
Totals					**330**	**801**	**1089**	**787**

APPENDIX K

ACOUSTIC STUDY FOR THE EWA BY GENTRY - MAKAI DEVELOPMENT

EWA, OAHU

Prepared for:

ENVIRONMENTAL COMMUNICATIONS, INC.

Prepared by:

Y. EBISU & ASSOCIATES
1126 12th Avenue, Room 305
Honolulu, Hawaii 96816

NOVEMBER 2001

Table OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF TABLES

LIST OF TABLES (CONTINUED)

CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Ewa By Gentry - Makai Development Project on the island of Oahu were evaluated for their potential impact on present and future noise sensitive areas. The future traffic noise levels along the primary access roadways to the project were calculated for the Year 2010.

Along the existing roadways which are expected to service the project traffic, noise levels are expected to increase by 0.8 to 1.6 DNL (or Ldn) between CY 1998 and CY 2010 as a result of project traffic. These increases in traffic noise levels associated with project traffic are not considered to be significant, and should not be discernible during the 12 year forecast interval.

By CY 2010, the dominant traffic noise sources in the project area will continue to be traffic noise from Fort Weaver Road. Traffic noise along the new sections of Kapolei Parkway south of Geiger Road and the new Street A will also be dominant noise sources within the project boundaries, particularly at those receptor locations which are removed from Ft. Weaver Road. Essentially all locations which front Ft. Weaver Road, Geiger Road, Kapolei Parkway, Iroquois Road, and Street A will experience relatively high noise levels above 65 DNL, and will require traffic noise mitigation measures. Those receptor locations which are removed from the major roadways as well as shielded by existing and new buildings should experience traffic noise levels less than 65 DNL.

Based on Year 2000/2001 and 2020 aircraft noise contours developed over the project site, only the commercial and industrial portions of the project site are located inside the 60 DNL noise contour. The aircraft noise contours indicate that planned residential or other noise sensitive uses within the petition area are located outside the airport's existing and forecasted 60 DNL contours, and are in conformance with local planning guidelines for the siting of noise sensitive land uses in the vicinity of airports. Special aircraft noise attenuation measures should not be required for this project. The implementation of the airport noise disclosure provisions of Chapter 508D, Hawaii Revised Statutes, 1996 will be necessary over the project areas which are contained within the FAR Part 150 noise contours, which were originally developed in 1987 for forecasted CY 1992 operations.

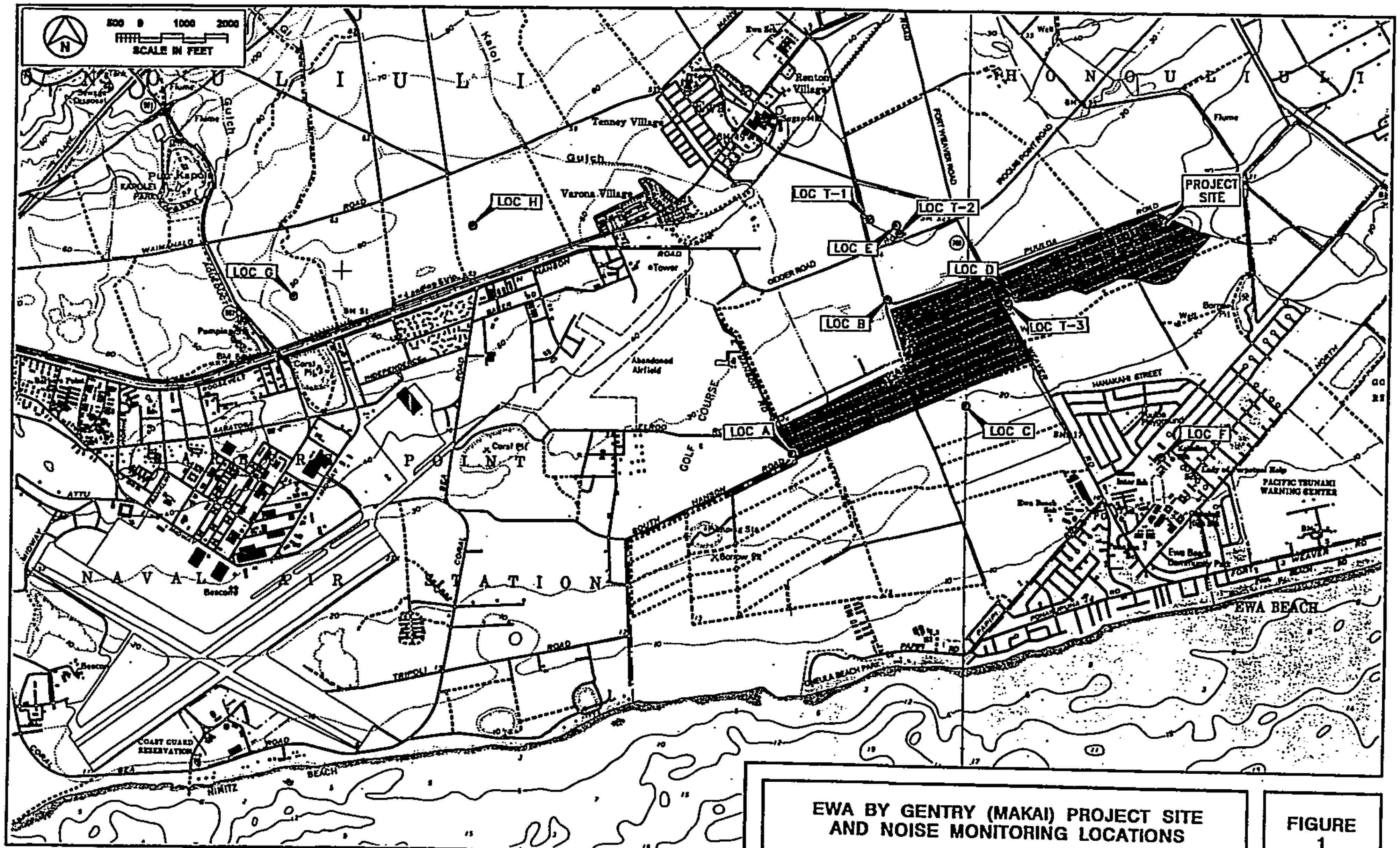
Unavoidable, but temporary, noise impacts may occur during the construction of the proposed project. Because construction activities are predicted to be audible at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. For this reason, the use of quiet equipment and construction curfew periods as required under the State Department of Health noise regulations are recommended to minimize construction noise impacts.

CHAPTER II. PURPOSE

The primary objective of this study was to describe the existing and future noise environment in the environs of the proposed Ewa By Gentry - Makai Development Project on the island of Oahu. The project site is located near the Hawaii Prince Golf Course and on both (east and west) sides of Fort Weaver Road where shown in Figure 1. It is directly under the straight-in approach flight track used by aircraft landing at Honolulu International Airport.

Roadway traffic noise level increases and impacts associated with the proposed development were to be determined within the project site as well as along the public roadways which are expected to service the project traffic. Traffic forecasts for 2010 were used. A specific objective was to determine future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases. Recommendations for minimizing traffic noise impacts were to be provided as required.

Assessments of possible noise impacts from aircraft landing at Honolulu International Airport, and from short term construction noise at the project site were also included in the noise study objectives. Recommendations for minimizing these noise impacts were also to be provided as required.



EWA BY GENTRY (MAKAI) PROJECT SITE AND NOISE MONITORING LOCATIONS

FIGURE 1

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (DNL or Ldn). This descriptor incorporates a 24-hour average of instantaneous A-Weighted sound levels as read on a standard Sound Level Meter. The maximum A-Weighted sound level occurring while a noise source such as a heavy truck or aircraft is moving past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value". The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level", or Lse, which is analogous to the energy of the time-varying sound levels associated with a single event.

The DNL values represent the average noise during a typical day of the year. DNL exposure levels of 55 or less are typical of quiet rural or suburban areas. DNL exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. DNL exposure levels above 65 are representative of densely developed urban areas and areas fronting high volume roadways.

By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. Because of the averaging used, DNL values in urbanized areas typically range between 50 and 75 DNL. In comparison, the typical range of intermittent noise events may have maximum Sound Level Meter readings between 75 and 105 dBA. A more complete list of noise descriptors is provided in Appendix B to this report. In Appendix B, the Ldn descriptor symbol is used in place of the DNL descriptor symbol.

Table 1, extracted from Reference 1, categorizes the various DNL levels of outdoor noise exposure with severity classifications. Table 2, also extracted from Reference 1, presents the general effects of noise on people in residential use situations. Figure 2, extracted from Reference 2, presents suggested land use compatibility guidelines for residential and nonresidential land uses. A general consensus among federal agencies has developed whereby residential housing development is considered acceptable in areas where exterior noise does not exceed 65 DNL. This value of 65 DNL is used as a federal regulatory threshold for determining the necessity for special noise abatement measures when applications for federal funding assistance are made.

As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.

TABLE 2

EFFECTS OF NOISE ON PEOPLE
(Residential Land Uses Only)

EFFECTS[1] / DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS	Hearing Loss: Qualitative Description	Speech Interference, Indoor: %Sentence Intelligibility	Speech Interference, Outdoor: Distance in Meters for 95% Sentence Intelligibility	Annoyance[2]: % of Population Highly Annoyed[3]	Average Community Reaction[4]	General Community Attitude Towards Area
75 and above	May Begin to Occur	98%	0.5	37%	Very Severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will Not Likely Occur	99%	0.9	25%	Severe	Noise is one of the most important adverse aspects of the community environment.
65	Will Not Occur	100%	1.5	15%	Significant	Noise is one of the important adverse aspects of the community environment.
60	Will Not Occur	100%	2.0	9%	Moderate to Slight	Noise may be considered an adverse aspect of the community environment.
55 and below	Will Not Occur	100%	3.5	4%		Noise considered no more important than various other environmental factors.

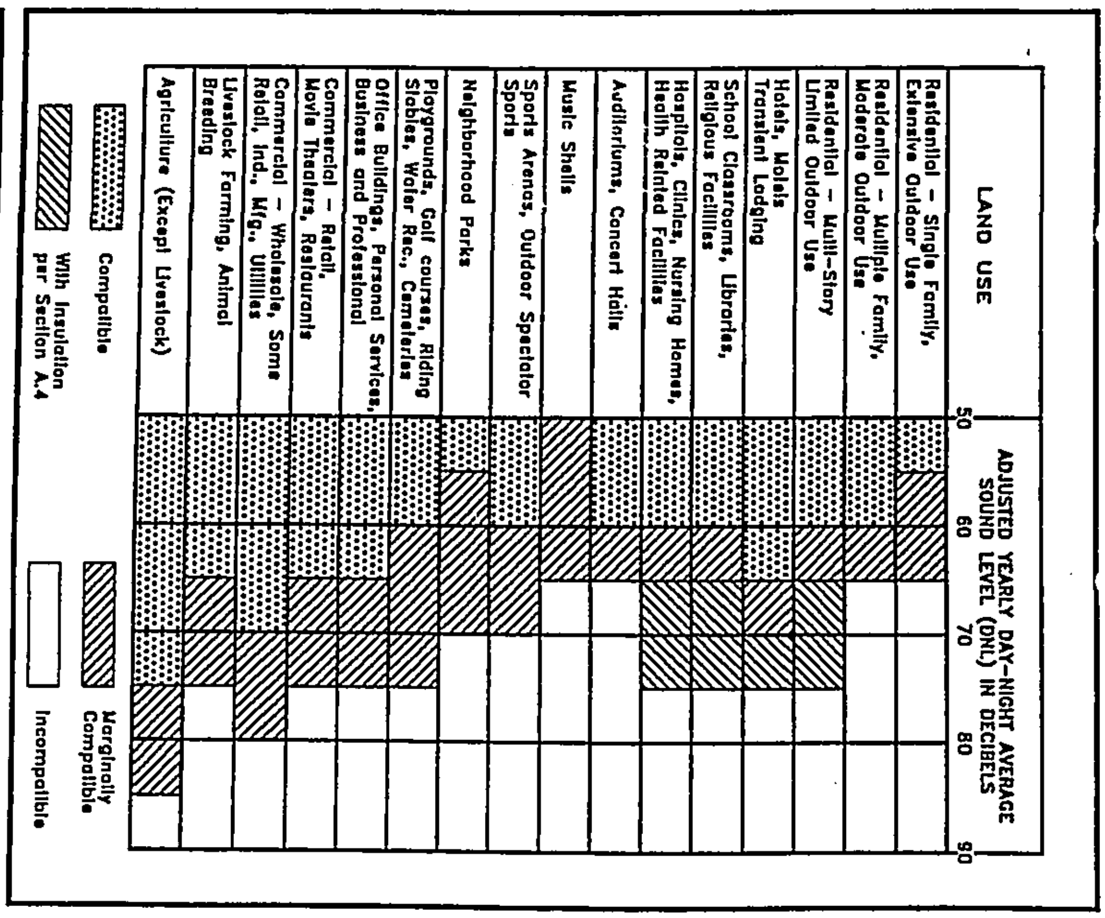
1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document": Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group 69 on Evaluation of Environmental Impact of Noise."

2. Depends on attitudes and other factors.

3. The percentages of people reporting annoyance to lesser extents are higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time.

4. Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important problem, particularly when it intrudes into a quiet environment.

NOTE: Research implicates noise as a factor producing stress-related health effects such as heart disease, high-blood pressure and stroke, ulcers and other digestive disorders. The relationships between noise and these effects, however, have not as yet been quantified.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY-NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9-1998/Part 5)

FIGURE 2

roadway is a high speed freeway. Due to noise shielding effects from intervening structures, interior lots are usually exposed to 3 to 10 DNL lower noise levels than the front lots which are not shielded from the traffic noise.

For the purposes of determining noise acceptability for funding assistance from federal agencies, an exterior noise level of 65 DNL or lower is considered acceptable. These federal agencies include the Federal Aviation Administration (FAA), Department of Defense (DOD); Federal Housing Administration, Housing and Urban Development (FHA/HUD), and Veterans Administration (VA). This standard is applied nationally (see Reference 3), including Hawaii.

Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise (see Reference 4). For typical, naturally ventilated structures in Hawaii, an exterior noise level of 55 DNL results in an interior level of approximately 45 DNL, which is considered to be the "Unconditionally Acceptable" (or "Near-Zero Risk") level of interior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For aircraft noise, the Hawaii State Department of Transportation, Airports Division (HDOTA), has recommended that 60 DNL be used as the common level for determining land use compatibility in respect to noise sensitive uses near its airports. Table 3 summarizes the recommendations for compatible land uses at various levels of aircraft noise. For those noise sensitive land uses which are exposed to aircraft noise greater than 55 DNL, the division recommends that disclosure of the aircraft noise levels be provided prior to any real property transactions. Reference 5 requires that such disclosure be provided prior to real property transactions concerning properties located within Air Installation Compatibility Use Zones (AICUZ) or located within airport noise maps developed under Federal Aviation Regulation (FAR) Part 150 - Airport Noise Compatibility Planning (14 CFR Part 150). The most recent FAR Part 150 noise contours for Honolulu International Airport were completed in 1987 and reflect conditions through 1992. Additional airport noise contours for 2007 were developed by the HDOTA for information purposes only during the 1987 to 1989 time frame.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

In the State of Hawaii, the State Department of Health (DOH) regulates noise from on-site activities. State DOH noise regulations are expressed in maximum

TABLE 3

HAWAII STATE DEPARTMENT OF TRANSPORTATION RECOMMENDATIONS FOR LOCAL LAND USE COMPATIBILITY WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVELS (DNL)

TYPE OF LAND USE	**** Yearly Day-Night Average Sound Level **** < 60	60-65	65-70	70-75	75-80	80-85
RESIDENTIAL						
Low density residential, resorts, and hotels (outdoor facil.)	Y(a)	N(b)	N	N	N	N
Low density apartment with moderate outdoor use	Y	N(b)	N	N	N	N
High density apartment with limited outdoor use	Y	N(b)	N(b)	N	N	N
Transient lodgings with limited outdoor use	Y	N(b)	N(b)	N	N	N
PUBLIC USE						
Schools, day-care centers, libraries, and churches	Y	N(c)	N(c)	N(c)	N	N
Hospitals, nursing homes, clinics, and health facilities	Y	Y(d)	Y(d)	Y(d)	N	N
Indoor auditorium and concert halls	Y(c)	Y(c)	N	N	N	N
Government services and office buildings serving the general public	Y	Y	Y(d)	Y(d)	N	N
Transportation and Parking	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
COMMERCIAL AND GOVERNMENT USE						
Offices - government, business, and professional	Y	Y	Y(d)	Y(d)	N	N
Wholesale and retail - building materials, hardware and heavy equipment	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
Airport businesses - car rental, tours, lei stands, ticket offices, etc.	Y	Y	Y(d)	Y(d)	N	N
Retail, restaurants, shopping centers, financial institutions, etc.	Y	Y	Y(d)	Y(d)	N	N
Power plants, sewage treatment plants, and base yards	Y	Y	Y(d)	Y(d)	Y(d)	N
Studios without outdoor sets, broadcasting, production facilities, etc.	Y(c)	Y(c)	N	N	N	N
MANUFACTURING, PRODUCTION, AND STORAGE						
Manufacturing, general	Y	Y	Y(d)	Y(d)	Y(d)	N
Photographic and optical	Y	Y	Y(d)	Y(d)	N	N
Agriculture (except livestock) and forestry	Y	Y(e)	Y(e)	Y(e)	Y(e)	Y(e)
Livestock farming and breeding	Y	Y(e)	Y(e)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y(f)	Y(f)	N	N	N
Outdoor music shells, amphitheaters	Y(f)	N	N	N	N	N
Nature exhibits and zoos, neighborhood parks	Y	Y	Y	N	N	N
Amusements, beach parks, active playgrounds, etc.	Y	Y	Y	Y	N	N
Public golf courses, riding stables, cemeteries, gardens, etc.	Y	Y	N	N	N	N
Professional/resort sport facilities, locations of media events, etc.	Y(f)	N	N	N	N	N
Extensive natural wildlife and recreation areas	Y(f)	N	N	N	N	N

Numbers in parentheses refer to notes.

KEY TO TABLE 3:

Y(Yes) = Land Use and related structures compatible without restrictions.
N(No) = Land Use and related structures are not compatible and should be prohibited.

TABLE 3 (CONTINUED)

HAWAII STATE DEPARTMENT OF TRANSPORTATION RECOMMENDATIONS FOR LOCAL LAND USE COMPATIBILITY WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVELS (DNL)

NOTES FOR TABLE 3:

(a) A noise level of 60 DNL does not eliminate all risks of adverse noise impacts from aircraft noise. However, the 60 DNL planning level has been selected by the State Airports Division as an appropriate compromise between the minimal risk level of 55 DNL and the significant risk level of 65 DNL.

(b) Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 DNL or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure plus air conditioning may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems.

(c) Because the DNL noise descriptor system represents a 24-hour average of individual aircraft noise events, each of which can be unique in respect to amplitude, duration, and tonal content, the NLR requirements should be evaluated for the specific land use, interior acoustical requirements, and properties of the aircraft noise events. NLR requirements should not be based solely upon the exterior DNL exposure level.

(d) Measures to achieve required NLR must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(e) Residential buildings require NLR. Residential buildings should not be located where noise is greater than 65 DNL.

(f) Impact of amplitude, duration, frequency, and tonal content of aircraft noise events should be evaluated.

allowable property line noise limits rather than DNL (see Reference 6). The noise limits apply on all islands of the State, including Oahu. Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for preservation/residential, apartment/commercial, and agricultural/industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

Because the proposed project site is located on lands designated for single family and multifamily residential, and commercial/industrial uses, various DOH noise limits would be applicable along the lot boundary lines or receptor locations for any stationary machinery, or equipment related to commercial/industrial or construction activities. These property line limits are 70 dBA during both the daytime and nighttime periods for industrial lots or receptors. For multifamily or apartment use, the State DOH limits are 60 dBA and 50 dBA during the daytime and nighttime periods, respectively. For single family residential and public facility uses, the State DOH limits are 55 dBA and 45 dBA during the daytime and nighttime periods, respectively. These noise limits cannot be exceeded for more than 2 minutes in any 20-minute time period under the State DOH noise regulations. The State DOH noise regulations do not apply to aircraft or motor vehicles.

CHAPTER IV. GENERAL STUDY METHODOLOGY

General. Noise measurements and modeling were used to describe existing and future noise levels in the project environs. Traffic and aircraft noise were evaluated, since they were and are expected to continue to be the dominant noise sources in the area. Risks of adverse noise impacts from traffic, aircraft, and construction activities were determined, and possible noise mitigation measures were provided.

Traffic Noise. Existing traffic noise levels were measured at four locations (T-1, T-2, T-3, and T-4) in the project environs to provide a basis for developing the project's traffic noise contributions along the roadways which will service the proposed development. The locations of the measurement sites are shown in Figure 1. Location T-4 was adjacent to and approximately 100 feet east of Location T-3. Traffic noise measurements were performed during October 2001. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in Table 4.

Traffic noise calculations for the existing conditions (1998 or Base Year) as well as noise predictions for 2010 were performed using the Federal Highway Administration (FHWA) Traffic Noise Model (Reference 7). Traffic data entered into the noise prediction model were: roadway and receiver locations; hourly traffic volumes, average vehicle speeds; estimates of traffic mix; and "Pavement", "Hard Soil," and "Loose Soil" propagation loss factors. The traffic data and forecasts for the project (Reference 8), plus the spot traffic counts obtained during the noise measurement periods were the primary sources of data inputs to the model. Appendix C summarizes the AM and PM peak hour traffic volumes for CY 1998 and 2010 which were used to model existing and future traffic noise along the streets surrounding the project site. For existing and future traffic along the streets surrounding the project site, it was assumed that the average noise levels, or Leq(h), during the PM peak traffic hour were approximately 1.4 to 2.0 dB less than the 24-hour DNL along those roadways.

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors without the benefit of shielding from natural or man made obstructions. Traffic noise levels were also calculated for future conditions with and without the proposed project. The forecasted changes in traffic noise levels over existing levels were calculated with and without the project, and noise impact risks evaluated. The relative contributions of non-project and project traffic to the total noise levels were also calculated, and an evaluation of possible traffic noise impacts was made.

Aircraft Noise. In addition to the traffic noise measurements, aircraft noise measurements were obtained at Locations A through H where shown in Figure 1. The

TABLE 4
TRAFFIC NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
T-1 87 FT from centerline of Kapolei Parkway (10/18/01)	1600 TO 1645	37	415	3	0	61.2	60.7
T-1 87 FT from centerline of Kapolei Parkway (10/22/01)	0630 TO 0730	37	437	9	0	60.6	61.4
T-2 57 FT from centerline of Geiger Road (10/22/01)	1600 TO 1700	37	972	14	1	67.1	67.8
T-2 57 FT from centerline of Geiger Road (10/23/01)	0630 TO 0730	37	994	34	4	68.7	68.0
T-4 200 FT from centerline of Ft. Weaver Road (10/24/01)	1507 TO 1607	38	2,256	22	22	58.6	59.1
T-3 100 FT from centerline of Ft. Weaver Road (10/24/01)	1615 TO 1715	38	2,117	29	7	66.7	68.0

TABLE 4 (CONTINUED)
TRAFFIC NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	Hourly Traffic Volume M.TRUCK	Hourly Traffic Volume H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
T-4 200 FT from centerline of Ft. Weaver Road (10/25/01)	0618 TO 0718	38	1,980	33	34	59.9	59.4
T-3 100 FT from centerline of Ft. Weaver Road (10/25/01)	0618 TO 0718	38	1,980	33	34	69.4	68.7
T-4 200 FT from centerline of Ft. Weaver Road (10/25/01)	0723 TO 0823	38	2,363	51	45	61.0	60.5
T-3 100 FT from centerline of Ft. Weaver Road (10/25/01)	0723 TO 0823	38	2,363	51	45	69.4	69.7

results of these measurements are shown in Tables 5A through 5H. These aircraft noise measurements as well as aircraft noise modeling were used to determine if the proposed housing units are in the acceptable noise zone of 60 DNL or less.

Aircraft noise contours for Honolulu International Airport (HIA) developed during the last FAR (Federal Aviation Regulations) Part 150 Noise Compatibility Program (see Reference 9) are shown in Figure 3 over the Ewa Beach and Kapolei areas. The noise contours were the result of forecasts and airport noise modeling for 1992 using an older version of the FAA INM (Federal Aviation Administration Integrated Noise Model). Figure 4 depicts the same 1992 FAR Part 150 noise contours over the project site. Using the current version (FAA INM Version 6.0) of the noise model, a rerun of the 1992 airport operational forecasts was performed during this current study to reconstruct the 1992 contours using the INM Version 6.0. These 1992 contours generated from INM Version 6.0 are shown in Figure 5. The contours shown in Figure 3 are slightly larger (or noisier) than those shown in Figure 5 due to user specified approach profiles employed in the original INM model run vs. the standard 3 degree approach profile which was employed in INM Version 6.0 model run.

Figures 3 and 4, which depict the official FAR Part 150 noise contours over the project site, are the applicable airport noise contours for disclosure purposes under Reference 5. Figure 5 was developed using the FAA INM Version 6.0 in order to determine that reasonably accurate and consistent noise contours for years beyond 1992 could be developed using the FAA INM Version 6.0.

Figure 6 depicts the 2007 noise contours which were also developed as the 20 year forecast noise contours for HIA during the last FAR Part 150 study (see Reference 9). Figure 6 was also developed using the older version of the FAA INM. Because the sizes of the noise contours in Figures 6 and 3 are similar, it could be concluded that major increases in the aircraft noise contours over the project site had not been forecast to occur between 1992 and 2007 when the last FAR Part 150 study for HIA was performed.

In order to update the published and unpublished noise contours shown in Figures 3, 5, and 6, additional airport noise contours for the 2000/2001 period and for 2020 were developed during this study using the FAA INM Version 6.0. The 2000 through 2001 period was used to model aircraft noise instead of the 12 month period ending December 2001 because of the large reductions in aircraft operations after September 11, 2001. The 2000/2001 and 2020 noise contours were used to describe existing aircraft noise levels for the 12 month period just prior to September 11, as well as predicted noise levels in the distant future. In addition, the aircraft noise contours were used to determine if sound attenuation treatment should be required at the residences within the project site, and to determine if the airport noise disclosure area would increase beyond those shown in Figures 3 and 4.

TABLE 5A

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "A"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	68.2; 71.2; 67.3; 73.9; 73.1; 67.8; 66.2 (AVE. = 69.7)	77.5; 77.5; 75.1; 78.2; 77.5; 75.8; 73.1 (AVE. = 76.7)
B-717(200) (RWY 8L LAND.)	73.7; 71.6; 64.9; 71.2; 60.9; 71.8 (AVE. = 69.0)	79.6; 76.3; 73.2; 79.5; 68.1; 79.1 (AVE. = 77.4)
2 EACH, F-15 (RWY 8L LAND.)	78.0; 81.4 (AVE. = 79.7)	85.9; 87.1 (AVE. = 83.5)
B-747 (RWY 8L LAND.)	66.6; 75.3; 72.0 (AVE. = 71.3)	75.1; 85.4; 80.1 (AVE. = 81.9)
DC-10/L-1011 (RWY 8L LAND.)	75.0; 69.6; 77.4; 72.6; 77.6; 76.8; 75.5 (AVE. = 74.9)	84.2; 79.1; 85.8; 81.6; 81.8; 83.7; 82.7 (AVE. = 83.1)
B-757/B-767 (RWY 8L LAND.)	72.3; 74.3; 74.9; 72.3; 73.2; 78.0; 68.4; 78.8; 81.8; 75.2 (AVE. = 74.9)	82.0; 83.0; 82.5; 78.4; 82.7; 80.3; 76.7; 80.4; 84.7; 82.8 (AVE. = 81.9)
C-130 (RWY 8L LAND.)	71.5; 72.8; 74.1 (AVE. = 72.8)	78.0; 81.4; 82.5 (AVE. = 81.0)
C-141 (RWY 8L LAND.)	80.1 (AVE. = 80.1)	86.1 (AVE. = 86.1)
DC-9 (50) (RWY 8L LAND.)	70.9 (AVE. = 70.9)	75.5 (AVE. = 75.5)
GA-1 (RWY 8L LAND.)	65.6 (AVE. = 65.6)	63.2 (AVE. = 63.2)

TABLE 5B

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "B"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	74.1; 74.6; 71.8; 70.6; 71.7; 74.6; 70.9; 76.1; 76.0; 67.8; 74.0; 69.4; 73.0 (AVE. = 72.7)	78.6; 80.6; 78.9; 79.1; 78.5; 82.9; 78.2; 83.0; 82.4; 77.8; 80.5; 76.2; 81.5 (AVE. = 80.3)
B-717(200) (RWY 8L LAND.)	69.9; 74.8; 73.4; 71.2; 67.7; 71.8; 73.5; 74.2; 75.9; 73.2 (AVE. = 72.5)	78.0; 82.6; 80.8; 79.3; 76.1; 79.5; 81.0; 80.7; 83.3; 80.4 (AVE. = 80.6)
B-747 (RWY 8L LAND.)	78.0; 88.6 (AVE. = 83.3)	87.4; 93.9 (AVE. = 91.8)
DC-10/L-1011 (RWY 8L LAND.)	77.5; 79.8; 78.2; 78.2 74.7; 81.5; 77.0; 71.9 77.0; 78.5 (AVE. = 77.4)	88.8; 86.5; 85.8; 86.7 82.8; 87.7; 84.3; 79.6 85.2; 86.5 (AVE. = 85.7)
B-757/B-767 (RWY 8L LAND.)	75.4; 75.3; 76.9; 75.7; 67.0; 73.6 78.6; 76.4; 73.4; 77.4; 74.0; 76.3; 72.9; 71.4 (AVE. = 74.6)	85.7; 84.9; 86.3; 81.7; 77.4; 82.7 88.4; 83.6; 80.9; 85.7; 83.4; 85.1; 82.4; 79.7 (AVE. = 83.9)
2 EACH, F-15 (RWY 8L LAND.)	80.0; 96.1; 73.8 (AVE. = 83.3)	86.3; 94.9; 82.2 (AVE. = 89.6)
C-130 (RWY 8L LAND.)	78.5; 76.4; 75.3; 75.2 (AVE. = 76.4)	85.7; 85.2; 83.0; 84.2 (AVE. = 84.6)
C-17 (RWY 8L LAND.)	78.0	84.9
GA-2 (RWY 8L LAND.)	64.8	73.1
KC-135R (RWY 8L LAND.)	77.0; 80.7; 75.5 (AVE. = 77.7)	85.7; 87.4; 83.6 (AVE. = 85.6)

TABLE 5C

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS LOCATION "C"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	72.7; 70.6; 74.5; 70.1; 73.9 (AVE. =72.4)	79.6; 79.9; 82.1; 77.8; 80.9 (AVE. = 80.3)
B-717(200) (RWY 8L LAND.)	73.7; 67.5; 70.5; 72.9; 70.6; 72.0 (AVE. = 71.2)	81.1; 77.1; 77.5; 80.7; 79.6; 79.9 (AVE. = 79.6)
2 EACH, F-15 (RWY 8L LAND.)	68.2; 77.8; 82.5; 99.2 (AVE. = 81.9)	77.0; 85.5; 87.7; 107.9 (AVE. = 98.9)
B-747 (RWY 8L LAND.)	79.3; 76.3; 77.4 (AVE. = 77.7)	88.2; 85.1; 86.4 (AVE. = 86.6)
DC-10/L-1011 (RWY 8L LAND.)	76.1; 78.2; 75.3; 76.5 (AVE. = 76.5)	85.2; 86.7; 83.7; 85.2 (AVE. = 85.3)
B-757/B-767 (RWY 8L LAND.)	76.3; 79.6; 77.0; 74.4; 79.1; 78.8 (AVE. = 77.6)	84.9; 86.2; 84.7; 83.5; 85.4; 84.8 (AVE. = 85.0)
C-130 (RWY 8L LAND.)	74.6 (AVE. = 74.6)	82.4 (AVE. = 82.4)
GA-2 (RWY 8L LAND.)	72.3; 68.0 (AVE. = 70.2)	80.2; 77.4 (AVE. = 79.0)
C-141 (RWY 8L LAND.)	78.1; 80.0; 79.0 (AVE. = 79.0)	85.6; 87.2; 85.2 (AVE. = 86.1)

TABLE 5D

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS LOCATION "D"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	73.6; 68.8; 70.0; 70.9; 68.6; 76.0; 74.7; 71.0; 72.4; 71.9; 69.8; 70.0; 72.2; 74.5; 77.6 (AVE.= 72.3)	80.5; 76.4; 76.4; 79.6; 77.2; 78.2; 81.6; 78.5; 79.0; 80.3; 77.5; 78.5 80.3; 80.9; 84.7 (AVE.= 80.0)
B-717(200) (RWY 8L LAND.)	74.2; 80.6; 69.7; 73.2; 69.5; 75.9 68.0; 69.7; 75.1; 73.7; 69.8; 73.1 (AVE.= 72.7)	80.4; 81.8; 78.1; 77.9; 78.5; 83.5 75.7; 74.8; 82.0; 80.1; 77.8; 80.5 (AVE.= 79.8)
B-747 (RWY 8L LAND.)	81.1	88.4
DC-10/L-1011 (RWY 8L LAND.)	75.5; 77.5; 78.8; 75.8; 72.4; 75.3; 77.7; 78.8; 76.1; 77.2; 75.8; 78.6 77.2; 72.5 (AVE.= 76.2)	85.1; 84.3; 85.1; 84.9; 80.3; 84.4; 84.1; 84.5; 85.2; 85.9; 84.2; 85.8 85.2; 81.4 (AVE.= 84.5)
B-757/B-767 (RWY 8L LAND.)	77.1; 76.0; 70.1; 78.0; 78.8; 76.1; 76.1; 69.1; 74.4; 71.6; 74.5; 70.0; 75.0; 71.8; 71.8 (AVE.= 74.0)	84.1; 83.4; 79.6; 85.6; 82.7; 83.4; 85.1; 80.5; 82.0; 80.4; 83.5; 79.2; 84.7; 80.4; 80.6 (AVE.= 82.8)
2 EACH, F-15 (RWY 8L LAND.)	83.8	92.1 (AVE.= 89.1)
C-130 (RWY 8L LAND.)	75.0	82.2
C-141 (RWY 8L LAND.)	84.2; 81.6 (AVE.= 82.9)	91.5; 89.2 (AVE.= 90.4)

TABLE 5E

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS LOCATION "E"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	63.7; 71.9; 65.2 (AVE. = 66.9)	70.7; 80.3; 72.2 (AVE. = 76.5)
B-747 (RWY 8L LAND.)	75.2; 72.8; 73.9; 70.5; 71.4 (AVE. = 72.8)	79.3; 82.6; 81.7; 79.8; 80.4 (AVE. = 81.0)
DC-10/L-1011 (RWY 8L LAND.)	71.2; 72.6; 70.3 (AVE. = 71.4)	81.1; 81.3; 77.8 (AVE. = 80.3)
DC-9(50) (RWY 8L LAND.)	70.4; 75.8 (AVE. = 73.1)	77.1; 83.3 (AVE. = 81.2)

TABLE 5F

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS LOCATION "F"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	72.0; 70.9; 70.2; 70.2 (AVE. = 70.8)	80.2; 78.3; 77.3; 77.2 (AVE. = 78.4)
B-747 (RWY 8L LAND.)	78.5; 77.6; 79.4; 77.3 (AVE. = 78.2)	87.4; 85.5; 86.8; 86.0 (AVE. = 86.5)
DC-10/L-1011 (RWY 8L LAND.)	76.5; 76.5; 78.5; 73.0; 76.3; 74.5; 73.7; 75.8; 74.6; 73.6; 72.4 (AVE. = 75.0)	84.4; 84.7; 84.7; 80.4; 83.0; 82.3; 82.3; 83.2; 83.3; 82.1; 81.4 (AVE. = 83.1)
DC-9(50) (RWY 8L LAND.)	71.3; 73.0; 76.9 (AVE. = 73.7)	81.6; 79.2; 81.4 (AVE. = 80.9)
2 EACH, F-15 (RWY 8L LAND.)	77.6; 81.9 (AVE. = 79.8)	84.4; 87.0 (AVE. = 85.9)

TABLE 5G

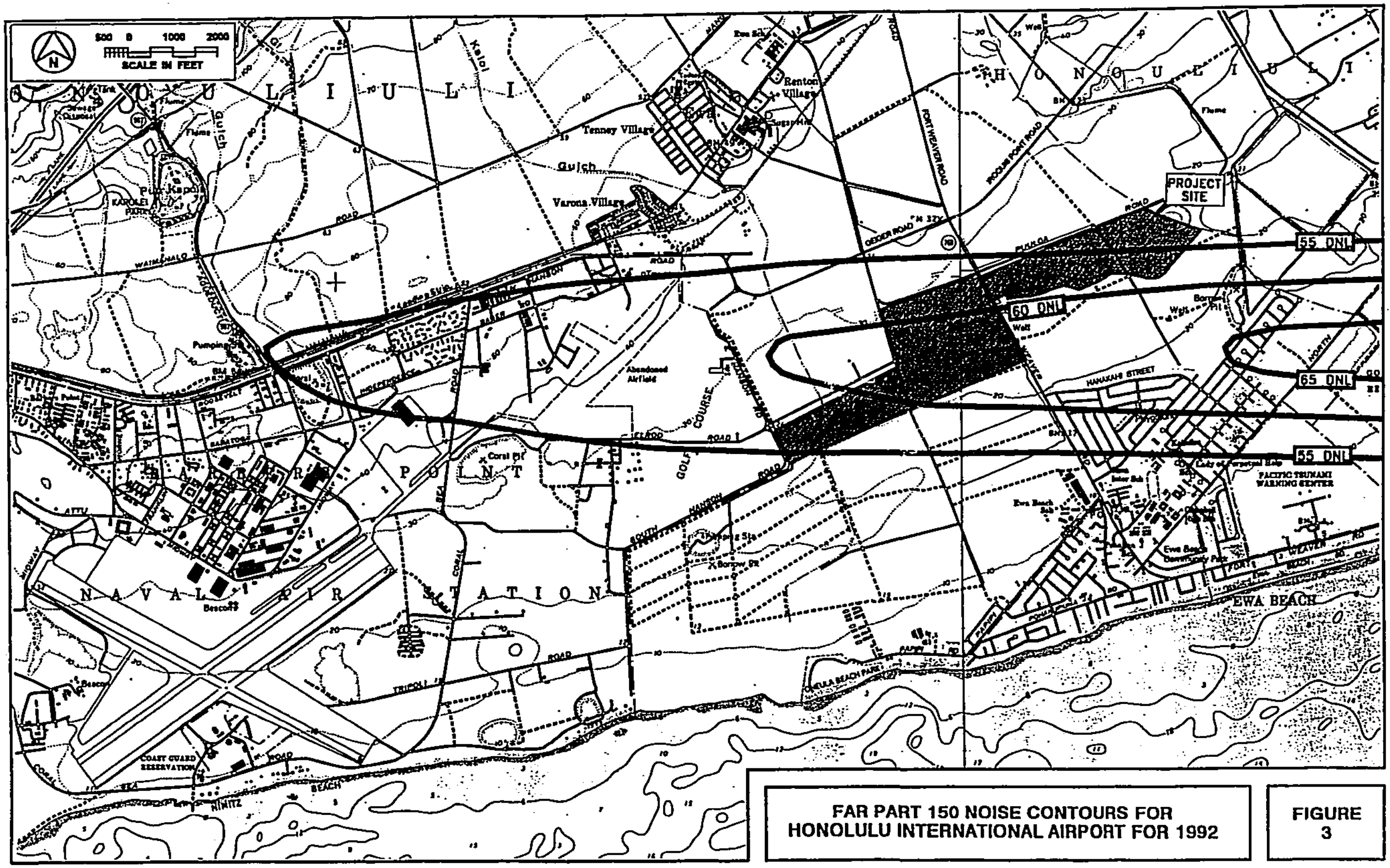
SUMMARY OF AIRCRAFT NOISE MEASUREMENTS LOCATION "G"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	66.7; 69.1; 70.5; 67.8 (AVE. = 68.5)	74.6; 76.7; 79.2; 74.4 (AVE. = 76.7)
B-747 (RWY 8L LAND.)	76.8; 74.8; 75.2 (AVE. = 75.6)	85.5; 84.1; 83.0 (AVE. = 84.3)
DC-10/L-1011 (RWY 8L LAND.)	65.0; 74.9; 75.6; 72.5; 60.2; 72.2; 66.7; 69.8; 69.6 (AVE. = 69.6)	71.6; 83.6; 82.4; 80.5; 68.1; 80.3; 75.1; 77.6; 79.2 (AVE. = 79.6)
DC-9(50) (RWY 8L LAND.)	67.7; 75.0; 63.6 (AVE. = 68.8)	78.8; 80.3; 70.7 (AVE. = 77.4)
2 EACH, F-15 (RWY 8L LAND.)	79.1	87.3 (AVE. = 84.3)

TABLE 5H

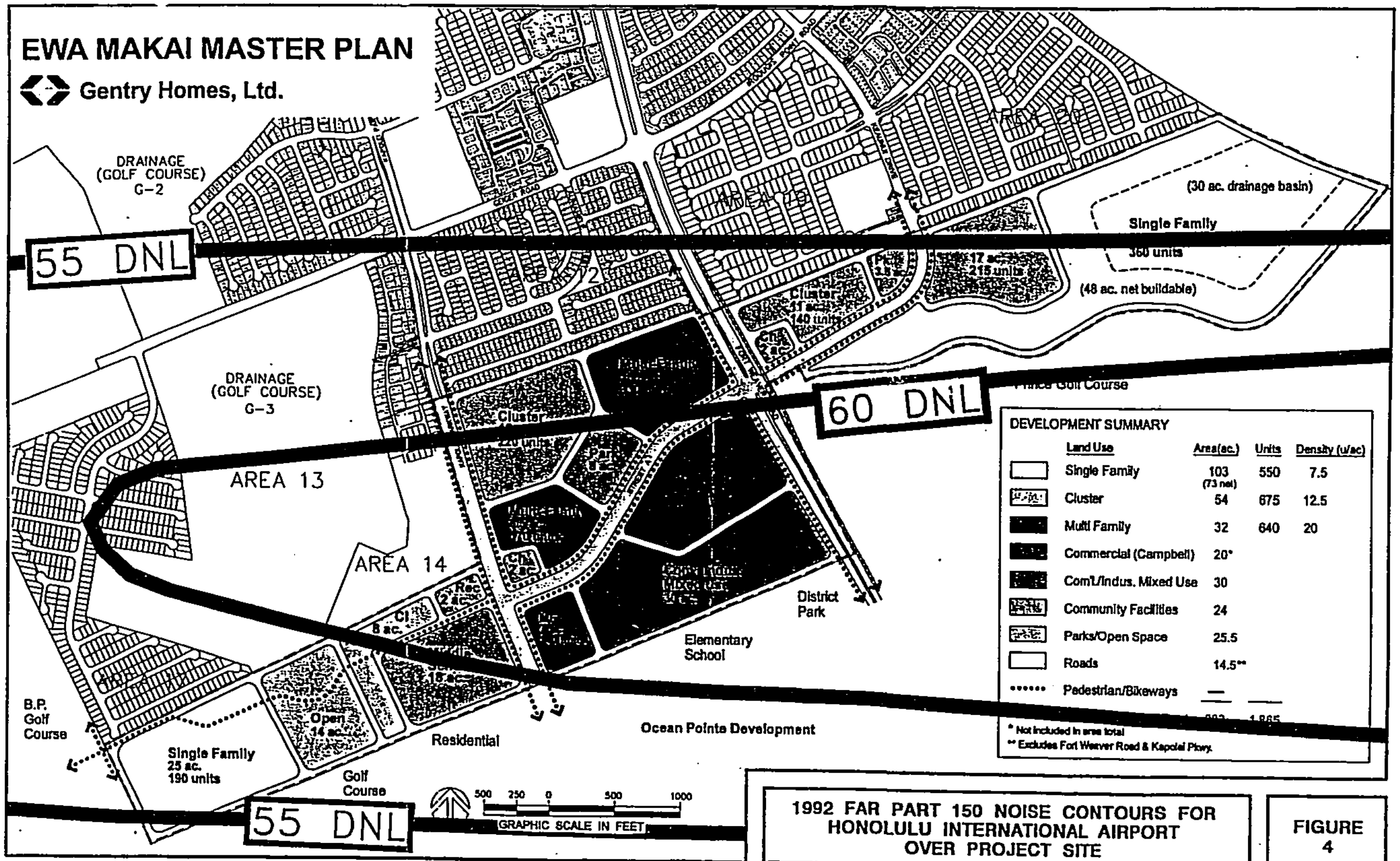
SUMMARY OF AIRCRAFT NOISE MEASUREMENTS LOCATION "H"

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (In dB)	SOUND EXPOSURE LEVELS Lse (In dB)
B-737(200) (RWY 8L LAND.)	71.9; 70.6; 71.2; 63.9; 62.0 (AVE. = 67.9)	81.5; 78.8; 81.2; 72.3; 70.4 (AVE. = 78.8)
B-747 (RWY 8L LAND.)	73.1; 71.9; 75.1; 74.6; 70.5; 73.5; 74.4; 73.4; 72.9 (AVE. = 73.3)	82.6; 82.1; 83.4; 83.6; 80.0; 83.6; 82.6; 82.3; 81.8 (AVE. = 82.6)
DC-9(50) (RWY 8L LAND.)	72.3	81.4



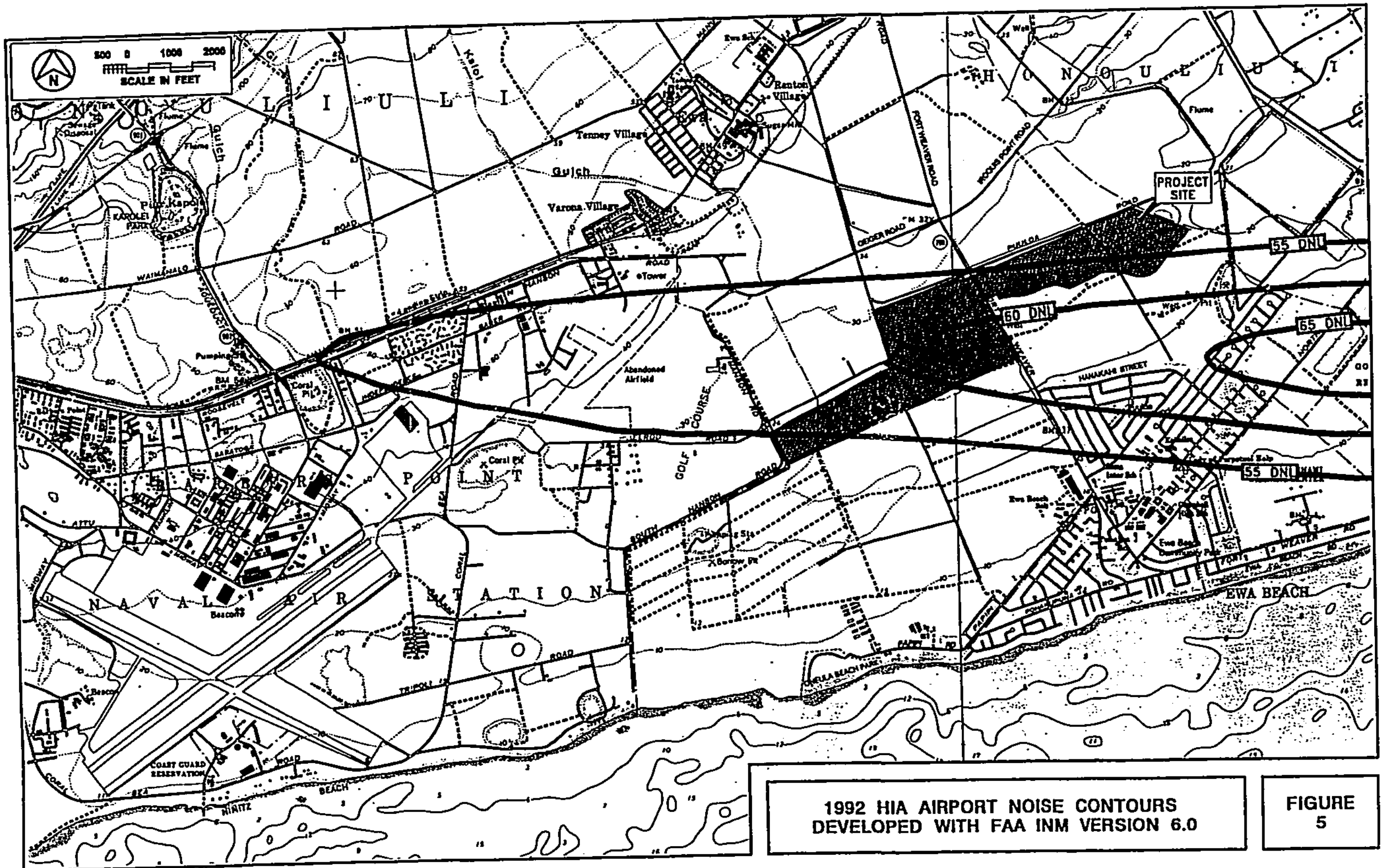
FAR PART 150 NOISE CONTOURS FOR HONOLULU INTERNATIONAL AIRPORT FOR 1992

FIGURE 3



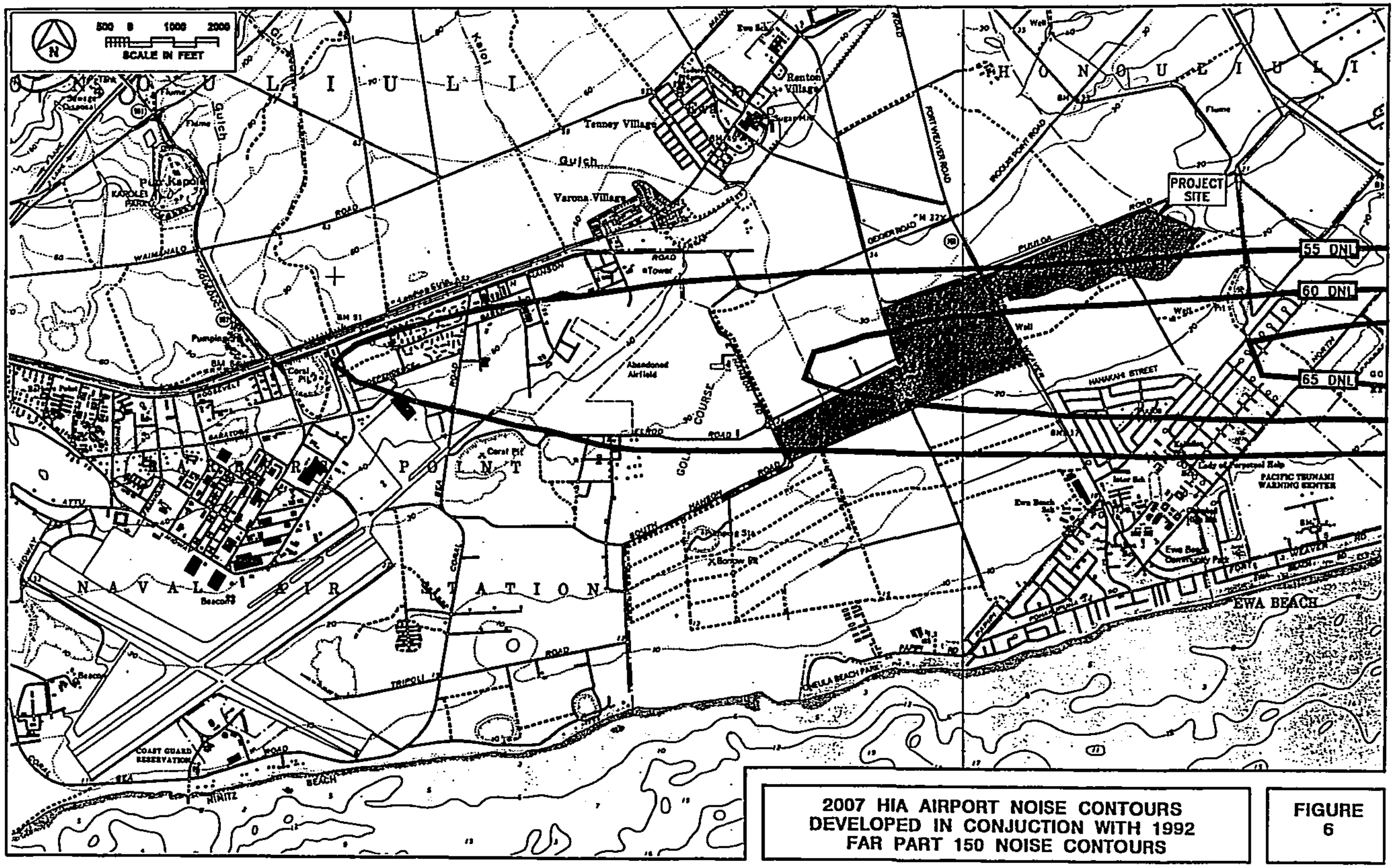
1992 FAR PART 150 NOISE CONTOURS FOR HONOLULU INTERNATIONAL AIRPORT OVER PROJECT SITE

FIGURE 4



1992 HIA AIRPORT NOISE CONTOURS
DEVELOPED WITH FAA INM VERSION 6.0

FIGURE 5



2007 HIA AIRPORT NOISE CONTOURS
DEVELOPED IN CONJUCTION WITH 1992
FAR PART 150 NOISE CONTOURS

FIGURE
6

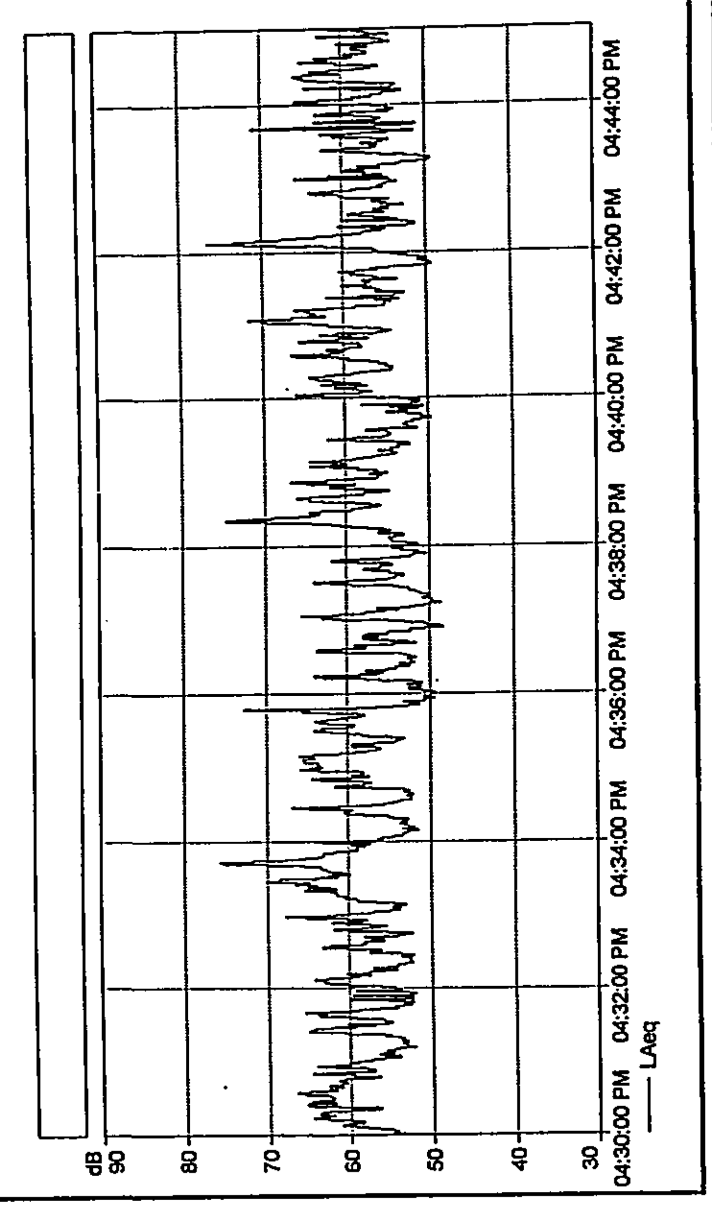
CHAPTER V. EXISTING NOISE LEVELS

General. The existing background ambient noise levels in the vicinity of the proposed Ewa By Gentry - Makai Development project are controlled by motor vehicle traffic along Fort Weaver Road and fixed wing aircraft landing at Honolulu International Airport. The noise from aircraft operating at Kalaeloa Airport and the natural sounds of birds, insects, wind, and foliage are also audible. Traffic, aircraft, and background ambient noise measurements were obtained at the locations (A through H, and T-1 through T-4) shown in Figure 1. Location A was at the southeast corner of Barbers Point Golf Course; Location B was at the south end of Kapolei Parkway; Location C was at the west end of Keoneula Boulevard; Location D was at the entrance to the Hawaii Prince Golf Course; Location E was at the east end of Geiger Park; Location F was at the entrance to Kaimiloa School; Location G was at the entrance to Kapolei High School; Location H was at the entrance to Kapolei Middle School; Locations T-1 and T-2 were at Geiger Park fronting Kapolei Parkway and Geiger Road, respectively; and Locations T-3 and T-4 were near the entrance road to the Hawaii Prince Golf Course.

Typical strip chart records of traffic noise obtained at Locations T-1 and T-2 are shown in Figures 7 and 8. Typical strip chart records of aircraft noise obtained at Locations A and D are shown in Figures 9, 10, and 11. The noise events from motor vehicle traffic tend to occur more frequently, with the duration of each event generally less than 10 seconds. The noise events from aircraft tend to occur less frequently, with the duration of each event being longer than 10 seconds. Aircraft noise events tend to be as loud as the noisiest auto or heavy truck at 60 to 85 feet. While traffic noise levels diminish due to distance and shielding effects from structures, aircraft noise levels (due to the high altitude of the aircraft) are less affected by distances along the ground or shielding effects from structures.

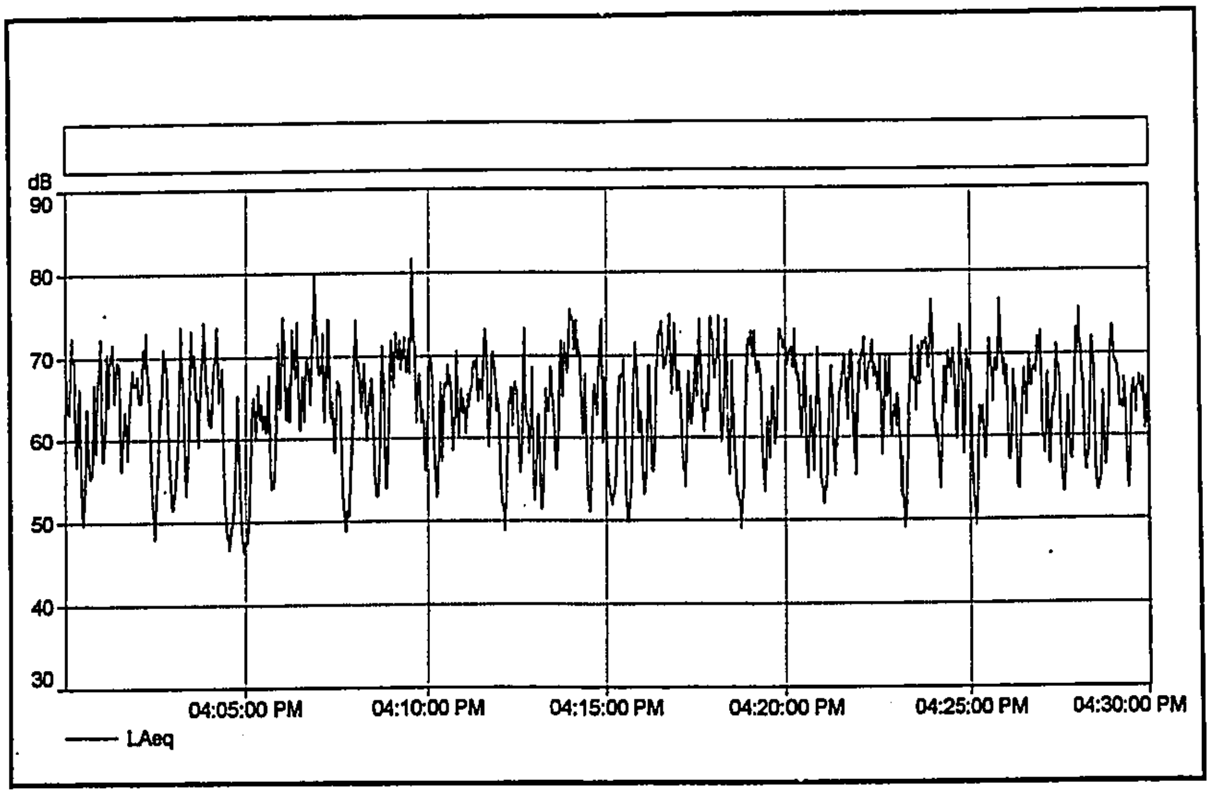
Motor Vehicle Traffic Noise. The dominant contributors to the existing background ambient noise levels within the project area are motor vehicles traveling on Fort Weaver Road and Geiger Road. The typical hourly variations in noise levels within the project area are also influenced by motor vehicle traffic along the other roadways in the area such as Kapolei Parkway, Geiger Road, and Iroquois Road. Traffic noise levels tend to be lowest during the early morning hours between 2 and 4 AM, and tend to be highest during the AM and PM peak commuting hours. Traffic noise levels are relatively constant during the daytime period between the AM and PM peak commuting hours.

The Base Year (1998) traffic volumes and their noise contributions at 50, 100, and 200 feet setback distances from the centerlines of the roadways servicing the project are shown in Appendix C and Tables 6A and 6B. The corresponding setback distances from the roadways' centerlines to their corresponding 65 and 75 DNL traffic noise contours for ground level receptors are shown in Table 7. Based on the results shown in Tables 6A, 6B, and 7, it was concluded that existing background noise levels in the project environs currently exceed 65 DNL at essentially all buildings which front Fort Weaver Road and Geiger Road, which have unobstructed lines of sight to the



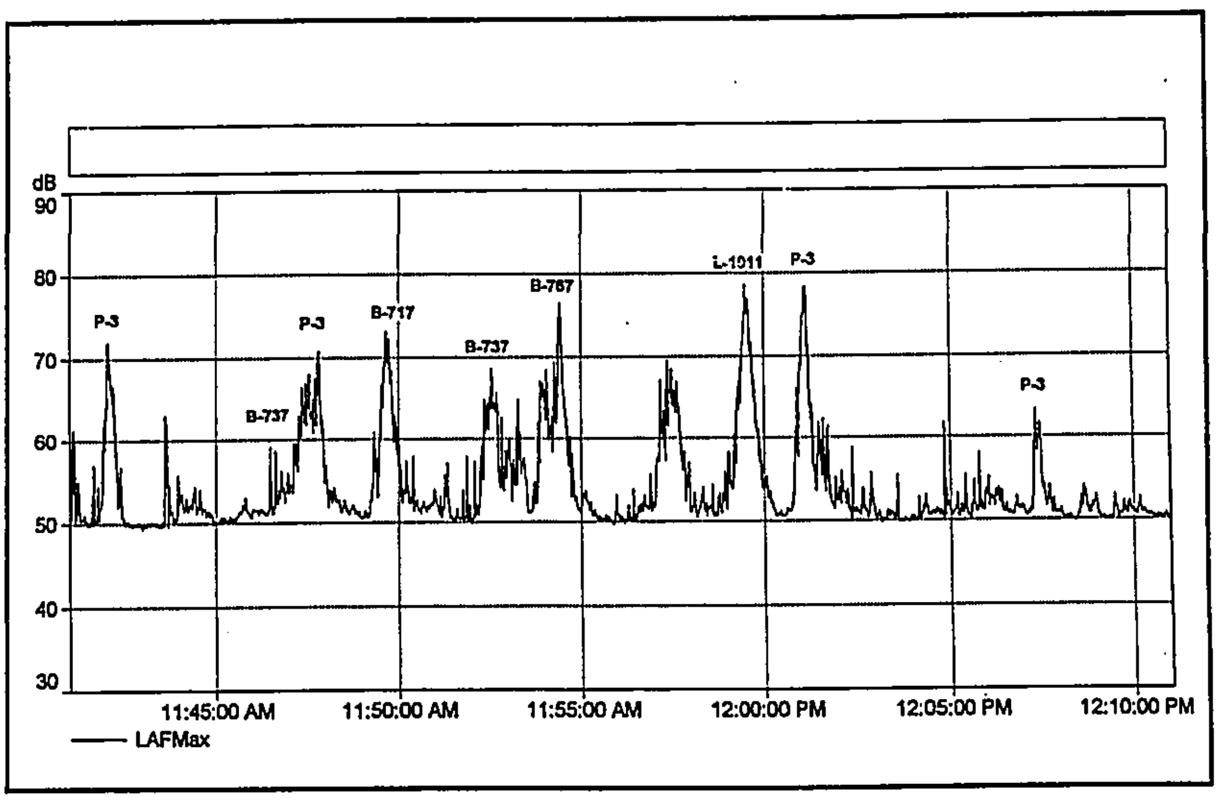
DBA VS. TIME HISTORY OF TRAFFIC NOISE LEVELS AT LOCATION T-1 (1630 TO 1645 HOURS; 10/18/01)

FIGURE 7



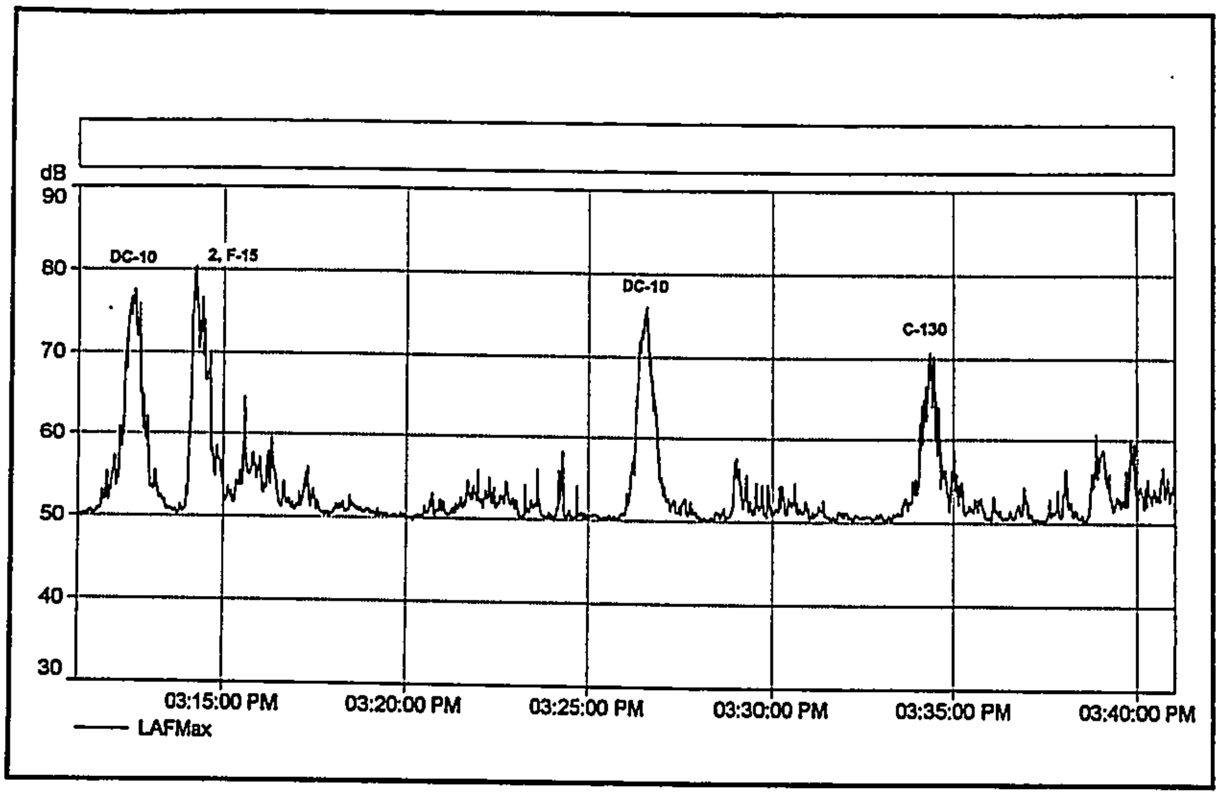
DBA VS. TIME HISTORY OF TRAFFIC NOISE LEVELS AT LOCATION T–2 (1600 TO 1630 HOURS; 10/22/01)

FIGURE 8



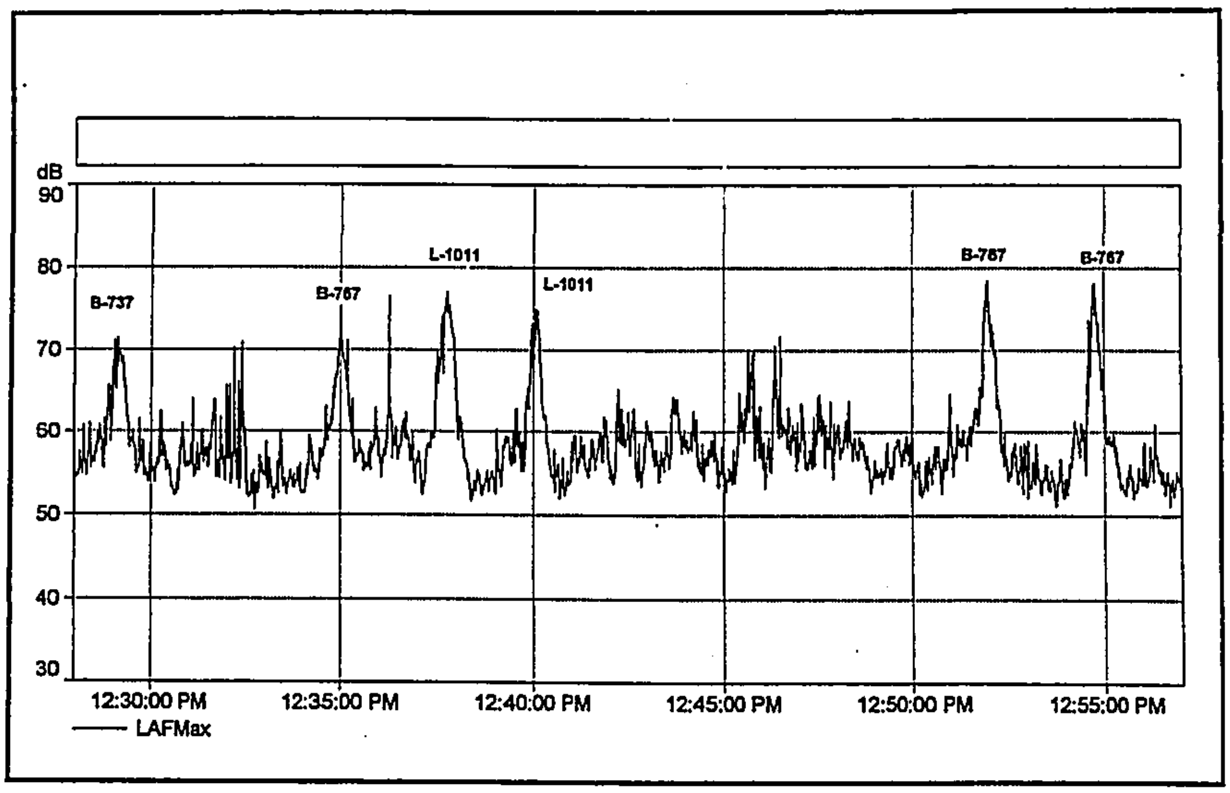
DBA VS. TIME HISTORY OF AIRCRAFT NOISE LEVELS AT LOCATION A (1141 TO 1211 HOURS; 10/16/01)

FIGURE 9



DBA VS. TIME HISTORY OF AIRCRAFT NOISE LEVELS AT LOCATION A (1511 TO 1541 HOURS; 10/16/01)

FIGURE 10



DBA VS. TIME HISTORY OF AIRCRAFT NOISE LEVELS AT LOCATION D (1228 TO 1257 HOURS; 10/22/01)

FIGURE 11

TABLE 6A

EXISTING (CY 1998) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (AM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	VOLUMES (VPH) AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Fort Weaver Rd. - North of Geiger Rd.	38	2,674	2,568	53	53	74.7	70.2	63.8
Fort Weaver Rd. - South of Geiger Rd.	38	2,630	2,524	53	53	74.7	70.2	63.8
Fort Weaver Rd. - North of Golf Course Rd	38	2,630	2,524	53	53	74.7	70.2	63.8
Fort Weaver Rd. - South of Golf Course Rc	38	2,620	2,516	52	52	74.7	70.1	63.8
Geiger Rd. - West of Fort Weaver Rd.	37	1,000	975	20	5	68.2	65.6	62.3
Geiger Rd. - East of Kapolei Parkway	37	761	742	15	4	67.8	64.4	61.1
Geiger Rd. - West of Kapolei Parkway	37	637	621	13	3	67.0	63.7	60.3
Iroquois Rd. - East of Fort Weaver Rd.	37	612	597	12	3	66.2	63.5	60.1
Iroquois Rd. - West of Keaunui Dr.	37	489	477	10	2	65.8	62.5	59.1
Iroquois Rd. - East of Keaunui Dr.	37	305	297	6	2	63.9	60.5	57.2
Iroquois Rd. - West of Street C	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iroquois Rd. - East of Street C	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Geiger Rd.	37	296	292	4	0	63.1	60.0	56.6
Kapolei Parkway - South of Geiger Rd.	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Entrance A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - South of Entrance A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Entrance B	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - South of Entrance B	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Street A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - South of Street A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Street A - West of Ft. Weaver Rd.	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Golf Course Rd. East of Ft. Weaver Rd.	25	12	12	0	0	43.8	40.8	37.4
Street A - East of Kapolei Parkway	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Keaunui Drive - South of Iroquois Rd.	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 6B

EXISTING (CY 1998) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	VOLUMES (VPH) AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Fort Weaver Rd. - North of Geiger Rd.	38	2,782	2,670	56	56	75.4	71.3	65.0
Fort Weaver Rd. - South of Geiger Rd.	38	2,564	2,462	51	51	75.1	71.0	64.7
Fort Weaver Rd. - North of Golf Course Rd	38	2,564	2,462	51	51	75.1	71.0	64.7
Fort Weaver Rd. - South of Golf Course Rc	38	2,551	2,449	51	51	75.0	70.9	64.6
Geiger Rd. - West of Fort Weaver Rd.	37	1,002	977	20	5	68.2	65.6	62.3
Geiger Rd. - East of Kapolei Parkway	37	802	782	16	4	67.2	64.7	61.3
Geiger Rd. - West of Kapolei Parkway	37	784	764	16	4	67.1	64.6	61.2
Iroquois Rd. - East of Fort Weaver Rd.	37	566	552	11	3	65.9	63.2	59.8
Iroquois Rd. - West of Keaunui Dr.	37	543	529	11	3	65.7	63.0	59.7
Iroquois Rd. - East of Keaunui Dr.	37	474	463	9	2	65.7	62.3	59.0
Iroquois Rd. - West of Street C	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iroquois Rd. - East of Street C	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Geiger Rd.	37	218	215	3	0	66.1	63.1	60.0
Kapolei Parkway - South of Geiger Rd.	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Entrance A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - South of Entrance A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Entrance B	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - South of Entrance B	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - North of Street A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kapolei Parkway - South of Street A	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Street A - West of Ft. Weaver Rd.	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Golf Course Rd. East of Ft. Weaver Rd.	25	33	33	0	0	48.2	45.2	41.8
Street A - East of Kapolei Parkway	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Keaunui Drive - South of Iroquois Rd.	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 7

YEAR 1998 AND 2010 DISTANCES TO 65 AND 75 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT) CY 1998	65 DNL SETBACK (FT) CY 2010	75 DNL SETBACK (FT) CY 1998	75 DNL SETBACK (FT) CY 2010
Fort Weaver Rd. - North of Geiger Rd.	249	286	75	95
Fort Weaver Rd. - South of Geiger Rd.	241	265	71	84
Fort Weaver Rd. - North of Golf Course Rd.	241	265	71	84
Fort Weaver Rd. - South of Golf Course Rd.	238	230	70	68
Geiger Rd. - West of Fort Weaver Rd.	170	178	12	21
Geiger Rd. - East of Kapolei Parkway	138	167	8	29
Geiger Rd. - West of Kapolei Parkway	132	153	8	11
Iroquois Rd. - East of Fort Weaver Rd.	90	215	7	18
Iroquois Rd. - West of Keaunui Dr.	86	215	7	18
Iroquois Rd. - East of Keaunui Dr.	77	103	10	8
Iroquois Rd. - West of Street C	N/A	103	N/A	8
Iroquois Rd. - East of Street C	N/A	22	N/A	2
Kapolei Parkway - North of Geiger Rd.	89	238	9	51
Kapolei Parkway - South of Geiger Rd.	N/A	232	N/A	49
Kapolei Parkway - North of Entrance A	N/A	232	N/A	49
Kapolei Parkway - South of Entrance A	N/A	230	N/A	47
Kapolei Parkway - North of Entrance B	N/A	230	N/A	47
Kapolei Parkway - South of Entrance B	N/A	227	N/A	46
Kapolei Parkway - North of Street A	N/A	227	N/A	46
Kapolei Parkway - South of Street A	N/A	190	N/A	33
Street A - West of Ft. Weaver Rd.	N/A	183	N/A	20
Golf Course Rd. East of Ft. Weaver Rd.	1	70	0	7
Street A - East of Kapolei Parkway	N/A	146	N/A	16
Keaunui Drive - South of Iroquois Rd.	N/A	64	N/A	7

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See Table 6B for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) DNL assumed to be 2.0 dB greater than PM peak hour Leq(h) along Ft. Weaver Road.
(5) DNL assumed to be 1.4 dB greater than PM peak hour Leq(h) along all other roadways.

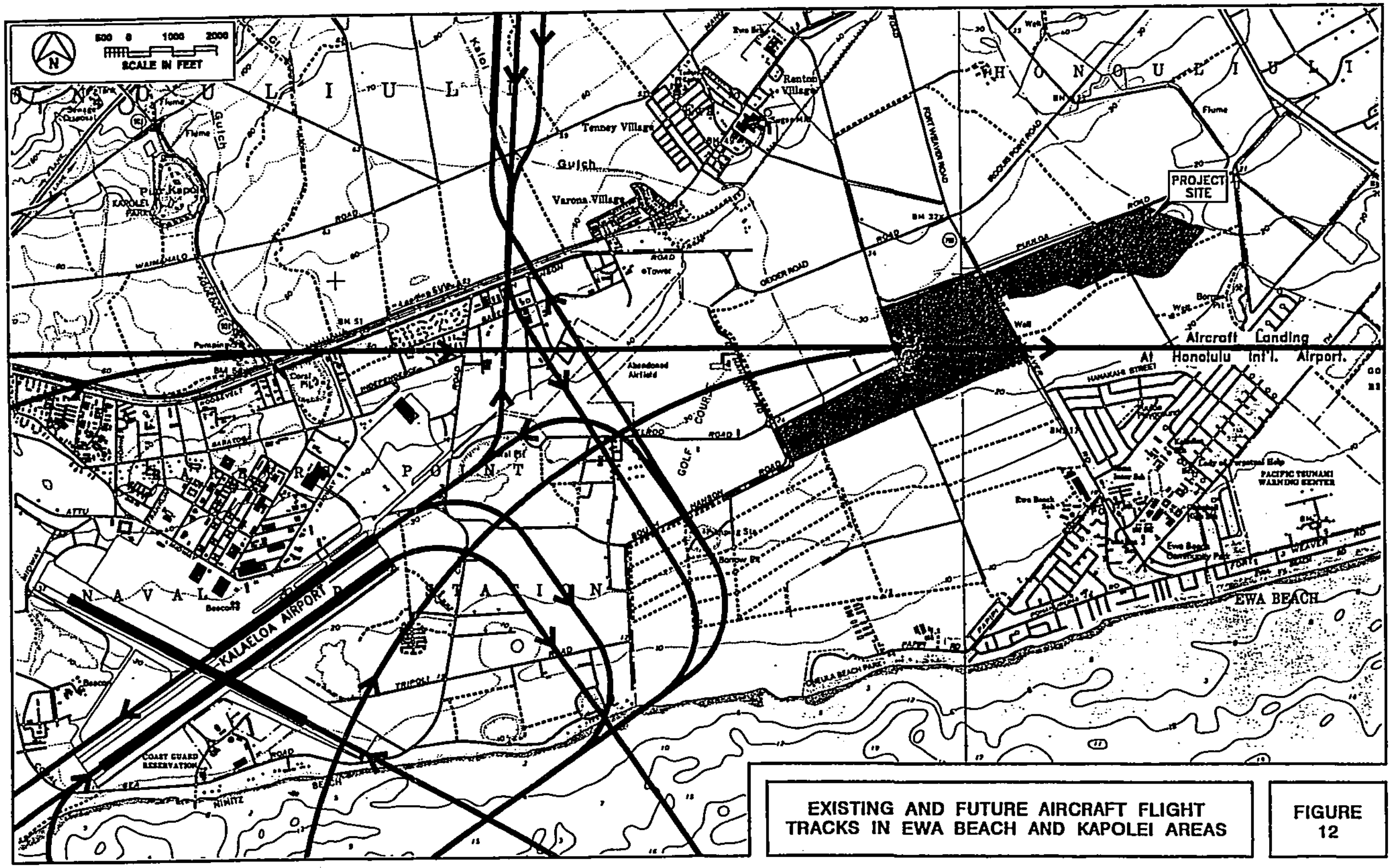
traffic lanes, and which are not shielded by sound attenuating walls. These homes are located in areas which are in the "Significant Exposure - Normally Unacceptable" noise exposure category. For those buildings which are shielded from the road traffic, existing traffic noise levels are 5 to 10 DNL units less than those units along the roadways' Rights-of-Way. Along the first row of homes which front Fort Weaver and Geiger Roads, roadway traffic noise is the dominant noise source.

Aircraft Noise. Existing aircraft noise levels during 2000 and 2001 (prior to September 11, 2001) were estimated using the measured aircraft noise levels shown in Tables 5A through 5H, aircraft schedules and operations forecasts for the 12-month period in 2000 and 2001 (prior to September 11, 2001), the aircraft flight tracks shown in Figure 12, a standard glide slope of 3 degrees (except for the special approach profile used by the F-15 aircraft) and modeling with the FAA INM Version 6.0. Average daily landings over the project site by various aircraft categories were estimated to be as follows: 13.1 B-747; 16.5 DC-10/L-1011; 21.2 B-757/767; 14.4 B-737(200); 1.5 DC-9(50); 10.6 B-717(200); 1.5 C-130; 2.0 C-141; 1.4 KC-135R; 0.7 C-5A; 7.5 F-15; and 0.5 KC-10.

The resulting Base Year airport noise contours over the project site are shown in Figures 13 and 14. Aircraft noise levels over the project site prior to the September 11, 2001 were less than 60 DNL. The aircraft noise measurement data at Locations A through D shown in Tables 5A through 5D are consistent with the noise contours, with measured average noise levels during the measurement periods as follows: Leq (5.93 hours) = 54.8 dB at Location A; Leq (9.63 hours) = 57.4 dB at Location B; Leq (5.32 hours) = 65.8 dB at Location C; and Leq (11.33 hours) = 55.5 dB at Location D. The measured average noise level at Location C was skewed upward by a pair of F-15 aircraft which measured 107.9 dB (SEL). Without that loud single event, the average noise level at Location C would have been 57.5 dB.

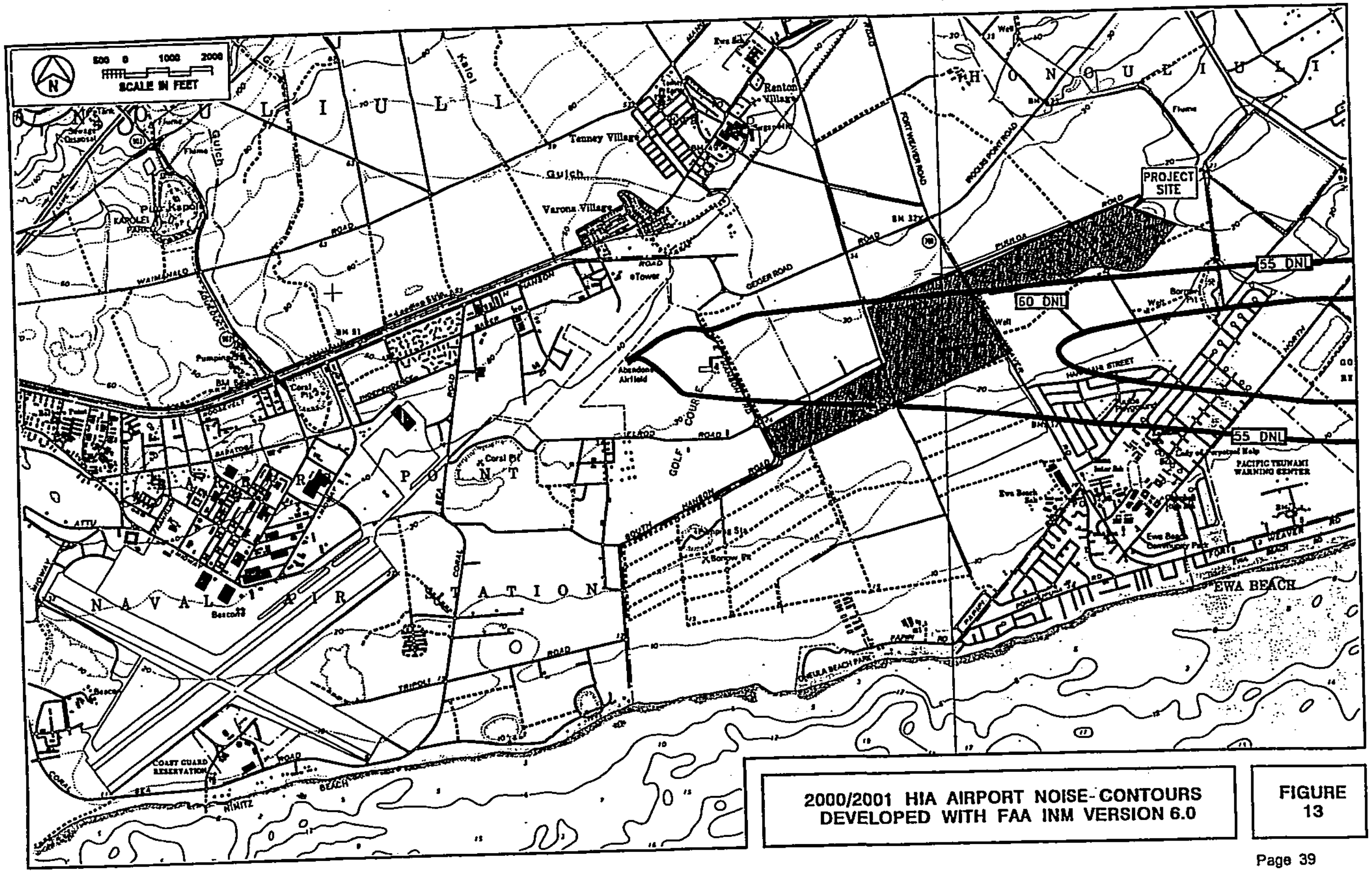
The estimated DNL's at Locations A through D were also calculated by applying the average SEL data shown in Tables 5A through 5D to the number of average daily aircraft operations shown in the earlier paragraph, which produced the following results: 52 DNL at Location A; 57 DNL at Location B; 60 DNL at Location C; and 55 DNL at Location D. The higher computed DNL values at Locations B and C were skewed upward by the relatively high SEL measurements during a single B-747 (93.9 dB) and F-15 pair (107.9 dB) flyby events at Locations B and C, respectively. The INM predictions for the SEL values of the B-747 and F-15 flyby events at locations B and C, respectively, were 83.9 dB and 96.1 dB. This suggests that the measured average SEL values for these two aircraft shown in Tables 5B and 5C were skewed upward by the relatively small sample sizes of the measurement data.

The aircraft noise contours shown in Figures 13 and 14 suggest that the proposed land uses in the Ewa By Gentry - Makai Development project should be compatible with the aircraft noise levels associated with Honolulu International Airport. The proposed land uses should be acceptable and in compliance with the land



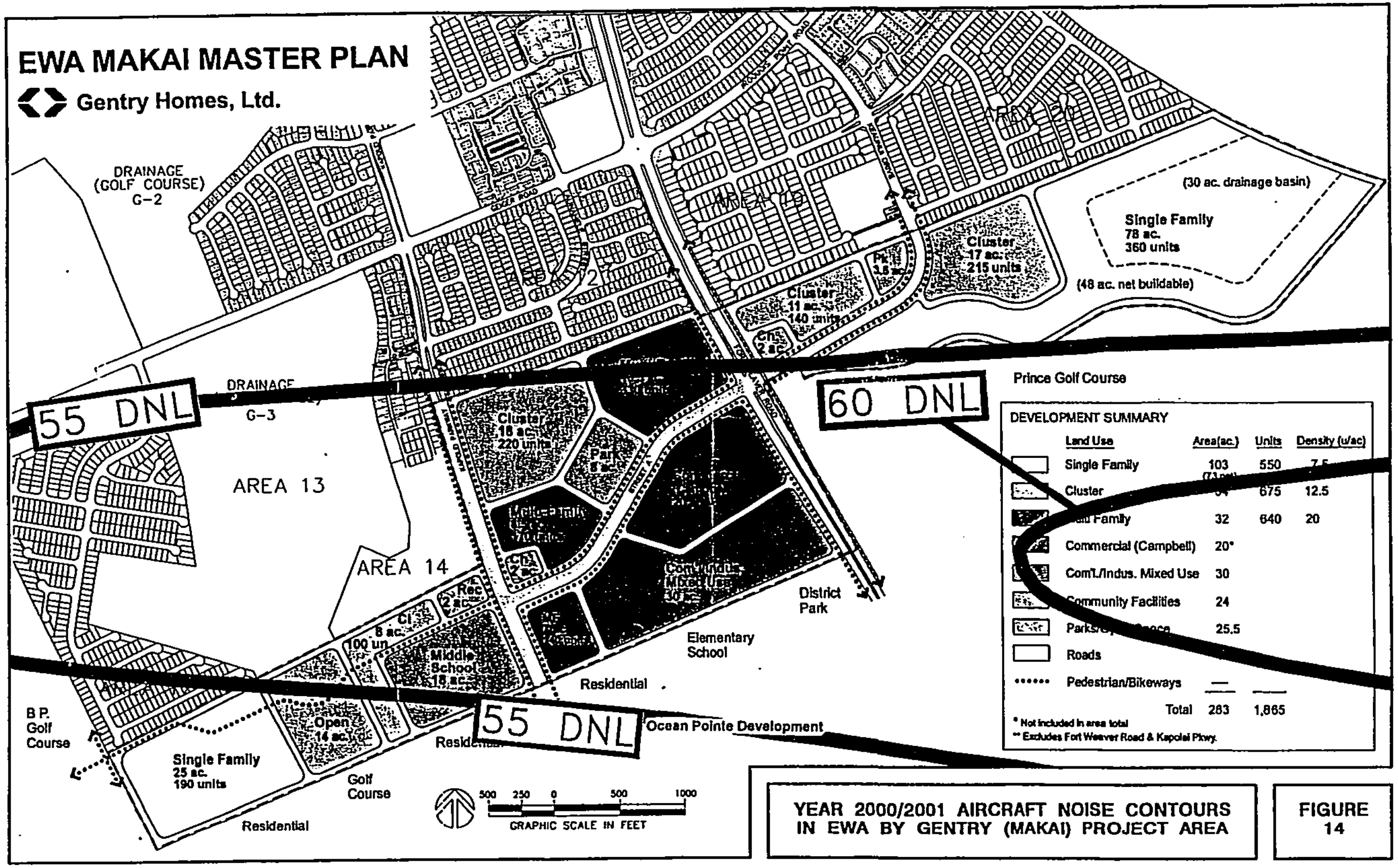
EXISTING AND FUTURE AIRCRAFT FLIGHT TRACKS IN EWA BEACH AND KAPOLEI AREAS

FIGURE 12



2000/2001 HIA AIRPORT NOISE-CONTOURS DEVELOPED WITH FAA INM VERSION 6.0

FIGURE 13



YEAR 2000/2001 AIRCRAFT NOISE CONTOURS IN EWA BY GENTRY (MAKAI) PROJECT AREA

FIGURE 14

use compatibility recommendations shown in Table 3, and aircraft noise levels over the project site should not place constraints on the locations of the proposed land uses.

The results of the aircraft noise level measurements in the immediate vicinity of the project site (see Tables 5A through 5D), indicate that the loudest aircraft noise events were typically associated with overflights by military jet aircraft. The number of overflights by military aircraft are significantly lower than the number of overflights by civilian jet aircraft. However, because the DNL system used to construct the aircraft noise contours uses a cumulative (or energy) averaging methodology, the louder noise events will tend to control the final DNL values. This has been and is still a typical characteristic of the aircraft noise environment in the project area.

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Traffic Noise. Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 8 for CY 2010 with and without the proposed project. The future projections of non-project and project traffic volumes for the No Build and Build Alternatives are shown in Appendix C. The future assignments of project plus non-project traffic on the roadway sections which would service the project are shown in Tables 8A and 8B for the AM and PM peak hours of traffic, respectively. Tables 8A and 8B contain the CY 2010 traffic volumes and average noise levels at 50, 100, and 200 feet from the roadways' centerlines for the Build Alternative. Future average vehicle speeds along all existing roadways were assumed to be identical to those used for CY 1998 (see Tables 6A and 6B).

Table 7 summarizes the predicted increases in the future setback distances to the 65 and 75 DNL (or Ldn) traffic noise contour lines along the roadways in the project environs and attributable to both project plus non-project traffic in CY 2010. The setback distances in Table 7 do not include the beneficial effects of noise shielding from terrain features and man-made structures (walls or buildings) or the detrimental effects of additive contributions of noise from intersecting streets. As indicated in Table 7, the setback distances to the 65 DNL contour are predicted to range from 230 to 286 feet from the centerline of Fort Weaver Road following project build-out in CY 2010. Along the Kapolei Parkway, setback distances to the 65 DNL contour are predicted to range from 227 to 238 feet from the roadway's centerline. Along Geiger and Iroquois Roads, setback distances to the 65 DNL contour are expected to range from 22 to 215 feet.

The increases in future traffic noise levels on the various roadways due to non-project and project traffic are shown in Tables 9A and 9B, for the AM and PM peak hours of traffic respectively. The increase in future traffic noise attributable to project traffic will be moderate and will typically range between 0.8 and 1.6 dB (Leq). The increases in future traffic noise levels as measured by the DNL (or Ldn) descriptor system should be similar to those shown in Table 9B for the PM peak hour. As indicated in Tables 9A and 9B, non-project traffic is expected to cause the larger increases in traffic noise along the new roadways in the project area. Increases in future traffic noise due to project traffic are expected to be largest (2.0 to 2.5 DNL) along the new Street A, which is located within the project boundaries.

In CY 2010, the dominant traffic noise sources in the project area will continue to be traffic noise from Fort Weaver Road. Traffic noise along the new sections of Kapolei Parkway south of Geiger Road and the new Street A will also be dominant noise sources within the project boundaries, particularly at those receptor locations which are removed from Ft. Weaver Road.

Essentially all locations which front Ft. Weaver Road, Geiger Road, Kapolei Parkway, Iroquois Road, and Street A will experience relatively high noise levels above

TABLE 8A

FUTURE (CY 2010) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (AM PEAK HOUR, WITH PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	VOLUMES (VPH) AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Fort Weaver Rd. - North of Geiger Rd.	38	3,685	3,537	74	74	76.7	72.6	66.3
Fort Weaver Rd. - South of Geiger Rd.	38	3,140	3,014	63	63	76.0	71.9	65.6
Fort Weaver Rd. - North of Golf Course Rd	38	3,140	3,014	63	63	76.0	71.9	65.6
Fort Weaver Rd. - South of Golf Course Rc	38	2,510	2,410	50	50	75.0	70.9	64.6
Geiger Rd. - West of Fort Weaver Rd.	37	1,455	1,419	29	7	70.5	67.2	63.9
Geiger Rd. - East of Kapolei Parkway	37	1,280	1,248	26	6	69.3	66.7	63.4
Geiger Rd. - West of Kapolei Parkway	37	725	706	15	4	67.6	64.3	60.9
Iroquois Rd. - East of Fort Weaver Rd.	37	1,040	1,014	21	5	68.5	65.8	62.4
Iroquois Rd. - West of Keaunui Dr.	37	1,040	1,014	21	5	68.5	65.8	62.4
Iroquois Rd. - East of Keaunui Dr.	37	535	521	11	3	65.7	63.0	59.6
Iroquois Rd. - West of Street C	37	535	521	11	3	65.7	63.0	59.6
Iroquois Rd. - East of Street C	37	215	210	4	1	61.7	58.9	55.6
Kapolei Parkway - North of Geiger Rd.	37	3,180	3,116	48	16	73.7	70.6	65.0
Kapolei Parkway - South of Geiger Rd.	37	2,975	2,915	45	15	73.4	70.3	64.7
Kapolei Parkway - North of Entrance A	37	2,975	2,915	45	15	73.4	70.3	64.7
Kapolei Parkway - South of Entrance A	37	2,825	2,769	42	14	73.2	70.1	64.5
Kapolei Parkway - North of Entrance B	37	2,825	2,769	42	14	73.2	70.1	64.5
Kapolei Parkway - South of Entrance B	37	2,760	2,705	41	14	73.1	70.0	64.4
Kapolei Parkway - North of Street A	37	2,760	2,705	41	14	73.1	70.0	64.4
Kapolei Parkway - South of Street A	37	2,145	2,102	32	11	72.0	68.9	63.3
Street A - West of Ft. Weaver Rd.	32	1,200	1,176	18	6	67.8	64.7	61.3
Golf Course Rd. East of Ft. Weaver Rd.	32	640	627	10	3	65.1	62.0	58.6
Street A - East of Kapolei Parkway	32	950	931	14	5	66.8	63.7	60.3
Keaunui Drive - South of Iroquois Rd.	32	425	417	6	2	63.1	60.1	56.7

TABLE 8B

FUTURE (CY 2010) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (PM PEAK HOUR, WITH PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	VOLUMES (VPH) AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Fort Weaver Rd. - North of Geiger Rd.	38	3,830	3,676	77	77	76.8	72.7	66.3
Fort Weaver Rd. - South of Geiger Rd.	38	3,245	3,115	65	65	76.1	72.0	65.6
Fort Weaver Rd. - North of Golf Course Rd	38	3,245	3,115	65	65	76.1	72.0	65.6
Fort Weaver Rd. - South of Golf Course Rc	38	2,395	2,299	48	48	74.8	70.7	64.3
Geiger Rd. - West of Fort Weaver Rd.	37	1,715	1,672	34	9	70.5	68.0	62.7
Geiger Rd. - East of Kapolei Parkway	37	1,555	1,516	31	8	70.9	67.5	62.2
Geiger Rd. - West of Kapolei Parkway	37	900	877	18	5	67.8	65.2	61.8
Iroquois Rd. - East of Fort Weaver Rd.	37	1,290	1,258	26	6	69.5	66.7	63.4
Iroquois Rd. - West of Keaunui Dr.	37	1,290	1,258	26	6	69.5	66.7	63.4
Iroquois Rd. - East of Keaunui Dr.	37	640	624	13	3	66.4	63.7	60.3
Iroquois Rd. - West of Street C	37	640	624	13	3	66.4	63.7	60.3
Iroquois Rd. - East of Street C	37	165	161	3	1	60.5	57.9	54.5
Kapolei Parkway - North of Geiger Rd.	37	3,195	3,131	48	16	73.7	70.6	65.0
Kapolei Parkway - South of Geiger Rd.	37	3,040	2,979	46	15	73.5	70.4	64.8
Kapolei Parkway - North of Entrance A	37	3,040	2,979	46	15	73.5	70.4	64.8
Kapolei Parkway - South of Entrance A	37	2,925	2,866	44	15	73.3	70.2	64.7
Kapolei Parkway - North of Entrance B	37	2,925	2,866	44	15	73.3	70.2	64.7
Kapolei Parkway - South of Entrance B	37	2,815	2,759	42	14	73.2	70.1	64.6
Kapolei Parkway - North of Street A	37	2,815	2,759	42	14	73.2	70.1	64.6
Kapolei Parkway - South of Street A	37	2,010	1,970	30	10	71.8	68.7	63.2
Street A - West of Ft. Weaver Rd.	32	1,740	1,705	26	9	69.4	66.3	62.9
Golf Course Rd. East of Ft. Weaver Rd.	32	640	627	10	3	65.1	62.0	58.6
Street A - East of Kapolei Parkway	32	1,385	1,357	21	7	68.4	65.3	61.9
Keaunui Drive - South of Iroquois Rd.	32	590	578	9	3	64.7	61.6	58.2

TABLE 8A

FUTURE (CY 2010) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (AM PEAK HOUR, WITH PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	********* VOLUMES (VPH) *********** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Fort Weaver Rd. - North of Geiger Rd.	38	3,685	3,537	74	74	76.7	72.6	66.3
Fort Weaver Rd. - South of Geiger Rd.	38	3,140	3,014	63	63	76.0	71.9	65.6
Fort Weaver Rd. - North of Golf Course Rd	38	3,140	3,014	63	63	76.0	71.9	65.6
Fort Weaver Rd. - South of Golf Course Rc	38	2,510	2,410	50	50	75.0	70.9	64.6
Geiger Rd. - West of Fort Weaver Rd.	37	1,455	1,419	29	7	70.5	67.2	63.9
Geiger Rd. - East of Kapolei Parkway	37	1,280	1,248	26	6	69.3	66.7	63.4
Geiger Rd. - West of Kapolei Parkway	37	725	706	15	4	67.6	64.3	60.9
Iroquois Rd. - East of Fort Weaver Rd.	37	1,040	1,014	21	5	68.5	65.8	62.4
Iroquois Rd. - West of Keaunui Dr.	37	1,040	1,014	21	5	68.5	65.8	62.4
Iroquois Rd. - East of Keaunui Dr.	37	535	521	11	3	65.7	63.0	59.6
Iroquois Rd. - West of Street C	37	535	521	11	3	65.7	63.0	59.6
Iroquois Rd. - East of Street C	37	215	210	4	1	61.7	58.9	55.6
Kapolei Parkway - North of Geiger Rd.	37	3,180	3,116	48	16	73.7	70.6	65.0
Kapolei Parkway - South of Geiger Rd.	37	2,975	2,915	45	15	73.4	70.3	64.7
Kapolei Parkway - North of Entrance A	37	2,975	2,915	45	15	73.4	70.3	64.7
Kapolei Parkway - South of Entrance A	37	2,825	2,769	42	14	73.2	70.1	64.5
Kapolei Parkway - North of Entrance B	37	2,825	2,769	42	14	73.2	70.1	64.5
Kapolei Parkway - South of Entrance B	37	2,760	2,705	41	14	73.1	70.0	64.4
Kapolei Parkway - North of Street A	37	2,760	2,705	41	14	73.1	70.0	64.4
Kapolei Parkway - South of Street A	37	2,145	2,102	32	11	72.0	68.9	63.3
Street A - West of Ft. Weaver Rd.	32	1,200	1,176	18	6	67.8	64.7	61.3
Golf Course Rd. East of Ft. Weaver Rd.	32	640	627	10	3	65.1	62.0	58.6
Street A - East of Kapolei Parkway	32	950	931	14	5	66.8	63.7	60.3
Keaunui Drive - South of Iroquois Rd.	32	425	417	6	2	63.1	60.1	56.7

TABLE 8B

FUTURE (CY 2010) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (PM PEAK HOUR, WITH PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	********* VOLUMES (VPH) *********** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Fort Weaver Rd. - North of Geiger Rd.	38	3,830	3,676	77	77	76.8	72.7	66.3
Fort Weaver Rd. - South of Geiger Rd.	38	3,245	3,115	65	65	76.1	72.0	65.6
Fort Weaver Rd. - North of Golf Course Rd	38	3,245	3,115	65	65	76.1	72.0	65.6
Fort Weaver Rd. - South of Golf Course Rc	38	2,395	2,299	48	48	74.8	70.7	64.3
Geiger Rd. - West of Fort Weaver Rd.	37	1,715	1,672	34	9	70.5	68.0	62.7
Geiger Rd. - East of Kapolei Parkway	37	1,555	1,516	31	8	70.9	67.5	62.2
Geiger Rd. - West of Kapolei Parkway	37	900	877	18	5	67.8	65.2	61.8
Iroquois Rd. - East of Fort Weaver Rd.	37	1,290	1,258	26	6	69.5	66.7	63.4
Iroquois Rd. - West of Keaunui Dr.	37	1,290	1,258	26	6	69.5	66.7	63.4
Iroquois Rd. - East of Keaunui Dr.	37	640	624	13	3	66.4	63.7	60.3
Iroquois Rd. - West of Street C	37	640	624	13	3	66.4	63.7	60.3
Iroquois Rd. - East of Street C	37	165	161	3	1	60.5	57.9	54.5
Kapolei Parkway - North of Geiger Rd.	37	3,195	3,131	48	16	73.7	70.6	65.0
Kapolei Parkway - South of Geiger Rd.	37	3,040	2,979	46	15	73.5	70.4	64.8
Kapolei Parkway - North of Entrance A	37	3,040	2,979	46	15	73.5	70.4	64.8
Kapolei Parkway - South of Entrance A	37	2,925	2,866	44	15	73.3	70.2	64.7
Kapolei Parkway - North of Entrance B	37	2,925	2,866	44	15	73.3	70.2	64.7
Kapolei Parkway - South of Entrance B	37	2,815	2,759	42	14	73.2	70.1	64.6
Kapolei Parkway - North of Street A	37	2,815	2,759	42	14	73.2	70.1	64.6
Kapolei Parkway - South of Street A	37	2,010	1,970	30	10	71.8	68.7	63.2
Street A - West of Ft. Weaver Rd.	32	1,740	1,705	26	9	69.4	66.3	62.9
Golf Course Rd. East of Ft. Weaver Rd.	32	640	627	10	3	65.1	62.0	58.6
Street A - East of Kapolei Parkway	32	1,385	1,357	21	7	68.4	65.3	61.9
Keaunui Drive - South of Iroquois Rd.	32	590	578	9	3	64.7	61.6	58.2

TABLE 9A

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2010) (AM PEAK HOUR)

STREET SECTION	NOISE LEVEL (DB) INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Fort Weaver Rd. - North of Geiger Rd.	1.2	1.2
Fort Weaver Rd. - South of Geiger Rd.	0.3	1.4
Fort Weaver Rd. - North of Golf Course Rd.	0.3	1.4
Fort Weaver Rd. - South of Golf Course Rd.	0.4	0.4
Geiger Rd. - West of Fort Weaver Rd.	0.9	0.7
Geiger Rd. - East of Kapolei Parkway	1.4	0.9
Geiger Rd. - West of Kapolei Parkway	-0.3	0.9
Iroquois Rd. - East of Fort Weaver Rd.	1.5	0.8
Iroquois Rd. - West of Keaunui Dr.	2.5	0.8
Iroquois Rd. - East of Keaunui Dr.	1.5	1.0
Iroquois Rd. - West of Street C	62.0	1.0
Iroquois Rd. - East of Street C	58.9	0.0
Kapolei Parkway - North of Geiger Rd.	9.6	1.0
Kapolei Parkway - South of Geiger Rd.	69.5	0.8
Kapolei Parkway - North of Entrance A	69.5	0.8
Kapolei Parkway - South of Entrance A	69.2	0.9
Kapolei Parkway - North of Entrance B	69.2	0.9
Kapolei Parkway - South of Entrance B	69.2	0.8
Kapolei Parkway - North of Street A	69.2	0.8
Kapolei Parkway - South of Street A	68.4	0.5
Street A - West of Ft. Weaver Rd.	61.0	3.7
Golf Course Rd. East of Ft. Weaver Rd.	19.4	1.8
Street A - East of Kapolei Parkway	60.5	3.2
Keaunui Drive - South of Iroquois Rd.	59.3	0.8

TABLE 9B

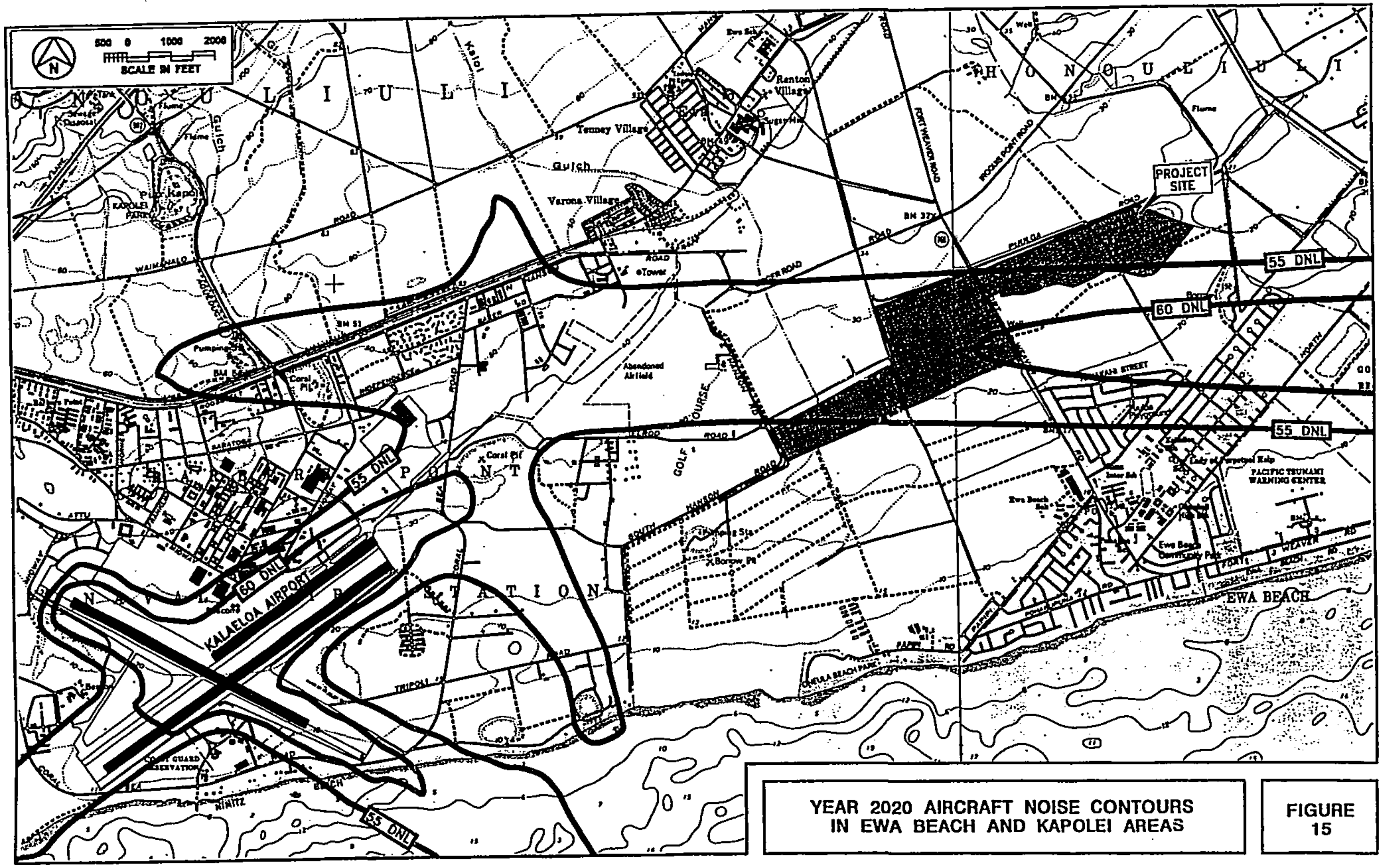
CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2010) (PM PEAK HOUR)

STREET SECTION	NOISE LEVEL (DB) INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Fort Weaver Rd. - North of Geiger Rd.	0.0	1.4
Fort Weaver Rd. - South of Geiger Rd.	-0.6	1.6
Fort Weaver Rd. - North of Golf Course Rd.	-0.6	1.6
Fort Weaver Rd. - South of Golf Course Rd.	-0.6	0.4
Geiger Rd. - West of Fort Weaver Rd.	1.3	1.1
Geiger Rd. - East of Kapolei Parkway	2.0	0.8
Geiger Rd. - West of Kapolei Parkway	-0.3	0.9
Iroquois Rd. - East of Fort Weaver Rd.	2.7	0.8
Iroquois Rd. - West of Keaunui Dr.	2.9	0.8
Iroquois Rd. - East of Keaunui Dr.	0.5	0.9
Iroquois Rd. - West of Street C	62.8	0.9
Iroquois Rd. - East of Street C	61.3	-3.4
Kapolei Parkway - North of Geiger Rd.	6.4	1.1
Kapolei Parkway - South of Geiger Rd.	69.6	0.8
Kapolei Parkway - North of Entrance A	69.6	0.8
Kapolei Parkway - South of Entrance A	69.4	0.8
Kapolei Parkway - North of Entrance B	69.4	0.8
Kapolei Parkway - South of Entrance B	69.3	0.8
Kapolei Parkway - North of Street A	69.3	0.8
Kapolei Parkway - South of Street A	68.2	0.5
Street A - West of Ft. Weaver Rd.	63.8	2.5
Golf Course Rd. East of Ft. Weaver Rd.	16.0	0.8
Street A - East of Kapolei Parkway	63.3	2.0
Keaunui Drive - South of Iroquois Rd.	60.7	0.9

65 DNL. Those receptor locations which are removed from the major roadways as well as shielded by existing and new buildings should experience traffic noise levels less than 65 DNL.

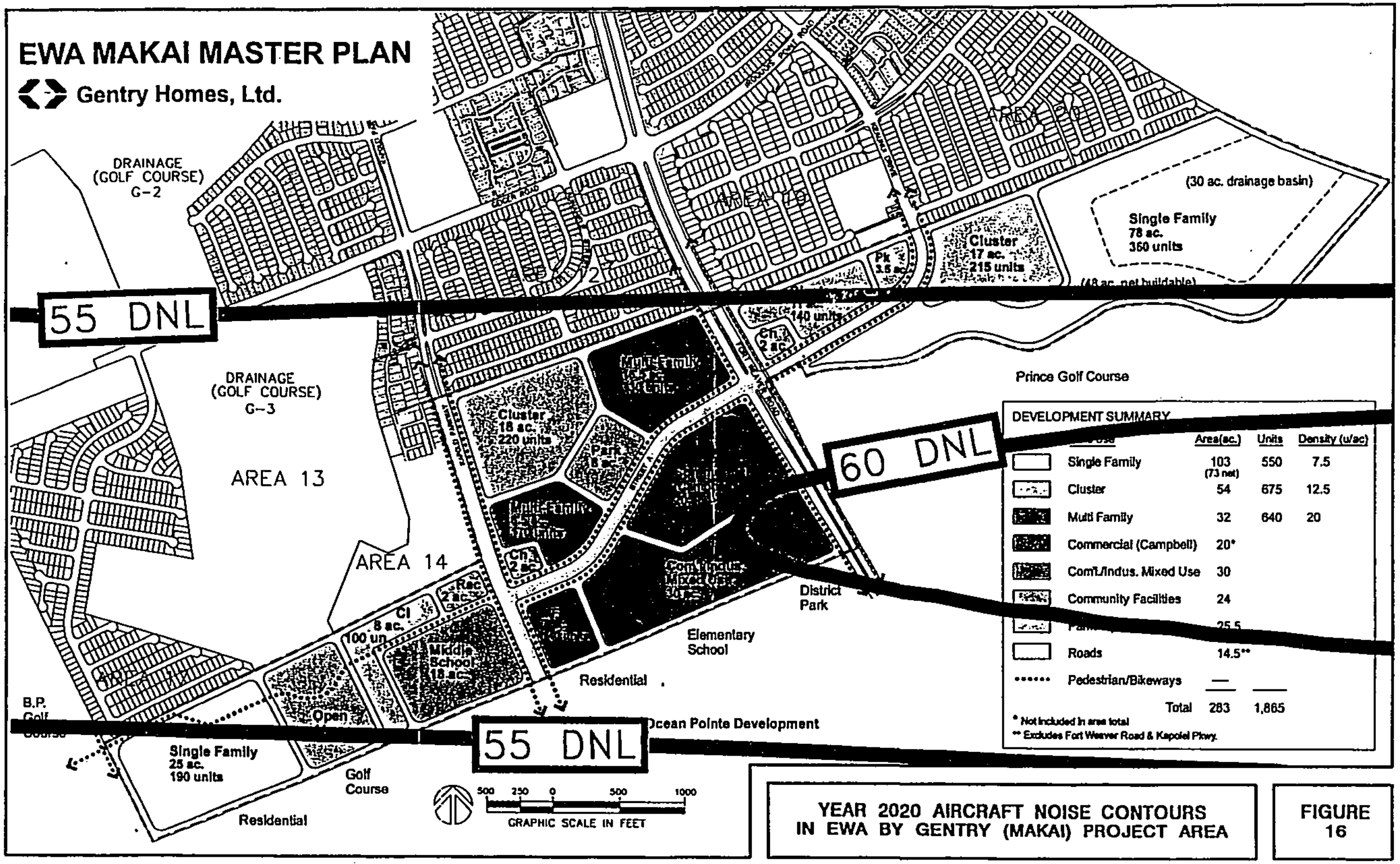
Aircraft Noise. The aircraft noise contours in the project environs for the CY 2020 period were developed using the available forecasts for Honolulu International Airport from Reference 10, and are shown in Figure 15. Figure 15 depicts the forecast combined aircraft noise contours of Kalaeloa and Honolulu International Airports in the Kapolei and Ewa Beach areas. The contours are similar to those reported in Reference 10, except that the FAA INM Verison 6.0 was used to develop the current contours shown in Figure 15. The worst case approach profiles for aircraft landing at HIA which were identical to those used in developing the 1992 FAR Part 150 contours of Figures 3 and 4 were also used in developing the contours shown in Figure 15.

The relationship of the CY 2020 aircraft noise contours to the project site are shown in Figure 16. The CY 2020 contours shown in Figure 16 indicate that the 60 DNL aircraft noise contour could encroach into the project site, and primarily over the commercial and industrial sections of the development. The available CY 2020 forecasts for aircraft noise over the project site indicate that the 60 DNL contour could expand slightly and begin to extend into the project site in the south section of the project alongside Ft. Weaver Road (see Figure 16). The residential and school parcels of the development should remain outside the 60 DNL contour. Planned noise sensitive uses of the project have been located outside the 60 DNL contour for CY 2020 in recognition of the existing planning guidelines shown in Table 3.



YEAR 2020 AIRCRAFT NOISE CONTOURS IN EWA BEACH AND KAPOLEI AREAS

FIGURE 15



YEAR 2020 AIRCRAFT NOISE CONTOURS IN EWA BY GENTRY (MAKAI) PROJECT AREA

FIGURE 16

CHAPTER VII. POTENTIAL NOISE IMPACTS ASSOCIATED WITH THE PROPOSED PROJECT AND POSSIBLE MITIGATION MEASURES

Traffic Noise Impacts. The increases in traffic noise levels attributable to the project from the Base Year to CY 2010 are predicted to not exceed 1.6 DNL along Ft. Weaver Road, and should not exceed 1.1 DNL along Geiger Road, Iroquois Road, Kapolei Parkway, and Keaunui Drive south of Iroquois Road. A traffic noise level increase of 1.6 DNL is considered to be moderate, but not significant. Traffic noise level increases of 0 to 1.0 DNL are considered to be insignificant and will be difficult to detect, particularly if the increase occurs over a 9 to 12 year period. Larger increases of 2.0 to 2.5 DNL are predicted to occur on the new Street A within the project area.

Potential noise impacts from project and non-project traffic are possible in the project environs, both in respect to existing and planned noise sensitive receptors along these roadways. Existing and future residences which are located along essentially all of the major roadways in the project area may be impacted by the future traffic noise along these roadways if their setback distances from the roadway centerlines are less than those shown for the 65 DNL contour in Table 7. The setbacks of existing homes along Fort Weaver Road, Geiger Road, Iroquois Road, and Kapolei Parkway are not adequate for avoiding future adverse noise impacts from traffic by CY 2010, with or without the project. For this reason, existing homes which front these two roadways are expected to be impacted by traffic noise in the future if they are not shielded by sound walls.

Because traffic noise along public roadways are generated by non-project as well as project traffic, mitigation of off-site traffic noise impacts are generally performed by individual property owners along the roadways' Rights-of-Way or by public agencies during roadway improvement projects. These mitigation measures generally take the form of increased setbacks, sound attenuating walls and/or berms, total closure and air conditioning, or the use of sound attenuating windows. Where adequate setbacks beyond the 65 DNL noise contour are not available, the construction of 6 to 8 feet high sound walls is generally effective for attenuating traffic noise at single story structures, or at the ground floors of multistory structures. If 6 to 8 feet high walls and/or berms are utilized to reduce traffic noise, at least 5 to 10 DNL units of reduction should be possible at ground level units. Second floor units will normally not benefit from the construction of 6 to 8 feet high walls. Whenever mitigation of traffic noise at the upper floors are required, the use of closure and air conditioning, or the use of sound attenuating windows are the more appropriate sound attenuation measures.

Aircraft Noise Impacts. The siting of future noise sensitive developments within the 60 DNL airport noise contour is not recommended by the State Department of Transportation, Airports Division. Residences, schools, churches, health centers, day-care centers, and hotels are included within the noise sensitive land use category. The siting of industrial and commercial uses within the 60 DNL contour is considered to be acceptable, since closure and air conditioning of industrial and commercial office spaces is the rule rather than an exception. The siting of these types of uses (or other

non-noise sensitive land uses) within the high noise areas is usually encouraged, since it tends to preclude future development of noise sensitive uses on the same lands.

By siting planned noise sensitive uses outside the existing and forecasted 60 DNL noise contours for Honolulu International Airport, risks of adverse aircraft noise impacts have been reduced to acceptable levels. The noise contour disclosure provisions of Reference 5 must be applied over all project lands which are located within the 1992 aircraft noise contours developed by the Hawaii State Department of Transportation, Airports Division during the last FAR Part 150 Noise Compatibility Program (see Figures 3 and 4). These official 1992 FAR Part 150 contours are the applicable contours for disclosure purposes. These disclosure provisions are intended to further reduce risks of occupant dissatisfaction with the aircraft noise levels in the project environs.

Unfortunately, the 1992 FAR Part 150 contours are dated, and probably cannot be used to depict existing conditions (prior to September 11, 2001). The 2007 forecast contours shown in Figure 6 are also dated since they utilized airport operations forecasts developed in the 1980's. The 2000/2001 and 2020 contours shown in Figures 13 through 16 are probably more representative of the existing and future aircraft noise contours over the project site, and they indicate that additional aircraft noise mitigation measures (other than disclosures) should not be required.

Combined Traffic and Aircraft Noise. When applying for FHA/HUD financial assistance on residential developments, sound attenuation measures are normally required if total exterior noise levels exceed 65 DNL. Traffic noise levels will exceed 65 DNL along the highway corridors and major thoroughfares which service the project. If the traffic noise level equals 65 DNL and the aircraft noise level equals 57 DNL at a project dwelling, the total noise level will be 66 DNL, which exceeds the FHA/HUD standard of 65 DNL. Where existing and forecasted aircraft noise levels over the project site do not exceed 55 DNL, combined traffic and aircraft noise levels should not exceed 65 DNL when traffic noise levels are less than 65 DNL. Where traffic noise levels exceed 65 DNL, the combined noise levels will be identical to the traffic noise levels and will not be dependent upon the levels of aircraft noise, as long as aircraft noise levels remain at least 10 DNL units below the traffic noise levels.

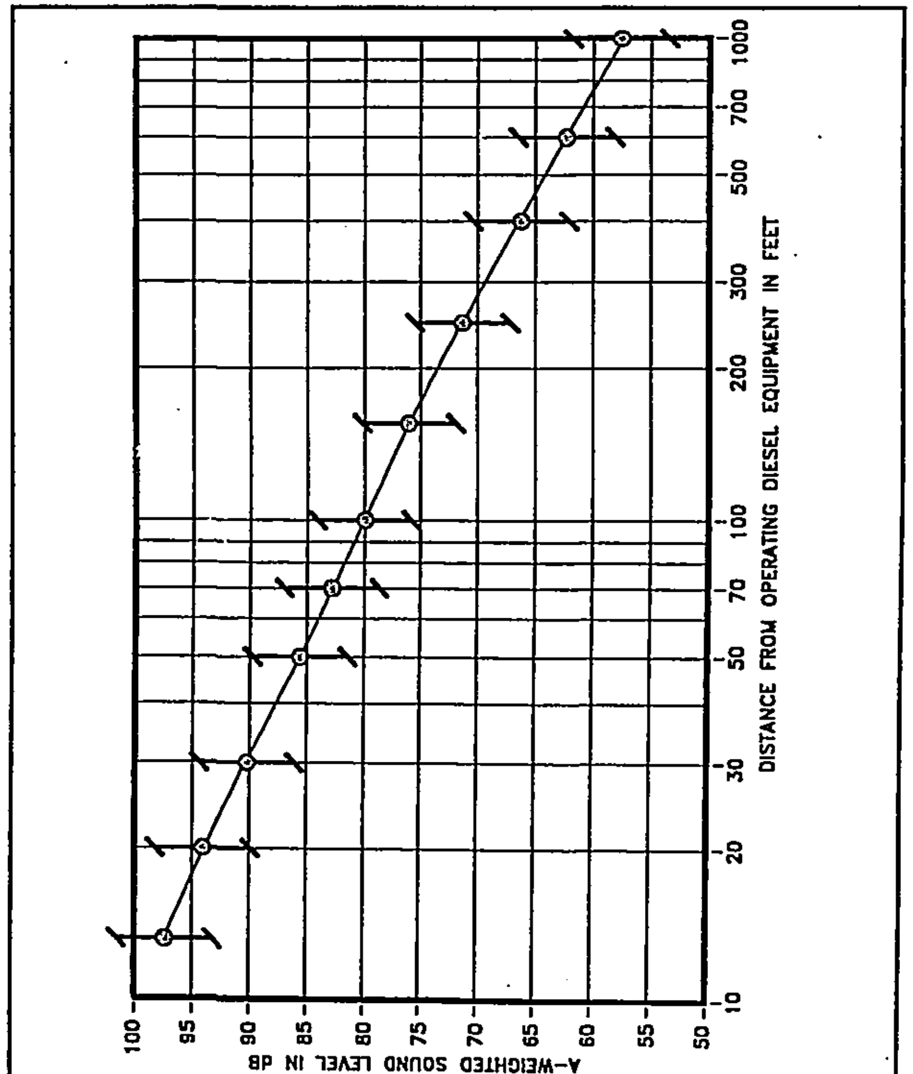
Aircraft noise contours for CY 2010 (the same year as the traffic noise predictions) were not constructed because detailed aircraft operations forecasts for Honolulu International Airport were not available. However, if the worst case CY 2020 aircraft noise contours are combined with the CY 2010 traffic noise contours, the following changes in the CY 2010 setback distances to the 65 DNL contours shown in Table 7 are predicted for locations within the 55 DNL contours shown in Figures 15 and 16:

a. Ft. Weaver Road north of Street A: Increase from 265 feet to 287 feet.
b. Kapolei Parkway north of Entrance A: Increase from 232 feet to 249 feet.
c. Kapolei Parkway south of Entrance A: Increase from 230 feet to 253 feet.

d. Kapolei Parkway north of Entrance B: Increase from 230 feet to 260 feet.
e. Kapolei Parkway south of Entrance B: Increase from 227 feet to 256 feet.
f. Kapolei Parkway north of Street A: Increase from 227 feet to 256 feet.
g. Kapolei Parkway south of Street A: Increase from 190 feet to 209 feet.
h. Street A east of Kapolei Parkway: Increase from 146 feet to 182 feet.
i. Street A west of Fort Weaver Road: Increase from 183 feet to 227 feet.
j. Golf Course Road east of Fort Weaver Road: Increase from 70 feet to 83 feet.

Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. During periods of construction, it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. Typical levels of noise from construction activity (excluding pile driving activity) are shown in Figure 17. The noise sensitive properties which are predicted to experience the highest noise levels during construction activities on the project site are the existing residences north and adjacent to the project site. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 feet distance), and due to the exterior nature of the work (grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site, and heavy truck and equipment staging areas should be located away from the existing residences to the north. The incorporation of State Department of Health construction noise limits and curfew times, which are applicable on the island of Oahu (Reference 6), is another noise mitigation measure which can be applied to this project. Figure 18 depicts the allowed hours of construction for construction noise which exceed the allowable noise limits at the project's property lines. Noisy construction activities are not allowed during the nighttime hours, or on Sundays and holidays under the DOH permit procedures.

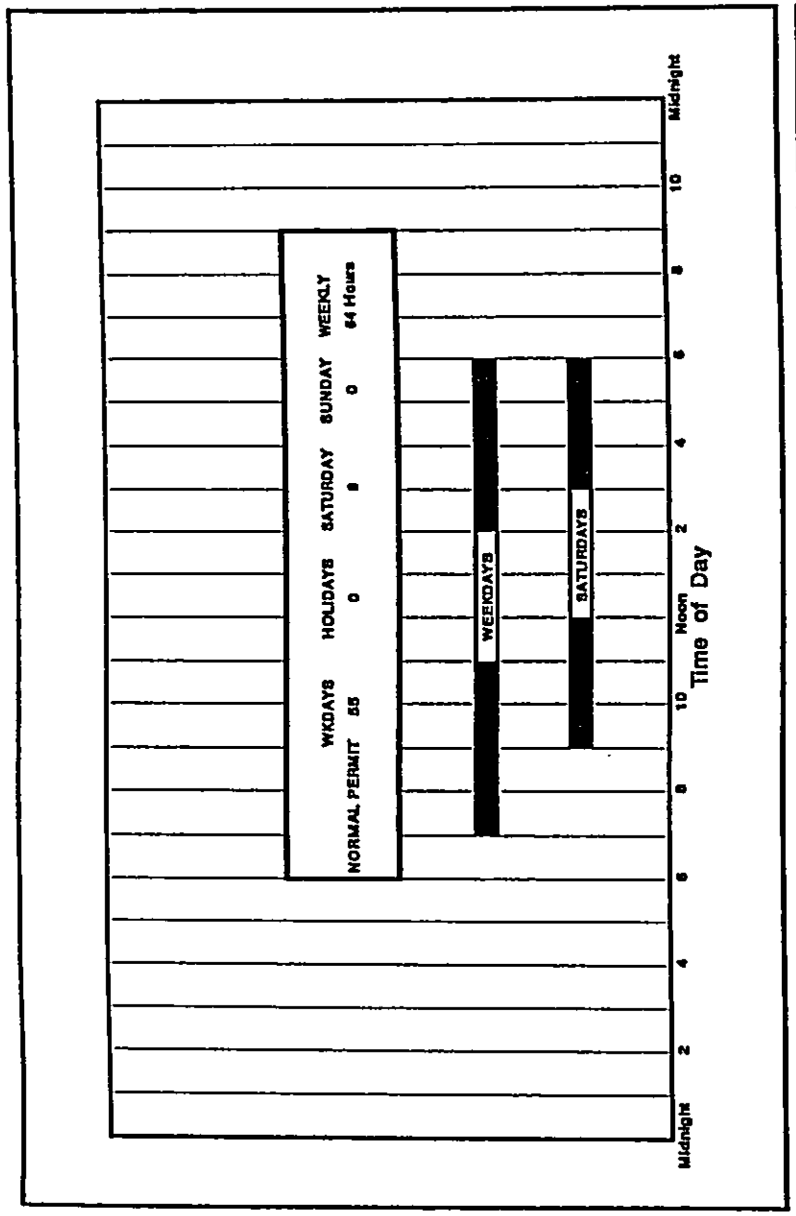


ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 17

FIGURE 18

AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE



APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use," ANSI S12.9-1998/ Part 5; Acoustical Society of America.

(3) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(4) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74- 004; March 1974.

(5) "Mandatory Seller Disclosures in Real Estate Transactions;" Chapter 508D, Hawaii Revised Statutes; July 1, 1996.

(6) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(7) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 1.1 User's Guide (Addendum) of September 2000.

(8) "Traffic Impact Analysis, Ewa By Gentry - Makai Development;" Parsons Brinckerhoff Quade & Douglas, Inc.; September 1998.

(9) "Honolulu International Airport Master Plan Update & Noise Compatibility Program, Volume 2, Part 1, FAR Part 150 - Noise Exposure Maps and Noise Compatibility Program;" State Department of Transportation, Airports Division; December 1989.

(10) "Kalaeloa Airport Master Plan - Final Report;" State Department of Transportation, Airports Division; November 1998.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE(1) A-WEIGHTING	OTHER(2) WEIGHTING	UNWEIGHTED
1. Sound (Pressure)(3) Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level (4) Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,...weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND FUTURE YEAR TRAFFIC VOLUMES

ROADWAY LANES	**** CY 1998 ***** AM VPH	**** CY 1998 ***** PM VPH	CY 2010 (NO BUILD) AM VPH	CY 2010 (NO BUILD) PM VPH	CY 2010 (BUILD) AM VPH	CY 2010 (BUILD) PM VPH
Fort Weaver Rd. - North of Geiger Rd.(NB)	1,496	1,206	1,795	1,230	2,375	1,725
Fort Weaver Rd. - North of Geiger Rd.(SB)	1,178	1,576	1,005	1,515	1,310	2,105
Two-Way	2,674	2,782	2,800	2,745	3,685	3,830
Fort Weaver Rd. - South of Geiger Rd.(NB)	1,333	1,100	1,310	1,035	1,835	1,520
Fort Weaver Rd. - South of Geiger Rd.(SB)	1,297	1,464	1,000	1,195	1,305	1,725
Two-Way	2,630	2,564	2,310	2,230	3,140	3,245
Fort Weaver Rd. - North of Golf Course (NB)	1,333	1,100	1,310	1,035	1,835	1,520
Fort Weaver Rd. - North of Golf Course (SB)	1,297	1,464	1,000	1,195	1,305	1,725
Two-Way	2,630	2,564	2,310	2,230	3,140	3,245
Fort Weaver Rd. - South of Golf Course (NB)	1,333	1,098	1,270	1,050	1,360	1,150
Fort Weaver Rd. - South of Golf Course (SB)	1,287	1,453	1,030	1,160	1,150	1,245
Two-Way	2,620	2,551	2,300	2,210	2,510	2,395
Geiger Rd. - West of Street X (WB)	N/A	N/A	140	50	140	50
Geiger Rd. - West of Street X (EB)	N/A	N/A	70	105	70	105
Two-Way	N/A	N/A	210	155	210	155
Geiger Rd. - East of Street X (WB)	N/A	N/A	285	310	315	425
Geiger Rd. - East of Street X (EB)	N/A	N/A	285	370	385	430
Two-Way	N/A	N/A	570	680	700	855
Geiger Rd. - West of Street Y (WB)	N/A	N/A	285	310	315	425
Geiger Rd. - West of Street Y (EB)	N/A	N/A	285	370	385	430
Two-Way	N/A	N/A	570	680	700	855
Geiger Rd. - East of Street Y (WB)	N/A	N/A	285	325	315	440
Geiger Rd. - East of Street Y (EB)	N/A	N/A	290	395	390	455
Two-Way	N/A	N/A	575	720	705	895
Geiger Rd. - West of Kapolei Parkway (WB)	386	359	305	325	335	440
Geiger Rd. - West of Kapolei Parkway (EB)	251	425	290	400	390	460
Two-Way	637	784	595	725	725	900
Geiger Rd. - East of Kapolei Parkway (WB)	403	394	545	585	675	720
Geiger Rd. - East of Kapolei Parkway (EB)	358	408	510	700	605	835
Two-Way	761	802	1,055	1,285	1,280	1,555

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND FUTURE YEAR
TRAFFIC VOLUMES

ROADWAY LANES	**** CY 1998 ***** AM VPH	PM VPH	CY 2010 (NO BUILD) AM VPH	PM VPH	CY 2010 (BUILD) AM VPH	PM VPH
Geiger Rd. - West of Kaahupahau St. (WB)	403	417	545	585	155	720
Geiger Rd. - West of Kaahupahau St. (EB)	341	428	510	700	605	835
Two-Way	744	845	1,055	1,285	760	1,555
Geiger Rd. - East of Kaahupahau St. (WB)	455	567	550	610	680	745
Geiger Rd. - East of Kaahupahau St. (EB)	629	466	680	735	775	870
Two-Way	1,084	1,033	1,230	1,345	1,455	1,615
Geiger Rd. - West of Fort Weaver Rd. (WB)	394	522	550	610	680	745
Geiger Rd. - West of Fort Weaver Rd. (EB)	606	480	675	735	775	970
Two-Way	1,000	1,002	1,225	1,345	1,455	1,715
Iroquois Rd. - East of Fort Weaver Rd. (WB)	341	301	610	410	740	495
Iroquois Rd. - East of Fort Weaver Rd. (EB)	271	265	255	660	300	795
Two-Way	612	566	865	1,070	1,040	1,290
Iroquois Rd. - West of Keaunui Dr. (WB)	366	329	610	410	740	495
Iroquois Rd. - West of Keaunui Dr. (EB)	123	214	250	660	300	795
Two-Way	489	543	860	1,070	1,040	1,290
Iroquois Rd. - East of Keaunui Dr. (WB)	182	260	285	200	360	245
Iroquois Rd. - East of Keaunui Dr. (EB)	123	214	145	320	175	395
Two-Way	305	474	430	520	535	640
Iroquois P. Rd. - West of Street C (WB)	N/A	N/A	285	200	360	245
Iroquois P. Rd. - West of Street C (EB)	N/A	N/A	145	320	175	395
Two-Way	N/A	N/A	430	520	536	640
Iroquois P. Rd. - East of Street C (WB)	N/A	N/A	135	85	135	65
Iroquois P. Rd. - East of Street C (EB)	N/A	N/A	80	100	80	100
Two-Way	N/A	N/A	215	185	215	165
Kapolei Parkway - North of Geiger Rd. (NB)	103	135	2,015	805	2,435	1,150
Kapolei Parkway - North of Geiger Rd. (SB)	193	83	515	1,635	745	2,045
Two-Way	296	218	2,530	2,440	3,180	3,195
Kapolei Parkway - South of Geiger Rd. (NB)	N/A	N/A	1,970	855	2,270	1,120
Kapolei Parkway - South of Geiger Rd. (SB)	N/A	N/A	490	1,645	705	1,920
Two-Way	N/A	N/A	2,460	2,500	2,975	3,040

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND FUTURE YEAR
TRAFFIC VOLUMES

ROADWAY LANES	**** CY 1998 ***** AM VPH	PM VPH	CY 2010 (NO BUILD) AM VPH	PM VPH	CY 2010 (BUILD) AM VPH	PM VPH
Kapolei Parkway - North of Entrance A (NB)	N/A	N/A	1,970	855	2,270	1,120
Kapolei Parkway - North of Entrance A (SB)	N/A	N/A	490	1,645	705	1,920
Two-Way	N/A	N/A	2,460	2,500	2,975	3,040
Kapolei Parkway - South of Entrance A (NB)	N/A	N/A	1,790	805	2,090	1,070
Kapolei Parkway - South of Entrance A (SB)	N/A	N/A	515	1,580	735	1,855
Two-Way	N/A	N/A	2,305	2,385	2,825	2,925
Kapolei Parkway - North of Entrance B (NB)	N/A	N/A	1,790	805	2,090	1,070
Kapolei Parkway - North of Entrance B (SB)	N/A	N/A	520	1,580	735	1,855
Two-Way	N/A	N/A	2,310	2,385	2,825	2,925
Kapolei Parkway - South of Entrance B (NB)	N/A	N/A	1,750	810	2,020	1,050
Kapolei Parkway - South of Entrance B (SB)	N/A	N/A	535	1,545	740	1,765
Two-Way	N/A	N/A	2,285	2,355	2,760	2,815
Kapolei Parkway - North of Street A (NB)	N/A	N/A	1,735	810	2,020	1,050
Kapolei Parkway - North of Street A (SB)	N/A	N/A	550	1,550	740	1,765
Two-Way	N/A	N/A	2,285	2,360	2,760	2,815
Kapolei Parkway - South of Street A (NB)	N/A	N/A	1,650	535	1,720	640
Kapolei Parkway - South of Street A (SB)	N/A	N/A	350	1,315	425	1,370
Two-Way	N/A	N/A	2,000	1,850	2,145	2,010
Kaahupahau St. - North of Geiger Rd.(NB)	30	80	70	50	70	50
Kaahupahau St. - North of Geiger Rd.(SB)	141	25	140	110	140	110
Two-Way	171	105	210	160	210	160
Kaahupahau St. - South of Geiger Rd.(NB)	194	66	150	85	150	85
Kaahupahau St. - South of Geiger Rd.(SB)	89	123	55	135	55	135
Two-Way	283	189	205	220	205	220
Entrance A - East of Kapolei Parkway (WB)	N/A	N/A	175	100	175	100
Entrance A - East of Kapolei Parkway (EB)	N/A	N/A	25	75	25	75
Two-Way	N/A	N/A	200	175	200	175
Entrance A - West of Kapolei Parkway (WB)	N/A	N/A	25	90	25	90
Entrance A - West of Kapolei Parkway (EB)	N/A	N/A	80	50	85	50
Two-Way	N/A	N/A	105	140	110	140

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND FUTURE YEAR
TRAFFIC VOLUMES

ROADWAY LANES	---- CY 1996 ---- AM VPH	PM VPH	CY 2010 (NO BUILD)	PM VPH	CY 2010 (BUILD) AM VPH	PM VPH
Entrance B - West of Kapolei Parkway (WB)	N/A	N/A	25	90	25	90
Entrance B - West of Kapolei Parkway (EB)	N/A	N/A	80	50	85	50
Two-Way	N/A	N/A	105	140	110	140
Entrance B - East of Kapolei Parkway (WB)	N/A	N/A	0	0	125	35
Entrance B - East of Kapolei Parkway (EB)	N/A	N/A	0	0	110	65
Two-Way	N/A	N/A	0	0	235	100
Street X - Sorth of Geiger Rd. (NB)	N/A	N/A	215	270	315	330
Street X - Sorth of Geiger Rd. (SB)	N/A	N/A	145	265	175	380
Two-Way	N/A	N/A	360	535	490	710
Street Y - South of Geiger Rd. (NB)	N/A	N/A	5	30	5	30
Street Y - South of Geiger Rd. (SB)	N/A	N/A	0	20	0	20
Two-Way	N/A	N/A	5	50	5	50
Keaunui Dr. - North of Iroquois Rd. (NB)	188	80	35	60	35	60
Keaunui Dr. - North of Iroquois Rd. (SB)	197	78	85	70	85	70
Two-Way	383	158	120	130	120	130
Keaunui Dr. - South of Iroquois Rd. (NB)	N/A	N/A	260	175	315	215
Keaunui Dr. - South of Iroquois Rd. (SB)	N/A	N/A	90	315	110	375
Two-Way	N/A	N/A	350	490	425	590
Golf Course - East of Fort Weaver Rd. (WB)	1	12	105	100	465	365
Golf Course - East of Fort Weaver Rd. (EB)	11	21	45	150	175	515
Two-Way	12	33	150	250	640	880
Street A - West of Fort Weaver Rd. (WB)	N/A	N/A	245	495	585	850
Street A - West of Fort Weaver Rd. (EB)	N/A	N/A	255	495	615	890
Two-Way	N/A	N/A	500	990	1,200	1,740
Street A - East of Kapolei Parkway (WB)	N/A	N/A	180	445	370	730
Street A - East of Kapolei Parkway (EB)	N/A	N/A	285	435	580	655
Two-Way	N/A	N/A	465	880	950	1,385
Street A - West of Kapolei Parkway (WB)	N/A	N/A	10	50	110	350
Street A - West of Kapolei Parkway (EB)	N/A	N/A	0	60	305	290
Two-Way	N/A	N/A	10	110	415	640
Street C - South of Iroquois P. Rd. (NB)	N/A	N/A	150	135	225	180
Street C - South of Iroquois P. Rd. (SB)	N/A	N/A	65	220	95	295
Two-Way	N/A	N/A	215	355	320	475

APPENDIX L

AIR QUALITY STUDY

FOR THE PROPOSED

EWA BY GENTRY MAKAI DEVELOPMENT

EWA, OAHU, HAWAII

Prepared for:

Environmental Communications, Inc.

January 2003

B.D. NEAL & ASSOCIATES

Applied Meteorology • Air Quality • Computer Science

P.O. BOX 1808 • KAILUA-KONA, HAWAII 96745 • TELEPHONE (808) 329-1627 • FAX (808) 331-8428

EMAIL: bdneal@kona.net

CONTENTS

FIGURES

TABLES

TABLES (cont.)

Table

1.0 SUMMARY

Gentry Homes, Ltd. is proposing to develop the Ewa by Gentry Makai Project at Ewa, Oahu. The proposed project will consist of a total of 1865 residential units, a 30-acre commercial/ industrial area, and associated community and support facilities. Development of the project is not expected to be completed and fully occupied until sometime after 2010. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate. Potential impacts on the project from nearby industrial sources are also examined.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are more stringent than the comparable national standards except for those pertaining to sulfur dioxide and particulate matter.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the Ewa Plain area is very much affected by its leeward and coastal situation. Winds are predominantly trade winds from the east northeast except for occasional periods when kona storms may generate strong winds from the south or when the trade winds are weak and landbreeze-seabreeze circulations may develop. Wind speeds typically vary between about 5 and 15 miles per hour providing relatively good ventilation much of the time. Temperatures in the leeward Oahu area are generally very moderate with average daily temperatures ranging from about 65°F to 84°F. The extreme minimum temperature recorded at the nearby (former) Ewa Plantation is 47°F, while the extreme maximum temperature is 93°F. This area of Oahu is one of the drier locations in the state with rainfall often highly variable from one year to the next. Monthly rainfall has been measured to vary from as little as a trace to as much as 15 inches. Average annual rainfall amounts to about 21 inches with summer months being the driest.

The present air quality of the project area appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national air quality standards are currently being met, although occasional exceedances of the more stringent state standard for ozone may occur. It is also possible that the more stringent state standards for carbon monoxide are exceeded at times near congested roadway intersections.

If the proposed project is given the necessary approvals to proceed, it may be inevitable that some short- and/or long-term impacts on air quality will occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, an air quality modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at intersections in the project vicinity and to predict future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are within both the state and the national ambient air quality standards. In the year 2010 without the project, carbon monoxide concentrations were predicted to increase at some locations and decrease at others, but concentrations would likely remain within the national and state standards at all locations studied. With the project in the year 2010, carbon monoxide concentrations were estimated to either remain unchanged or increase slightly at some locations compared to the without-project case; worst-case concentrations should remain within both national and state standards. Due to the small impact the project is expected to have, implementing mitigation measures for traffic-related air quality impacts is probably unnecessary and unwarranted.

At this time, the specific tenants of the commercial/industrial area associated with the project have not been identified, but the types of facilities that are expected to locate there are not significant sources of air pollution. Before any air pollution sources can be built anywhere in the state, an application must be submitted to the Department of Health for a permit to construct the facility, and detailed information concerning any air pollution emissions will need to be provided in the application.

In evaluating the proposed project, it may be appropriate to consider not only impacts created by the project but also potential impacts on the project from nearby industrial sources. Due to the relatively close proximity of industries located at Campbell Industrial Park, occasional impacts on the project from emissions emanating from these facilities may occur in conjunction with coincidental occurrences of industry malfunctions and westerly winds, both of which are relatively infrequent events. Increased scrutiny by the Department of Health, an air quality task force mandated by the state legislature, and the modernization by some industrial park tenants should help to mitigate future impacts on the proposed project.

2.0 INTRODUCTION

Gentry Homes, Ltd. is proposing to develop the Ewa by Gentry Makai Project on 283 acres of land at Ewa, Oahu (see Figure 1 for project location). The development will include 550 single-family residential units, 675 cluster residential units, 640 multi-family homes, a 30-acre commercial/industrial area, and associated educational, community and support facilities. The site of the proposed development is bordered on the north by the existing Ewa by Gentry subdivision and on the south by the Ocean Pointe development and by Ewa Beach. Fort Weaver Road intersects the property. Construction of the project is expected to commence during 2003, and full development and occupancy is planned for sometime after 2010.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short- and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities as planned. Potential impacts on the project from nearby air pollution sources are also discussed. Measures to mitigate impacts either by the project or on the project are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National

AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the state 1-hour limit for ozone is more than two times as stringent as the national 1-hour standard. The U.S. Environmental Protection Agency (EPA) is currently working on a plan to phase out the national 1-hour ozone standard in favor of the new (and more stringent) 8-hour standard.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and at this time, it is expected that the new standards for particulate will be

implemented by 2005. To date, the Hawaii Department of Health has not updated the state particulate standards.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affects the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. The site of the proposed project is located on the broad Ewa Plain leeward of the Koolau Mountains.

The nearest and most representative long-term wind data available for the site were collected at the Barbers Point Naval Air Station located about 3 miles to the west. Data available from the Honolulu International Airport, located about 8 miles to the east, may also be at least semi-representative. Wind frequency data given in Table 2 for Barbers Point show that the annual prevailing wind direction for this area of Oahu is east northeast (the same as at Honolulu International Airport). On an annual basis, 38.1 percent of the time the wind is from this direction, and more than 80 percent of the time the wind is in the northeast quadrant. Winds from the south are infrequent occurring only a few days during the year and mostly in winter in association with kona storms. Wind speeds average about 10 knots (12 mph) and mostly vary between about 5 and 15 knots (6 and 17 mph). Surface winds at the project site are very similar to those recorded at Barbers Point.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project's near coastal, leeward location results in a relatively moderate temperature profile compared to other locations around Oahu and the state. Based on more than 50 years of data collected at Ewa Plantation, average

annual daily minimum and maximum temperatures in the project area are 65°F and 84°F, respectively [1]. The extreme minimum temperature on record is 47°F, and the extreme maximum is 93°F.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is oftentimes measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Ewa area, stability class 5 or 6 is generally the highest stability class that occurs, developing during clear, calm nighttime or early morning hours when temperature inversions form due to radiational cooling. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3000 feet (1000 meters).

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The Ewa Plain is one of the driest areas on Oahu due to its leeward and near sea level location. Average annual rainfall amounts to about 21 inches but may vary from about 10 inches during a dry year to more than 40 inches during a wet year [1]. Most of the rainfall usually occurs during the winter months. Monthly rainfall may vary from as little as a trace to as much as 15 inches or more.

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, industrial sources, agricultural operations and to a lesser extent by natural sources. Table 3 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. The emission rates shown in the table

pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, it appears that emissions of particulate and nitrogen oxides have increased during the past ten years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons have declined.

Fort Weaver Road, which intersects the project site, is a major arterial roadway that presently carries moderate to heavy levels of vehicle traffic during peak traffic hours. Emissions from motor vehicles using this roadway, primarily nitrogen oxides and carbon monoxide, will tend to be carried over portions the project site by the prevailing winds.

Several sources of industrial air pollution are located in the Campbell Industrial Park, which is located about 4 miles to the west at Barbers Point. Industries currently operating there include the Chevron and BHP refineries, H-Power, Kalaeloa

Partners, Applied Energy Services, Hawaiian Cement and others. Hawaiian Electric Company's Kahe Generating Station is located about 7 miles to the northwest at Kahe Point. These industries emit large amounts of sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide and other air pollutants. Prevailing winds from the east or northeast will carry these emissions away from the site most of the time.

Until recently, air pollution in the project area originating from agricultural sources could mainly be attributed to sugar cane operations near the project site. Emissions from both the mill and the canefield operations in the area have now been eliminated with the closure of the Oahu Sugar Company and much of the former sugarcane lands are currently being used as pastureland or for diversified agriculture. Long-range uses for the land have not yet been determined.

Natural sources of air pollution emissions that also could affect the project area but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air

quality parameters. Table 4 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 1997 through 2001. These are the most recent data that are currently available.

During the 1997-2001 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located at Kapolei. Concentrations monitored were consistently low compared to the standards. Annual second-highest 3-hour concentrations (which are most relevant to the air quality standards) ranged from 17 to 64 $\mu g/m^3$, while the annual second-highest 24-hour concentrations ranged from 5 to 16 $\mu g/m^3$. Annual average concentrations were only about 1 to 2 $\mu g/m^3$. There were no exceedances of the state/national 3-hour or 24-hour AAQS for sulfur dioxide during the 5-year period.

Particulate matter less than 10 microns in diameter (PM-10) is also measured at the Kapolei monitoring station. Annual second-highest 24-hour PM-10 concentrations ranged from 26 to 129 $\mu g/m^3$ between 1997 and 2001. Average annual concentrations ranged from 13 to 19 $\mu g/m^3$. All values reported were within the state and national AAQS.

Carbon monoxide measurements were also made at the Kapolei monitoring station. The annual second-highest 1-hour concentrations ranged from 1.2 to 1.9 mg/m^3. The annual second-highest 8-hour concentrations ranged from 0.6 to 1.3 mg/m^3. No exceedances of the state or national 1-hour or 8-hour AAQS were reported.

Nitrogen dioxide is also monitored by the Department of Health at the Kapolei monitoring station. Annual average concentrations of this pollutant ranged from 6 to 9 μg/m^3, safely inside the state and national AAQS.

The nearest available ozone measurements were obtained at Sand Island (about 12 miles east of the project area). The second-highest 1-hour concentrations for each year from 1997 to 2001 ranged from 96 to 110 μg/m^3. Up to 13 exceedances of the state AAQS per year were recorded during the monitoring period, but there were no exceedances during the last two years of the five-year period.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS

were recorded. Monitoring for this parameter was discontinued during 1997.

Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter and lead are currently being met at the project site. It is likely, however, that the state AAQS for ozone may be exceeded on occasion based on the Sand Island measurements for this parameter. While carbon monoxide measurements at the Kapolei monitoring station suggest that concentrations are within the state and national standards, local "hot spots" may exist near traffic-congested intersections.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project sites, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the three project sites would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures

such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

7.1 Roadway Traffic

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation requires further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration, which will begin to take effect during the next decade. The added restrictions on emissions from new motor vehicles will lower average emissions each

year as more and more older vehicles leave the state's roadways. It is estimated that carbon monoxide emissions, for example, will go down by an average of about 30 to 40 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential long-term indirect ambient air quality impact of increased roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single new development.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2002 with present conditions, (2) year 2010 without the project, and (3) year 2010 with the project. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing.

For this study, the four key intersections identified in the traffic study were also selected for air quality analysis. These included the following intersections:

- Fort Weaver Road at Geiger Road/Iroquois Road;
- Kapolei Parkway at Geiger Road;
- Kaahupahau Street at Geiger Road;
- Keaunui Drive at Iroquois Road.

The traffic impact assessment report for the project [4] describes the projected future traffic conditions and laneage configurations of these intersections in detail.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated morning and afternoon peak traffic periods. These same periods were evaluated in the air quality impact assessment.

The EPA computer model MOBILE6 [5] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6 is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 46.4% light-duty gasoline-powered automobiles, 40.9% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.3% heavy-duty diesel-powered trucks and buses, and 0.6% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change slightly with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and emission estimates given by MOBILE6 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model has become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Although CAL3QHC is intended primarily for use in assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, two of the study intersections are unsignalized. These include Kapolei Parkway at Geiger Road and Keaunui Drive at Iroquois Road. In the future, in accordance with

the traffic report, these two intersections were assumed to be signalized.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings (where applicable). All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOBILE6 based on assumed free-flow vehicle speeds corresponding to the posted speed limits (25 to 45 mph depending on location).

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all three scenarios. This implies that pedestrian sidewalks either already exist or are assumed to exist in the future. All receptor heights were placed at 1.5 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 5 was assumed for the morning cases, while atmospheric stability category 4 was assumed for the afternoon cases. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within suburban areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were accounted for by adding a background concentration of 0.5 ppm to all predicted concentrations for 2002. Although increased traffic is expected to occur within the project area within the next several years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

<u>Predicted Worst-Case 1-Hour Concentrations</u>

Table 5 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for three scenarios: year 2002 with existing traffic, year 2010 without the project and year 2010 with the project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2002) case was 8.7 mg/m^3. This was projected to occur during the morning peak traffic hour near the intersection of Fort Weaver Road and Geiger Road/Iroquois Road. Concentrations at other locations and times studied were 7.2 mg/m^3 or lower. All predicted worst-case 1-hour concentrations for the 2002 scenario were within both the national AAQS of 40 mg/m^3 and the state standard of 10 mg/m^3.

In the year 2010 without the proposed project, the highest worst-case 1-hour concentration was again predicted to occur during the morning at the intersection of Fort Weaver Road and Geiger

Road/Iroquois Road. A value of 6.1 mg/m^3 was predicted to occur at this location. Peak-hour worst-case values at the other locations and times studied for the 2010 without project scenario ranged between about 3 and 5 mg/m^3. Although concentrations in the vicinity of Fort Weaver Road and Geiger Road/Iroquois Road decreased compared to the existing case, concentrations at the other locations studied remained about the same or increased somewhat due both to higher traffic volumes and to the assumed installation of traffic signals at two of the intersections. All projected worst-case concentrations for this scenario remained within the state and national standards.

Predicted 1-hour worst-case concentrations for the 2010 with project scenario were essentially unchanged compared to the 2010 without project scenario, with the project showing only a small impact in the worst-case concentrations at the intersections of Fort Weaver Road at Geiger Road/Iroquois Road and Kapolei Parkway at Geiger Road. All predicted worst-case 1-hour concentrations for the 2010 with project scenario were within both the national and the state AAQS.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study based on modeling [9] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [11] suggest that this factor may range between about 0.2 and 0.6 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 6. For the 2002 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the four locations studied ranged from 0.9 mg/m^3 at the Keaunui Drive at Iroquois Road intersection to 4.4 mg/m^3 at the Fort Weaver Road at Geiger

Road/Iroquois Road intersection. The estimated worst-case concentrations were within both the state standard of 5 mg/m^3 and the national limit of 10 mg/m^3.

For the year 2010 without project scenario, worst-case concentrations ranged between 1.6 and 3.0 mg/m^3, with the highest concentration at Fort Weaver Road and Geiger Road/Iroquois Road decreasing substantially compared to the existing case. All predicted concentrations were within the standards.

For the 2010 with project scenario, worst-case concentrations remained nearly unchanged compared to the without project case, indicating minimal project impact. All predicted 8-hour concentrations for this scenario were within both the national and the state AAQS.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds

of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

7.2 Commercial/Industrial Mixed Uses

Air pollution emissions from industrial sources locating within the proposed commercial/industrial mixed-use area of the project could potentially result in direct impacts on air quality. While the specific industrial residents of the proposed project have not yet been identified, it is expected these will not have the potential to emit significant amounts of air pollution.

Without specific information concerning stack heights and stack gas temperatures, exit velocities and emission rates, air quality impacts from the potential industrial facilities locating within the proposed industrial park cannot be quantitatively estimated. At the present time, such detailed information is not available. However, Hawaii air pollution control rules [3] require that any activity that causes air pollution must obtain written approval from the director of the Hawaii Department of Health. This written approval generally involves applying for both a permit to construct and a permit to operate. At the time of application, detailed information must be provided by the applicant concerning the type and nature of any air pollution emissions and the emission control technology that would be utilized. Depending on the magnitudes of the project emissions and other factors, air quality impact analyses and/or air quality monitoring may be required before the application to construct/operate is approved. Thus, even though an assessment of potential direct impacts from project air pollution emissions cannot be done at this time, state rules may require that such analyses be performed at a later date when specific businesses apply to locate at the proposed industrial park.

8.0 IMPACTS ON PROJECT FROM CAMPBELL INDUSTRIAL PARK

In addition to assessing the air quality impacts of the project on the surrounding area, the reverse problem of impacts of air pollution sources located in the surrounding area on the residents of the project is also of concern. For the this project, the issue of primary concern is the Campbell Industrial Park (CIP) located about 4 miles west of the project site. Several large industrial sources of air pollution are located at CIP including Applied Energy Systems (AES) Generating Station, Kalaeloa Partners Cogeneration Plant, the Chevron and BHP Refineries, H-Power and Hawaiian Cement. During the past few years, several incidents of acute air pollution levels have occurred in areas within and adjacent to CIP. Some of these incidents have been caused by upset conditions at the BHP and Chevron Refineries, while the source or sources of other incidents have never been identified.

As indicated in Section 4, the prevailing winds are in the northeast quadrant, which will carry emissions from CIP away from the project site more than 80 percent of the time. Winds from the west, which

could carry emissions toward the site, occur less than about 5 percent of the time. While estimating specific air pollution levels at the project site is beyond the scope of the present study, it is unlikely that concentrations exceed air quality standards during normal operations. Emissions during normal operations are regulated by the Hawaii Department of Health, and industry operators are required to demonstrate compliance with state and national air quality standards. Perhaps the greatest concern is the coincidence of industry malfunctions and in conjunction with westerly-wind periods. Even if industry operators are very diligent in operating and maintaining their facilities, occasional malfunctions that result in air pollution incidents in nearby areas are probably unavoidable.

After several incidents over the past few years, the Department of Health has increased scrutiny of industries at CIP. Also, a task force mandated by the state legislature was formed to investigate recent air pollution incidents and to reduce future occurrences. In response to plant malfunctions that have caused the excessive release of air contaminants, several industries have begun modernization programs which are intended to improve operations.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The major potential short-term air quality impact of the project will occur from the emission of fugitive dust during construction.

Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program and to adjust the program if necessary.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After the proposed project is completed, any long-term impacts on air quality in the project area due to emissions from project-related motor vehicle traffic should be small. Worst-case concentrations of carbon monoxide should remain within both the state and the national ambient air quality standards. Implementing any air quality mitigation measures for long-term traffic-related impacts is probably unnecessary and unwarranted.

At this time, sufficient detail is not available describing the facilities that may be located within the commercial/industrial area included in the project to perform any quantitative impact assessments. However, the types of facilities currently being considered do not emit significant amounts of air pollution. In any case, before any air pollution sources can be built anywhere in the state, an application must be submitted to the Department of Health for a permit to construct the facility, and detailed information concerning any air pollution emissions will need to be provided in the application. If deemed necessary, the Department of Health may require the applicant to assess the air quality impact of the proposed emissions.

Due to the relatively close proximity of industries located at CIP, occasional impacts on the project from emissions emanating from these facilities will probably be unavoidable. Such impacts may occur in conjunction with the coincidental occurrences of industry malfunctions and westerly winds, both of which are relatively infrequent events. Increased scrutiny by the Department of Health, a special task force mandated by the state legislature to assess and monitor emissions in the area, and the upgrade of some of the industries located at CIP, such as Chevron, should help to mitigate future impacts on areas adjacent to CIP.

REFERENCES

1. "Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", U.S. Department of Commerce, Weather Bureau, Washington, D.C., 1965.

2. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

3. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

4. Parsons Brinckerhoff, Inc., Traffic Impact Analysis, Ewa by Gentry Makai Development, Draft, November, 2002.

5. User's Guide to MOBILE6.0, Mobile Source Emission Factor Model, U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Assessment and Standards Division, Ann Arbor, Michigan, January 2002.

6. Guideline on Air Quality Models (Revised), Including Supplements A and B, EPA-450/2-78-027R, U.S. Environmental Protection Agency, Research Triangle Park, NC, July 1986.

7. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, U.S. Environmental Protection Agency, November 1992.

8. CALINE4 - A Dispersion Model for Predicting Air Pollutant Concentrations Near Roadways, FHWA/CA/TL-84/15, California State Department of Transportation, November 1984 with June 1989 Revisions.

9. "Persistence Factors for Mobile Source (Roadway) Carbon Monoxide Modeling", C. David Cooper, Journal of the Air & Waste Management Association, Volume 39, Number 5, May 1989.

10. Guideline for Modeling Carbon Monoxide from Roadway Intersections, U.S. Environmental Protection Agency, EPA-454/R-92-005, November 1992.

11. Annual Summaries, Hawaii Air Quality Data, 1997-2001, State of Hawaii Department of Health.

Figure 1 - Project Location Map

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	µg/m³	Annual 24 Hours	50[a] 150[b]	50[a] 150[b]	50 150[c]
Particulate Matter (<2.5 microns)	µg/m³	Annual 24 Hours	15[a] 65[d]	15[a] 65[d]	- -
Sulfur Dioxide	µg/m³	Annual 24 Hours 3 Hours	80 365[c] -	- - 1300[c]	80 365[c] 1300[c]
Nitrogen Dioxide	µg/m³	Annual	100	100	70
Carbon Monoxide	mg/m³	8 Hours 1 Hour	10[c] 40[c]	- -	5[c] 10[c]
Ozone	µg/m³	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	- 100[c]
Lead	µg/m³	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	µg/m³	1 Hour	-	-	35[c]

[a] Three-year average of annual arithmetic mean.

[b] 99th percentile value averaged over three years.

[c] Not to be exceeded more than once per year.

[d] 98th percentile value averaged over three years.

[e] Three-year average of fourth-highest daily 8-hour maximum.

[f] Standard is attained when the expected number of exceedances is less than or equal to 1.

Note: Standards for particulate matter (<2.5 microns) and for 8-hour ozone have not yet been implemented.

Table 2

ANNUAL WIND FREQUENCY FOR HONOLULU INTERNATIONAL AIRPORT (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 3

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF OAHU, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 4

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR
MONITORING STATIONS NEAREST EWA BY GENTRY MAKAI DEVELOPMENT

Parameter / Location	1997	1998	1999	2000	2001
Sulfur Dioxide / Kapolei					
3-Hour Averaging Period:					
No. of Samples	2845	2723	2710	2505	2511
Highest Concentration ($\mu g/m^3$)	61	69	30	23	24
2nd Highest Concentration ($\mu g/m^3$)	52	64	17	18	15
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
No. of Samples	361	343	360	362	359
Highest Concentration ($\mu g/m^3$)	20	17	6	6	7
2nd Highest Concentration ($\mu g/m^3$)	16	16	6	5	6
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	2	2	2	1	2
Particulate (PM-10) / Kapolei					
24-Hour Averaging Period:					
No. of Samples	269	359	362	356	352
Highest Concentration ($\mu g/m^3$)	41	34	129	148	121
2nd Highest Concentration ($\mu g/m^3$)	26	34	39	129	104
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	13	15	15	17	19
Carbon Monoxide / Kapolei					
1-Hour Averaging Period:					
No. of Samples	8649	8044	8395	8595	8515
Highest Concentration (mg/m^3)	1.8	1.9	1.5	2.5	2.3
2nd Highest Concentration (mg/m^3)	1.7	1.5	1.2	1.6	1.9
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
No. of Samples	1085	1044	1048	1076	1073
Highest Concentration (mg/m^3)	0.7	0.6	0.6	1.0	1.6
2nd Highest Concentration (mg/m^3)	0.7	0.6	0.6	0.8	1.3
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration ($\mu g/m^3$)	8	8	7	9	6
Ozone / Sand Island					
1-Hour Averaging Period:					
No. of Samples	8702	8688	8566	8482	8448
Highest Concentration (mg/m^3)	106	114	110	98	104
2nd Highest Concentration (mg/m^3)	106	110	106	96	100
No. of State AAQS Exceedances	13	7	8	0	0

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 1997 - 2001"

Table 5

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS
ALONG ROADWAYS NEAR
EWA BY GENTRY MAKAI DEVELOPMENT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario					
	2002/Present		2010/Without Project		2010/With Project	
	AM	PM	AM	PM	AM	PM
Fort Weaver Road at Geiger/Iroquois Roads	8.7	7.2	6.1	5.0	6.7	5.5
Kapolei Parkway at Geiger Road	3.4	2.3	4.3	3.8	4.7	4.1
Kaahupahau Street at Geiger Road	3.9	3.2	3.7	3.1	3.7	3.2
Keaunui Drive at Iroquois Road	1.8	1.5	3.2	2.6	3.2	2.6

Hawaii State AAQS: 10
National AAQS: 40

Table 6

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS
ALONG ROADWAYS NEAR
EWA BY GENTRY MAKAI DEVELOPMENT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario		
	2002/Present	2010/Without Project	2010/With Project
Fort Weaver Road at Geiger/Iroquois Roads	4.4	3.0	3.4
Kapolei Parkway at Geiger Road	1.7	2.2	2.4
Kaahupahau Street at Geiger Road	2.0	1.8	1.8
Keaunui Drive at Iroquois Road	0.9	1.6	1.6

Hawaii State AAQS: 5
National AAQS: 10

APPENDIX M

Ewa Makai
Social Impact Assessment

Prepared by Earthplan

September 2002

Contents

TABLES AND FIGURES

1 Background and Introduction

1.1 Report Description

Gentry Homes, Inc. proposes to develop an area adjacent to the existing Ewa by Gentry community in Ewa, Oahu. The project requires a re-designation from Agriculture to Urban by the State Land Use Commission. This report contains the social impact assessment conducted as part of this process. It will be summarized in and appended to the report that will accompany the petition to the Land Use Commission.

This social impact assessment was prepared by Earthplan, Inc., whose offices are located at 81 South Hotel Street, Suite 211, Honolulu, Hawaii. Berna Cabacungan, principal of Earthplan, was project manager, and principal analyst and writer. Sara Verga assisted in project research.

The remaining portions of this section describe the proposed actions and discuss the role and purpose of social impact assessments.

Section 2 describes the existing social environment in terms of population trends and, demographic information. Section 3 extends the baseline information by exploring what may occur in the region with or without the proposed changes.

Proposed social impacts are described in Section 4 in terms of population changes, the project's relationship to regional public policies and community expectations, and public facilities and services.

1.2 Description of the Proposed Project

Gentry Homes, Inc., proposes to develop the region of Ewa Makai. This project is located on both sides of Fort Weaver Road in Ewa. It is bordered on the east side by the Hawaii Prince Golf Course and on the west by the Barbers Point Golf Course. The south side of the project site is bordered by a district park, residential areas, an elementary school, and the Hawaii Prince Golf Course. The north side of the project site is bordered by the Ewa Gentry community.

The proposed development includes 1,865 residential units, a commercial and industrial mixed use area, and related public and community facilities on 283 acres in Ewa. An overview of the proposed project is provided in Table 1.

Table 1: Proposed Uses/ Units/ Acres

Land Use	Units	Area (ac.)
Single Family	550	93 (73 net)
Cluster	675	64 (54 net)
Multi Family	640	32
Commercial (Campbell)		20
Commercial / Industrial Mixed Use		30
Community Center		2
Middle School		18
Church / Day Care		4
Parks/Open Space		25.5
Roads		14.5
Total	1,865	283

Figure A illustrates the Ewa Makai project and the following describes the location of these uses in the project site:

East of Fort Weaver Road: On the easternmost portion of the project site, 360 single-family residences will be developed on 68 acres. Two cluster areas will also be developed. One will be on 27 acres of land and will include 215 units; the other, on eleven acres of land with140 units. A 3.5-acre park, which will be contiguous to a planned six-acre park in the adjacent community, is also planned, as well as four acres for church facilities.

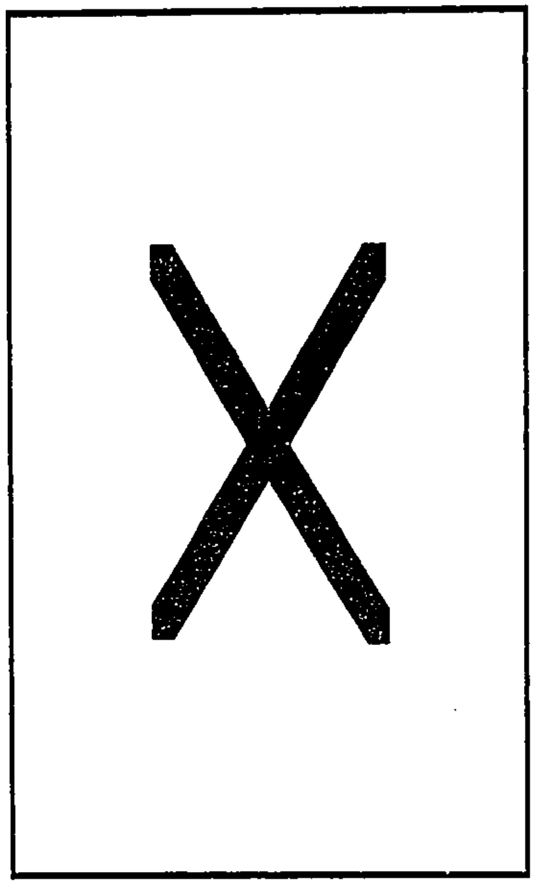


Figure A: Proposed Ewa Makai Project

West of Fort Weaver Road and east of Kapolei Parkway: The western portion of Fort Weaver Road will be divided into two areas by the new Kapolei parkway. The area between Fort Weaver Road and Kapolei Parkway will be further divided by the extension of Keaunui Drive in the east-west direction. North of this road will include two multi-family sections separated by an eight-acre community park. One multi-family neighborhood will be developed on 16.5 acres and will include 330 units; the other will be developed on 8.5 acres and will include 170 units. Also in this area is a cluster development comprising 220 units on 18 acres. Four acres are planned for church facilities.

South of Keaunui Drive extension is a 30-acre Industrial/ Commercial area that is adjacent to the Laulani Commercial Center which is being developed by the Estate of James Campbell. Also in this portion of the project site is a seven- acre multi family lot with 140 units fronting Kapolei Parkway Road.

West of Kapolei Parkway: On the western side of Kapolei Parkway, the developer proposes that 18 acres, adjacent to a two-acre community center, be set aside for a middle school. Cluster housing comprising 100 units is proposed for eight acres and 190 single family units are proposed for 25 acres. Approximately 14 acres of open space will separate the cluster units from the single-family housing.

Total Development Summary: The total development that is planned for Ewa Makai are 93 acres of single family homes totaling to 550 units. Sixty-four acres of cluster homes totaling 675 units will also be built, as well as 32 acres of multi-family homes totaling 640 units. Industrial and Commercial mixed use development will be on 30 acres of land on the project site. Twenty four acres of land will be devoted to community facilities, with the remaining 25.5 acres being left for parks and open space, and 14.5.acres being set aside for roads (excluding Fort Weaver Road and Kapolei Parkway).

1.3 The Role and Purpose of Social Impact Assessments

The social aspects of an area relate to people living and interacting with other people. Social impact analysis explores how the physical environment of a community or neighborhood may be changed by a proposed land development, and how these changes may affect the neighborhood as a social environment. [1]

Social impact assessment, hereafter referred to as SIA, became a recognized subfield of research and policy application, with the passage of the U.S. National Environmental Policy Act (NEPA) legislation in 1969. [2] It is an interdisciplinary, inter-professional field of social science knowledge and application. SIA draws sometimes from social science, but other times from organizational development, political analysis, or journalism. Its primary function has to do with the development and disclosure of social information relevant to informing the decision-making process and/or designing management actions to deal with problematic social outcomes of a proposed project.

The goal of SIA is to predict the social effects of a policy, program or project while still in the planning stage, before those effects have occurred. The overall framework for SIA is anticipatory research, which seeks to place the expectation and attainment of desired outcomes on a rational and reliable basis.

Commonly identified uses of SIA include:

Understanding the ability of a community or group to adapt to changing conditions - In identifying social consequences of a proposed action, cause-and-effect relationships are complex. Different people and different communities react differently to similar events. An important function of SIAs is therefore to obtain and analyze the necessary information about community organization and likely responses to changing conditions. As such, the non-project social scenario is as important as the with-project scenario because it provides the analyst with a realistic social context for the proposed action.

[1] *Kathleen Christiansen, **Social Impacts of Land Development: An Initial Approach to Estimating Impacts on Neighborhood Usages and Perceptions** (1976)*

[2] *Rabel Burdge and Frank Vanclay, "Social Impact Assessment," **Environmental and Social Impact Assessment**, ed. Frank Vanclay and Daniel A. Bronstein (1998), 34.*

Defining the problems or clarifying the issues involved in a proposed change - Frequently, opposition to or support for a proposed project can only be understood and addressed when the proponent is aware of cultural tendencies, underlying issues, vested interests, and misperceptions. The SIA is the basis for defining and clarifying project or program issues in a systematic approach within the EIS framework.

Illuminating the meaning and importance of anticipated change - An important objective of SIA is to determine what meaning a probable impact would have for a community and its residents. Whereas a certain impact may have relatively low social significance in some communities, it may be given more import or significance in other settings or communities.

Identifying mitigation opportunities or requirements - Another function of SIA is to explore how a proposed action can cause the least adverse and most beneficial impacts, and to identify responses from the community and affected persons. SIA information can be crucial in determining what mitigation is necessary, what mitigation alternatives exist, and which mitigation strategies are most likely to work.

2 Profile of the Existing Community

2.1 Study Area Definition

2.1.1 Overall Study Area

The Overall Study Area for this report is the Ewa Development Plan region, which covers the entire Ewa plain, includes the coastline between West Loch and Kahe Point, and extends to the mauka areas. Formerly, virtually this entire region comprised the Ewa Neighborhood Board No. 23 area. To accommodate the current and anticipated population growth, the City divided the previous Neighborhood Board area into two Boards: the Ewa (No. 23) area and Makakilo/ Kapolei/ Honokai Hale/ Nanakai Gardens Neighborhood Board (No. 24) area.

The Makakilo/ Kapolei/ Honokai Hale/ Nanakai Gardens Neighborhood Board area encompasses the western portion of the Ewa Development Plan area. A focal point of this western half is the City of Kapolei, which forms the region's new commercial and government center.

Honokai Hale and Nanakai Gardens form a contiguous residential community containing approximately 290 residences. The Villages of Kapolei is a cooperative housing development between the government and several private developers. Currently being developed in phases, the project will include eight residential villages and support facilities on approximately 890 acres of land at full build-out. Located on the southern foothills of Wai'anae Range, the development of Makakilo began in the early 1960s as a planned hillside residential project of Finance Realty. When completed, the entire development should include about 6,200 homes.

2.1.2 Primary Study Area

The Primary Study Area for this report is the Ewa Neighborhood Board area, which is generally the eastern portion of the Ewa Development Plan area. The Primary Study Area includes the existing communities of Ewa Beach, Ewa Villages, West Loch Estates, Ewa by Gentry and Ocean Pointe. Figure B illustrates the Primary Study Area for this report.

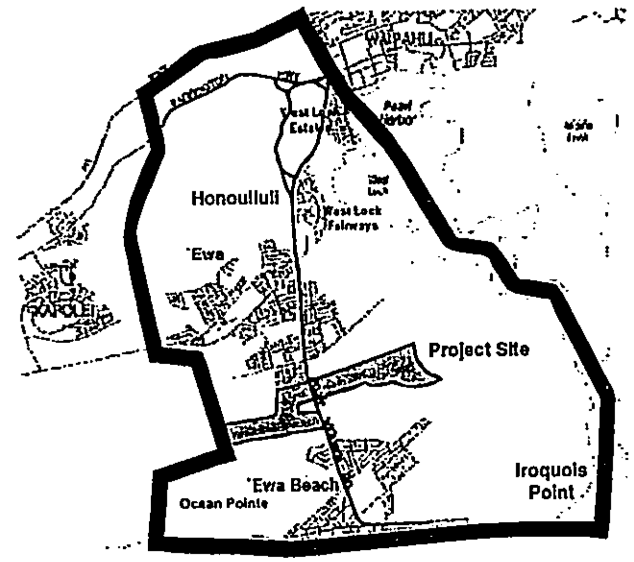


Figure B: Primary Study Area for This SIA

The name and existence of the present town of Ewa comes from the founding of the Ewa Plantation, incorporated in early 1890[3]. By 1877, James Campbell had acquired approximately 41,000 acres of arid ranch lands on the Ewa plain. With the need for water apparent, Campbell arranged for the drilling of Hawaii's first artesian wells, an effort that proved successful and made available water reserves for the area. In 1889, the Honouliuli lands were leased to B.F. Dillingham, who later subleased a portion of those lands to W.R. Castle who, with Castle and Cooke, organized the Ewa Plantation Company. A merger of Ewa Plantation with Oahu Sugar occurred in 1970.[4]

[3] *Yardley, 1891.*
[4] *The Estate of James Campbell, 1974.*

According to written reports, the lands of Ewa Beach were once part of the Magoon, Parish, and Dowsett Estates and used for seafront summer homes. In 1948, approximately 200 people lived in the area. The Ewa Beach Community Association formed in 1950. By 1958, the population had grown to 300. Of those, approximately 70 percent were families of personnel from the nearby Barbers Point Naval Air Station.[5] Today, the community contains residential subdivisions, shopping areas, schools, churches, and all the public and private amenities associated with small towns that exist throughout the island.

Ewa Villages was at one time home to nearly 3,000 Ewa Plantation sugar workers and their families. Today, efforts to restore many of the historic structures and houses from the villages of Tenney, Renton, and Varona are being undertaken through the City and County of Honolulu's Revitalization Program. In addition to restoration, over 1,000 new homes will be constructed at market and affordable prices. The community includes an 18-hole municipal golf course and commercial space.[6]

West Loch Estates, a City and County of Honolulu master-planned community, includes 1,600 residential units on approximately 500 acres of land acquired from the Estate of James Campbell. The first phase, completed in 1990, contains 593 homes. The second phase, completed in 1994, contains approximately 700 residential units. The development also includes an 18-hole municipal golf course, a shoreline park, and units designed for senior living.

Ewa by Gentry, an ongoing development of the Gentry companies, began selling homes in their Soda Creek project in 1988. The 1,000-acre master-planned community, located on both sides of Fort Weaver Road, will include approximately 7,200 homes. Approximately 5,000 units have been completed thus far.

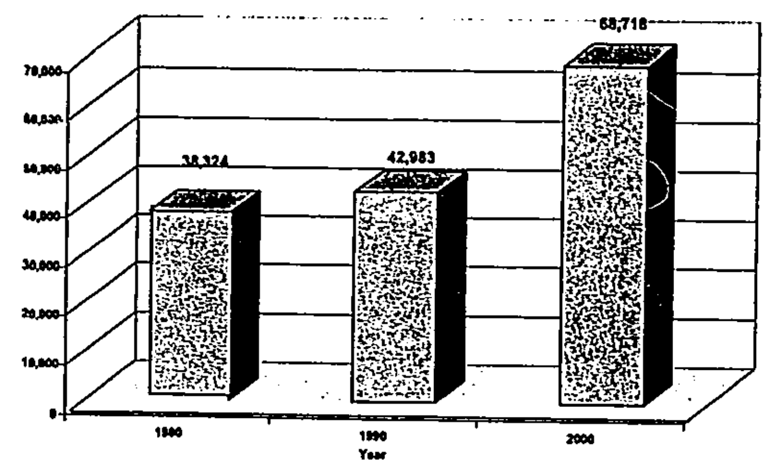
[5] *Information is taken from Ewa Area Chronology, a typed record of events for the area contained at the Ewa Beach Community Library. Reference to specific information cited is listed as HSB 12/19/58, 14:1 and HSB 12/18/58.*

[6] *Historic Hawaii, 1991, and the Estate of James Campbell, 1994.*

2.2 Population Trends

Designated the Secondary Urban Center by the City and County of Honolulu, the Ewa region has been undergoing many changes over the last two decades. As more residential units are being built, the population of this region has increased from 38,324 in 1980, to 42,983 in 1990 and to 68,718 persons in 2000, as illustrated in *Figure C.*

Figure C: Ewa Development Plan Population, 1980, 1990, 2000



In terms of average annual growth rates, these increases mean that the Study Area has been growing at rates much higher than that of the City and County of Honolulu. From 1980 to 1990, the Oahu-wide population grew from 762,534 to 836,231 persons; this represents an average annual growth rate of 0.9 percent. By 2000, the Oahu-wide population grew to 876,156 persons, which represents an average annual growth rate of 0.5 percent from 1990 to 2000.

In the Ewa Development Plan area, the average annual growth rate between 1980 and 1990 was 1.2 percent. As development activity increased, the growth rate increased significantly, as indicated by the 5.9 percent average annual growth rate from 1990 to 2000.

The Total Study Area is expected to increase its proportion of the total islandwide population, as shown on Table 2.

Table 2: Projected Growth for Development Plan Regions, 2010 and 2020

	2010 Projection	Percent of Total Oahu Population	2020 Projection	Percent of Total Oahu Population
Primary Urban Center	454,070	48.9%	484,646	48.5%
Ewa	88,401	9.5%	100,697	10.1%
Central Oahu	153,300	16.5%	166,794	16.7%
East Honolulu	46,182	5.0%	50,762	5.1%
Koolaupoko	113,780	12.3%	118,963	11.9%
Koolauloa	14,068	1.5%	15,726	1.6%
North Shore	17,305	1.9%	19,648	2.0%
Waianae	41,095	4.4%	42,184	4.2%
Total	928,201		999,400	

Source: Provided by Steve Young, City Development of Planning and Permitting, July 3, 2002.

In 2000, the Ewa Development Plan area accounted for 7.8 percent of the total Oahu population. By 2010, it is projected that Ewa will comprise nine percent of Oahu's population; by 2020, ten percent.

2.2.1 Total and Primary Study Areas

Table 3 presents demographic information for Oahu, the Ewa Development Plan area and the Ewa Neighborhood Board area.

Table 3: Demographic Information for Oahu, the Total Study Area and the Primary Study Area, 1990 and 2000

	Oahu		Total Study Area, Ewa Development Plan Area		Primary Study Area, Ewa Neighborhood Board	
	1990	2000	1990	2000	1990	2000
Population	836,231	876,156	42,931	68,718	26,898	53,099
Age						
Less than 5	7.4%	6.5%	11.9%	9.1%	9.9%	9.4%
5 to 17	17.1%	20.0%	18.9%	22.6%	23.0%	22.8%
18 to 64	64.5%	60.1%	64.2%	61.5%	60.9%	60.9%
65 and older	11.0%	13.4%	4.9%	6.8%	6.2%	6.9%
Median age	32.2	35.7	27.5	31.2	27.8	30.8
Ethnicity (1)						
Caucasian	31.7%	21.3%	40.1%	18.4%	32.9%	16.9%
Asian	45.6%	46.0%	42.3%	46.0%	48.3%	49.7%
Hawaiian	10.8%	8.9%	9.5%	7.5%	13.0%	6.8%
All Other	12.0%	23.8%	8.2%	28.0%	5.8%	26.6%
Households						
Total Households	265,304	286,450	11,449	14,324	6,768	14,324
Family households	74.4%	71.8%	99.8%	84.5%	88.9%	85.1%
Average household size	3.02	2.95	3.65	3.68	3.96	3.68
Average family size	3.50	3.59	3.59	4.24	4.10	4.08
Housing Units						
Number	281,683	315,988	11,722	20,804	6,971	15,845
Owner Occupied	49.0%	49.5%	52.1%	63.7%	52.9%	62.8%
Renter Occupied	45.2%	41.2%	45.3%	27.3%	44.2%	27.6%
Vacant Units	5.8%	9.3%	2.6%	9.0%	2.9%	9.6%

Notes:

1. Ethnicity proportions are presented for information only. 1990 and 2000 information cannot be compared because of methodology differences in gathering information. In 1990, census respondents were required to pick one ethnic category. In 2000, multi-ethnic respondents were allowed to select the appropriate number of categories.

*Sources: The 1990 information for Oahu and Ewa is from Summary Tape 1-A of the 1990 census. The 2000 Oahu information is from the U.S. Census Bureau (**Profiles of General Demographic Characteristics. 2000 Census of Population and Housing, Hawaii** [May 2001]). The 2000 Ewa information is from the City and County of Honolulu Department of Planning and Permitting (**Community Profiles: Neighborhood Board Areas, 1990 and 2000** (January 2002)).*

Age

The Total and Primary Study Areas tend to be younger than the Oahu population. When compared to the islandwide community, both had relatively higher proportions of people 17 years old and younger, and lower proportions of people 65 years and older.

In terms of median age, the Total and Primary Study Areas consistently had lower median ages than the islandwide community. The Oahu 1990 median age was 32.2 years; for 2000, 35.7 years. The 1990 median ages for the Total and Primary Study Areas were 27.5 and 27.8 years, respectively. The 2000 median ages for the Total and Primary Study Areas were 31.2 and 30.8 years, respectively.

From 1990 and 2000, the Total Study Area experienced a slight increase in youngsters 17 years and younger (from 31 to 32 percent), a decrease in those 18 to 64 years (64 to 62 percent), and an increase in the 65 years and older category (five to seven percent).

Between 1990 and 2000, the Primary Study Area experienced stability in all categories. Both census years indicated similar proportions of people 17 years (33 percent), 18 to 64 years (61 percent) and 65 years and older (from six to seven percent).

Ethnicity [7]

A detailed analysis of ethnic trends is not possible due to the methodology differences in gathering information between the 1990 and 2000 census taking. In 1990, census respondents were required to pick a single ethnic category. In 2000, multi-ethnic respondents were allowed to select the appropriate number of categories. Nevertheless this information provides relative ethnic proportions.

When compared to the 2000 islandwide ethnic profile, the Total Study Area tended to have lower proportions of Caucasians (Oahu 21 percent; Total Study Area 18 percent) and Hawaiians (Oahu nine percent; Total Study Area eight percent).

[7] *Ethnicity proportions are presented for information only. 1990 and 2000 information cannot be compared because of methodology differences in gathering information. In 1990, census respondents were required to pick one ethnic category. In 2000, multi-ethnic respondents were allowed to select the appropriate number of categories.*

The Primary Study Area had proportionally less Caucasians (17 percent), and other/mixed (27 percent) and more Asians (50%) when compared to the Total Study Area.

Both Oahu and the Total Study Area Asian Population amounted to 46 percent of the total population. The proportion of those of other and mixed races was higher in the Total Study Area (28 percent) than on Oahu (24 percent).

Households and Families

Both the Total and Primary Study Areas had significantly high proportions of family households when compared to the islandwide community. In 1990 and 2000, about 74 and 72 percent, respectively, were family households out of the total household count. In the Total Study area, almost all of the households were family households in 1990, and 84 percent were family households in 2000. In the Primary Study Area, 89 percent of the households were families in 1990, and 85 percent in 2000.

Household and family sizes were higher in the Total and Primary Study Areas than in the Oahu-wide community. In 1990 and 2000, the Oahu-wide average household size was three persons. The average household size for the Total Study Area was 3.7 persons in 1990 and 2000. In the Primary Study Area, the average household size was four persons in 1990 and decreased to 3.7 persons in 2000.

The Oahu-wide average family size was 3.5 and 3.6 persons in 1990 and 2000, respectively. For the Total Study Area, family sizes averaged 3.6 and 4.2 persons in 1990 and 2000, respectively. Average family size in the Primary Study Area was 4.1 persons in 1990 and 2000.

Housing Units

The Total Study Area experienced a 77 percent increase in housing units from 11,721 to 20,804 units from 1990 to 2000. The Primary Study Area housing units more than doubled from 1990 to 2000, from 6,972 to 15,845 units.

Both increases were significantly high, when compared to the twelve percent increase experienced on Oahu from 1990 to 2000.

In terms of housing unit occupancy in 2000, about half of the Oahu housing supply was occupied by its owners and 41 percent were renter-occupied. Approximately 5.8 percent of the housing units were vacant.

The Total and Primary Study Areas experienced an increase in owner-occupied units from 1990 to 2000, and had significantly higher proportions when compared to Oahu. The 2000 owner-occupancy rate for the Total Study Area was 64 percent; for the Primary Study Area, 63 percent.

Housing vacancy was also high in the Total and Primary Study Areas due to the ongoing construction activity. The Total Study Area had a nine percent housing vacancy rate; the Primary Study Area, ten percent.

2.2.2 Primary Study Area Communities

The City Department of Planning and Permitting has prepared 2000 census information on specific Oahu communities that is not available in standard census products. In the Primary Study Area, such information is available for Ewa Villages / Honouliuli, Ewa Gentry / West Loch, Ewa Beach / Iroquois Point, and Ocean Pointe.

It is noted that, while these are the major communities within the Ewa Neighborhood Board area, which is the Primary Study Area, the boundaries for these individual communities are not inclusive of the entire Neighborhood Board area. The information presented in Table 4 is presented nevertheless to provide comparisons of the communities near the proposed Ewa Makai.

Age-wise, the older communities of Ewa Villages / Honouliuli had relatively older populations with a median age of 34.1 years. The Ewa Beach / Iroquois Point community, also older neighborhoods, has the lowest median age of 30.1 years.

In terms of ethnicity, over half of the Ewa Villages / Honouliuli (68 percent) and Ewa Gentry / West Loch (55 percent) populations were of Asian ancestry in 2000. In Ewa Beach / Iroquois Point and Ocean Pointe, respectively 40 and 44 percent of the population were Asian

Caucasians accounted for only four and 13 percent of the Ewa Villages / Honouliuli and Ewa Gentry / West Loch populations, respectively. The Caucasian proportions were higher in Ewa Beach / Iroquois Point and Ocean Pointe, where respectively 24 and 19 percent were in this category.

Table 4: Demographic Information for Neighborhoods in the Primary Study Area, 2000

	Ewa Villages/ Honouliuli	Ewa Gentry/ West Loch	Ewa Beach/ Iroquois Point	Ocean Pointe
Population	5,214	19,123	18,506	728
Age				
Less than 5	7.1%	9.8%	9.0%	9.8%
5 to 17	19.9%	21.2%	23.7%	1.8%
18 to 64	58.0%	63.9%	58.7%	69.0%
65 and older	15.0%	5.1%	8.6%	3.4%
Median age	34.1	31.4	30.1	31.4
Ethnicity				
Caucasian	4.4%	12.8%	23.6%	19.4%
Asian	67.6%	54.9%	40.2%	44.4%
Hawaiian and other Pacific Islanders	5.2%	5.6%	8.5%	4.1%
All Other	22.8%	26.6%	27.7%	32.1%
Households				
Total Households	1,279	4,650	3,898	183
Family households	84.1%	79.2%	90.4%	74.7%
Average household size	3.95	3.25	4.25	2.97
Average Family size	4.45	3.74	3.68	3.48
Housing Units				
Total	1,386	6,247	5,001	261
Owner Occupied	71.6%	71.9%	45.9%	93.9%
Renter Occupied	20.6%	22.2%	40.4%	0.0%
Vacant Units	7.7%	6.0%	13.8%	6.1%

Source: City and County of Honolulu, Department of Planning and Permitting, Community Profiles: Island Development Plan Areas, 1990 and 2000 (January 2002)

Ewa Beach / Iroquois Point had the highest proportion of Hawaiians and other Pacific Islanders, with eight percent. The lowest proportion was found in Ocean Pointe, at four percent.

The older communities tended to have larger household sizes. The largest households were found in Ewa Beach / Iroquois Point where the average household size was 4.24 persons. In Ewa Villages / Honouliuli, an average of 3.95 persons lived in each household.

These communities also had the highest proportions of family households. Over 90 percent of households in Ewa Beach / Iroquois Point were family households. In Ewa Villages / Honouliuli, 84 percent were family households.

Ocean Pointe had the smallest household and family sizes in 2000, with 2.97 persons and 3.48 persons, respectively.

Generally, housing units in these communities tended to be owner-occupied, with the highest level of owner-occupancy in the new community of Ocean Pointe.

Only the Ewa Beach / Iroquois Point community had a relatively high proportion of renters. Forty percent of the housing units were renter-occupied and 48 percent were owner-occupied. Housing vacancies were also the highest in this community, with 14 percent of the housing unit supply vacant in 2000.

3 Major Forces for Change

The Total and Primary Study Areas are expected to undergo major changes regardless of whether the proposed project is implemented. These changes extend the baseline context of the social environment and are outlined in this section. Section 3.1 presents changes advocated by the public sector, and private sector projects are presented in Section 3.2.

3.1 Ewa Development Plan

The City and County of Honolulu guides and directs land use and growth through a three-tier system of policies, planning principles, guidelines, and regulations. The General Plan forms the first tier of this system and comprises statements of objectives and policies. Adopted in 1977, the General Plan has been amended several times, although the basic elements in the original document remain the same.

The second tier of the system includes the Development and Sustainable Communities Plans. There are eight plans that cover the Primary Urban Center, East Honolulu, Central Oahu, Ewa, Waianae, North Shore, Koolauloa, and Koolaupoko.

The third tier of the system comprises the implementing ordinances, including the Land Use Ordinance and the City's Capital Improvement Program.

The project is in the Ewa Development Plan area. The General Plan calls for the Secondary Urban Center to be centered in Kapolei, which is planned as the focus of major economic activity and housing development, and a center for government services. It also encourages development of the Secondary Urban Center at Kapolei, and residential development of the urban fringe areas in Ewa.

In keeping with the General Plan, the Ewa Development Plan provides a secondary employment center with its nucleus in the City of Kapolei to supplement the Primary Urban Center (PUC). It concentrates primary employment activities at industrial and resort areas, government facilities and higher education centers around the City of Kapolei.

The Ewa Development Plan also provides for significant residential development throughout Ewa, and calls for a variety of housing types from affordable units and starter homes to mid-size multi-family and single family units.

The Ewa Development Plan contains land use policies, principles and guidelines related to open space preservation and development, regional parks and recreation complexes, community-based parks, historic and cultural resources, the City of Kapolei, residential development and non-residential development. The following are social-related policies that are relevant to the proposed Ewa Makai.

- **Residential Development**

  The Ewa Development Plan calls for a housing density of ten to 15 units per acre in aggregate areas zoned for residential use. Low density areas should have between five to twelve units per acre and medium density areas should have ten to 13 units per acre. High density areas should have 25 to 90 units per acre. Building heights restrictions include two stories for low density housing, up to three stories for medium density and up to 90 feet for high density.

  The Ewa Development Plan also calls for:

  - A physical definition of neighborhoods,
  - A compatible mix of building forms,
  - Transit-oriented streets,
  - Opportunities for pedestrian and bicycle travel, and
  - Integration of linear corridors.

- **Community-Based Parks**

  The Development Plan calls for new residential development to include land for open space and recreation at a minimum of two acres per 1,000 residents. Community-based parks include

  - mini parks, with a .25-mile service radius,
  - neighborhood parks, with a .50-mile service radius,
  - community parks, with a one mile-service radius, and
  - district parks, with a two-mile service radius.

Further, the Ewa Development Plan notes that the existing deficit to City park stands at almost 40 acres, and that an additional 76 acres of community-based parks and recreation should be developed to meet the needs of the projected 2020 population.

- **Commercial Centers**

  The Ewa Development Plan identifies four types of commercial centers, based on size and function. These types include neighborhood commercial center (five to ten acres), community commercial center (ten to 30 acres), major community commercial center (up to 50 acres) and regional community center (more than 50 acres). The latter two types of commercial centers are only located in the City of Kapolei, as that region is intended to provide for regional shopping needs.

  For the neighborhood and community commercial centers, the Plan provides guidelines for street frontage, floor area, and types of uses. Generally, these commercial centers should be dedicated mostly to retail uses and office uses that provide services to the surrounding community.

- **Industrial Uses**

  Industrial centers in the Ewa Development Plan region include the Barbers Point Industrial Area and the Honouliuli Industrial Area. Service-oriented industrial uses, such as automobile repair shops, contractor's yards, and businesses serving residential and commercial areas, can be located near the City of Kapolei, in the Kapolei Business Park and on Industrial-designated land in the Barbers Point Naval Air Station. Alternatively, a commercial, cultural or recreational entertainment attraction may be permitted in the area fronting the OR&L Historic Railway. An industrial area in Laulani is also included in the Ewa Development Plan; it is intended for service oriented light industrial use.

3.2 Private Development Efforts

Ewa is a region in transition and there are major changes which are being undertaken as part of the effort to establish the region as the Island's secondary urban core. Kapolei is envisioned as providing an urban center with facilities for commerce, finance, government services, and industrial activities. The major components include several commercial and office complexes, the existing James Campbell Industrial Park, the new 800- acre Kapolei Business Park, Barbers Point Harbor, Ko'Olina Resort, and the City of Kapolei's numerous residential neighborhoods.

Specific projects underway in the Primary Study Area include the following:

Ocean Pointe

Adjacent to Ewa Beach and south of the project site, Ocean Pointe is a planned 1,100-acre community that includes a full-service 1,400-slip marina with a maritime commercial complex. This complex includes light industrial, commercial and retail facilities, as well as ancillary visitor accommodations. The project also includes 4,850 residential units, a golf course and a 20-acre district park.

Developer HASEKO (Ewa) recently submitted a request to rezone a portion of the project to accommodate drainage system modifications. The proposed changes included reduction of the marina size from 120 to 70 acres, converting the eastern basin to a portion of the golf course, reducing the golf course from 27 to 18 holes, reduction and reconfiguration of the commercial and industrial support area, and incorporating a neighborhood business area. The rezoning request for reconfiguration was recently approved by the Honolulu City Council.

Ewa by Gentry

Gentry has completed approximately 5,000 housing units in Ewa by Gentry, which is located just north of the project site. When development is completed in 2010, there will be approximately 7,200 housing unit.

Ewa Villages

The City and County of Honolulu acquired 600 acres northwest of the project site. This area surrounds and includes the former plantation villages, including Tenney, Renton and Varona Villages. Existing structures in Ewa Villages are being rehabilitated for reuse, and related affordable and market housing is being developed. A total of 1,900 residential units will be available at full buildout.

4 Potential Social Impacts

4.1 Population Impacts

The Ewa Makai development will result in an increase in the residential population due to the increase in residential units. Table 5 presents the range of potential population impacts.

Table 5: Range of Potential Impact on Resident Population

Range	Low	Middle	High
Basis	2000 average household size on Oahu	2000 average household size in Ewa Gentry, a comparable mix of housing types	2000 average household size in Primary Study Area
Average household size	2.95	3.25	3.68
Projected Ewa Makai Residential Population	5,502	6,061	6,863

On the low end of the possible range, the proposed project could add 5,500 persons to the region, based on the Oahu 2000 average family size of 2.95 persons. This is considered the low end of the range because the Oahu housing supply has a high proportion of medium and high density units. Further , Oahu has relatively high proportion of renters and low proportion of family households.

The high end of the possible range is 6,900 persons based on the 2000 Primary Study Area average household size of 3.68 persons. This is considered the high end because the Primary Study housing type mix has a relatively high proportion of single family units.

The most likely estimate of population impact is the mid-range projection that Ewa Makai may add 6,000 persons to the region. This estimate is based on the 2000 average household size in Ewa Gentry, a relatively recent community with a mix of units and community amenities similar to that proposed in Ewa Makai.

The projected Ewa Development Plan population for 2010 is 88,400 persons [8] The proposed project would comprise approximately seven percent of this projected population.

The projected Ewa Development Plan population for 2020 is 100,700 persons. Ewa Makai would comprise approximately six percent of the projected population.

4.2 Project Relationship to Public Policies and Community Expectations

4.2.1 Public Policies

The proposed Ewa Makai is consistent with public policy as set forth in the Ewa Development Plan.

Overall growth and residential policy

The project is consistent with public policy to promote residential development in the urban fringe of the Ewa Development Plan area. Ewa Makai is included in Phase 1 of the Development Plan phasing of Ewa development. It is referred to as Laulani Residential, with 1,100 units, and Fairways Residential with 900 units. [9]

Ewa Makai also offers a variety of housing types, including single-family homes, townhouses, and residential cluster neighborhoods, which provides for a wide range of affordability for a mixture of household types and sizes.

Residential component

The project is well below the residential density called for in the Ewa Development Plan. The residential density for single-family units is 7.5 units per acre, which is within the Development Plan range of five to twelve units per acre. The combined project density for cluster and multi-family units is 15 units per acre, which is within the Development Plan range of ten to 30 units per acre.

[8] *See Table 2.*

[9] *See Table 2-2 of the Ewa Development Plan.*

The project includes 24 acres for community facilities, consistent with the Ewa Development Plan residential provision for community facilities including churches, community centers and elderly and child care centers.

Further, the developer intends to comply with design and land use guidelines related to building height and form, compatibility and architectural character.

Community-Based Parks

The proposed project may result in a resident population between 5,500 and 6,900 persons. Based on the parks standards set forth by the Ewa Development Plan, these population levels would require community park acreage between eleven and 13.8 acres. The proposed project includes 13.5 acres designated for park space, plus 14 acres designated for open space. The Ewa Makai project is consistent with the policies related to community-based parks in that the 13.5 acres generally meet the standard that would apply to the high end of the population estimate.

Commercial and Industrial Areas

The Industrial/ Commercial component of Ewa Makai is included in the Development Plan phasing of Ewa Development Plan, as part of Laulani Commercial. Thirty acres is designated for Industrial use.

4.2.2 Community Reaction

This study included a review of Ewa Neighborhood Board actions to assess possible community issues on this project. We reviewed Board minutes of meetings held from June 2000 to May 2002.

This Board deals with issues related to a stable residential community. In terms of proposed community changes, the Board generally tends to support the improvement of existing facilities, such as sidewalks, bus stops, and a Conditional Use Permit to convert a church office space into classrooms. After reviewing project merits, the Board also supported ocean-related projects including a moi farm and a limu restoration project. The Ocean Pointe rezoning request was supported in January 2001.

The Board reviewed park night closure, and its members voted to support the testing of night closure at Geiger Park and eventually supported permanent night closure at that facility. When the Board evaluated uniform park night closures, the Board was divided. Some felt that the consideration should be given to people living adjacent to parks, while others felt that parks should be open to those who want to use them after 10 P.M.

Regarding new development projects, the Board was somewhat supportive, but continue to express concern about infrastructure impacts, particularly those related to roadways and traffic circulation. When the Ewa Makai project was discussed in February 2001, the Board discussed a construction moratorium but the motion was withdrawn. The Board voted to not support the rezoning request from Ewa by Gentry in Area 20.

In October 2001, the Board voted to support a moratorium on further construction until proper highway improvements are in place. The Board has since worked with the City, State, and private developers, namely Gentry Homes, Ltd. and HASEKO. In February 2002, the Board unanimously voted to withdraw its request for a construction moratorium noting that the private developers have historically completed their share of improvements in a timely manner.

The Ewa Makai project was discussed in the Planning and Zoning Committee in January 2002. Key issues included:

- Moving the residential units around the planned 14-acre open space area, though this concern was alleviated when it was learned that this is not a designated park
- The adequacy of school facilities, considering the cumulative growth planned for the region
- Infrastructure concerns, namely roads, drainage and schools

In March 2002, the Ewa Neighborhood Board passed the following motion:

1. *Support the development of the Ewa Makai project, which incorporates the infrastructure development for roads/technology, sewage and the intermediate school site development*
2. *The Department of Education should actively encourage parents of students in overcrowded area schools to apply for geographic exemptions to attend Iroquois Point Elementary*
3. *Do not support any future request for increasing density in the project*
4. *Future legislators need to ensure CIP funding for the development of the new intermediate school* [10]

[10] *City and County of Honolulu Neighborhood Commission, Ewa Neighborhood Board No. 23 Minutes of Regular Meeting: Thursday, March 14, 2002, Ewa Public Library.*

4.3 Public Services and Facilities

4.3.1 Police Protection

The project site is served by the Kapolei Police Station, which is located at 1100 Kamokila Boulevard in Kapolei. There is also a storefront office next to the 7-eleven store at 91-1669 Fort Weaver Road.

The Primary Area, which is the Ewa Neighborhood Board area is divided into Police Beats 874, 875, 876, 877, and 879. The project site is located in Police Beats 875 and 876. At any given time, there is a minimum of 14 officers assigned to this region.

Potential project impacts on current services would be a likely increase in calls for police services. [11]

It is recommended that the Ewa Makai project can mitigate impacts on police protection services through security measures such as on-site security, design measures such as well-lit public areas and walkways, and the establishment of neighborhood watch programs. As an extension of the Ewa by Gentry Community, Ewa Makai will have on-site security and will be part of an established community watch program.

4.3.2 Fire Protection

In the event of a single alarm fire, the project site would be served by the Waipahu Fire Station. For a multiple alarm such as a structure fire, three engine companies and one ladder company would be sent from the Ewa Beach, Waipahu, and Kapolei Fire Stations. The ladder company would originate from the Waipahu Fire Station.

Five firefighters are assigned to the Waipahu Fire Station, with a minimum of four people on call at all times. A minimum of four people would respond in the event of a single alarm incident. In the event of a multiple alarm incident, there would be a minimum of 18 firefighters responding from the three engine and one ladder companies, as well as a fire chief and the assigned driver. The response time to the project site depends on traffic, but is usually from four to six minutes.

[11] *Based on letter dated 13 June 2002 from Chief of Police Lee Donohue in response to questions provided by Earthplan.*

If a backup company is needed, the backup company can come from the Waipahu, Ewa Beach, and Kapolei Fire Stations. In the event of a second alarm in a multiple incident, two additional engine companies from the Waikele and Pearl City Fire Stations would respond, as well as a ladder company coming from the Kapolei Fire Stations. [12]

The project will increase the demand for fire protection services by adding new structures and approximately 6,000 people to the area.

4.3.3 Emergency Medical Services

The Honolulu Emergency Services Department, hereafter referred to as EMS, is responsible for providing the following:

- an efficient, effective and economical operation of the pre-hospital emergency medical care and emergency ambulance service,
- a comprehensive aquatic safety program at 19 City beach parks, including lifeguard services,
- injury prevention, public education and public health programs, and
- coordination with other agencies and jurisdictions [13]

In an emergency response, either EMS personnel or the nearest fire station is notified. EMS uses a global tracking system that places each vehicle within 30 feet of its current location.

The Ewa area is primarily serviced by two ambulances from St. Francis West and the Waipahu Fire Station. There is also a single Rapid Response Unit based at Kalaeloa. The Rapid Response Unit does not transport patients, however.

Ambulances are staffed by two paramedics, and the Rapid Response Unit is staffed by a single paramedic. If needed, additional EMS vehicles respond from Waianae and Aiea. The average response time to the project site is approximately six to nine minutes. [14]

[12] *Based on personal communication with Captain John Clark, Deputy Fire Chief, on June 3, 2002*

[13] *Salvatore S. Lanzilotti, Emergency Services Department (undated).*

[14] *Based on personal communication from Robin McCulloch, Chief of EMS, on July 8, 2002.*

4.3.4 Public Education

Based on current district boundaries residents of the Ewa Makai community will be served by the Pohakea and Ewa Beach Elementary Schools, Ilima Intermediate, and Campbell High School. The current and projected enrollments of these schools are presented in Table 6.

Table 6: Current and Future Enrollment for Schools Servicing Ewa Makai Area

School	Current Student Enrollment	Projected Student Enrollment for 2007
Ewa Beach Elementary	581	831
Pohakea Elementary School	562	649
Ilima Intermediate School	1,012	1,243
Campbell High School	2,033	2,289

**Personal communication with Sanford Beppu, Facilities Branch, Hawaii State Department of Education, June 10, 2002.*

The proposed project will impact these facilities by increasing the school-aged population. Table 7 presents the long-term projection for Ewa Makai students at full build-out, and as the on-site population stabilizes.

Table 7: Long-Term Projected School Population for Ewa Makai

Grade Level	Projected Population Estimate
Kindergarten through sixth grade	466
Seventh and eighth grade	205
Ninth through twelfth grade	224
Total	895

Based on personal communication with Keith Kameoka, Statistical Research, Hawaii State Department of Education, July 8, 2002.

In general, the project's impact on the area's schools fall within the projected 2007 enrollment. The region is targeted for significant residential population growth with or without Ewa Makai, however, so it is likely that cumulative growth will exceed projected 2007 enrollment if the project is implemented.

The Gentry Companies has been working with the State Department of Education to determine the developer's contribution to the public education system. As of this writing, the parties have agreed that reserving 18 acres for a new middle school meets the developer's fair share requirement.

REFERENCES

Christiansen, Kathleen. **Social Impacts of Land Development: An Initial Approach to Estimating Impacts on Neighborhood Usages and Perceptions.** 1976.

Burdge, Rabel and Frank Vanclay. **Environmental and Social Impact Assessment**, ***Social Impact Assessment.*** Edited by Frank Vanclay and Daniel A. Bronstein. 1996.

City and County of Honolulu Department of Planning and Permitting. **Community Profiles: Island Development Plan Areas 1990 and 2000.** January 2002.

City and County of Honolulu Department of Planning and Permitting. **Community Profiles: Neighborhood Areas 1990 and 2000.** January 2002.

City and County of Honolulu Neighborhood Commission. *Minutes of the Ewa Neighborhood Board meetings from June 2000 to May 2002.*

The Estate of James Campbell. *Kapolei, The Story Unfolds (pamphlet).* 1994.

Lanzilotti, Salvatore S. ***Emergency Services Department.*** Undated.

U.S. Department of Commerce, Bureau of the Census. ***1990 Census Summary Tape File 1-A.***

U.S. Department of Commerce, U.S. Census Bureau. **Profiles of General Demographic Characteristics. 2000 Census of Population and Housing, Hawaii.** Issued May 2001. Available online at http://www2.census.gov/census_2000/datasets/demographic_profile/Hawaii/2kh15.pdf

Yardley, Paul T. **Millstones and Milestones: The Career of B.F. Dillingham.** University Press of Hawai'i. Honolulu, 1981.

END

CERTIFICATION

I HEREBY CERTIFY THAT THE MICROPHOTOGRAPH APPEARING IN THIS REEL OF FILM ARE TRUE COPIES OF THE ORIGINAL DOCUMENTS.

2006
DATE

Sammy Yoshimura
SIGNATURE OF OPERATOR

TOP

Film Identification

A & P International

715/262-5788 • Fax 715/262-3823
577 Locust Street • Prescott, WI 54021
Web Site http://www.zimc.com/apintl

PRECISION℠ RESOLUTION TARGETS

LEFT

RIGHT

150 MM

6″

PA-3 8½″x11″ PAPER PRINTED GENERAL TARGET

DENSITY TARGET

ADVANCED MICRO-IMAGE SYSTEMS HAWAII